

The art of hatching and bringing up domestick fowls of all kinds, at any time of the year. Either by means of the heat of hot-beds, or that of common fire / By M. de Réaumur.

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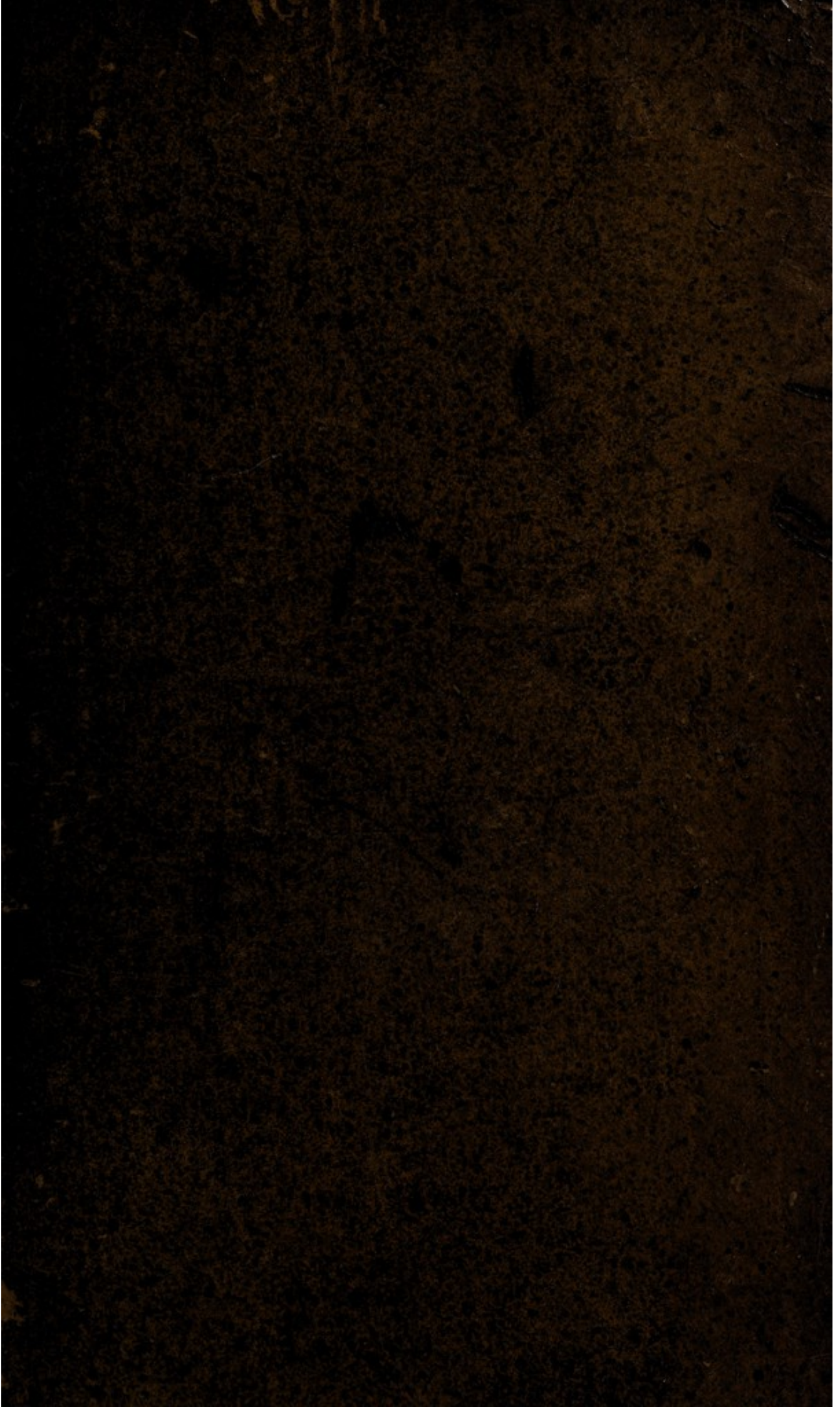
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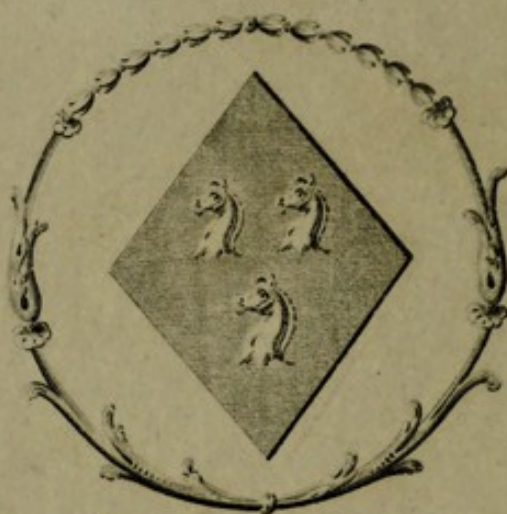
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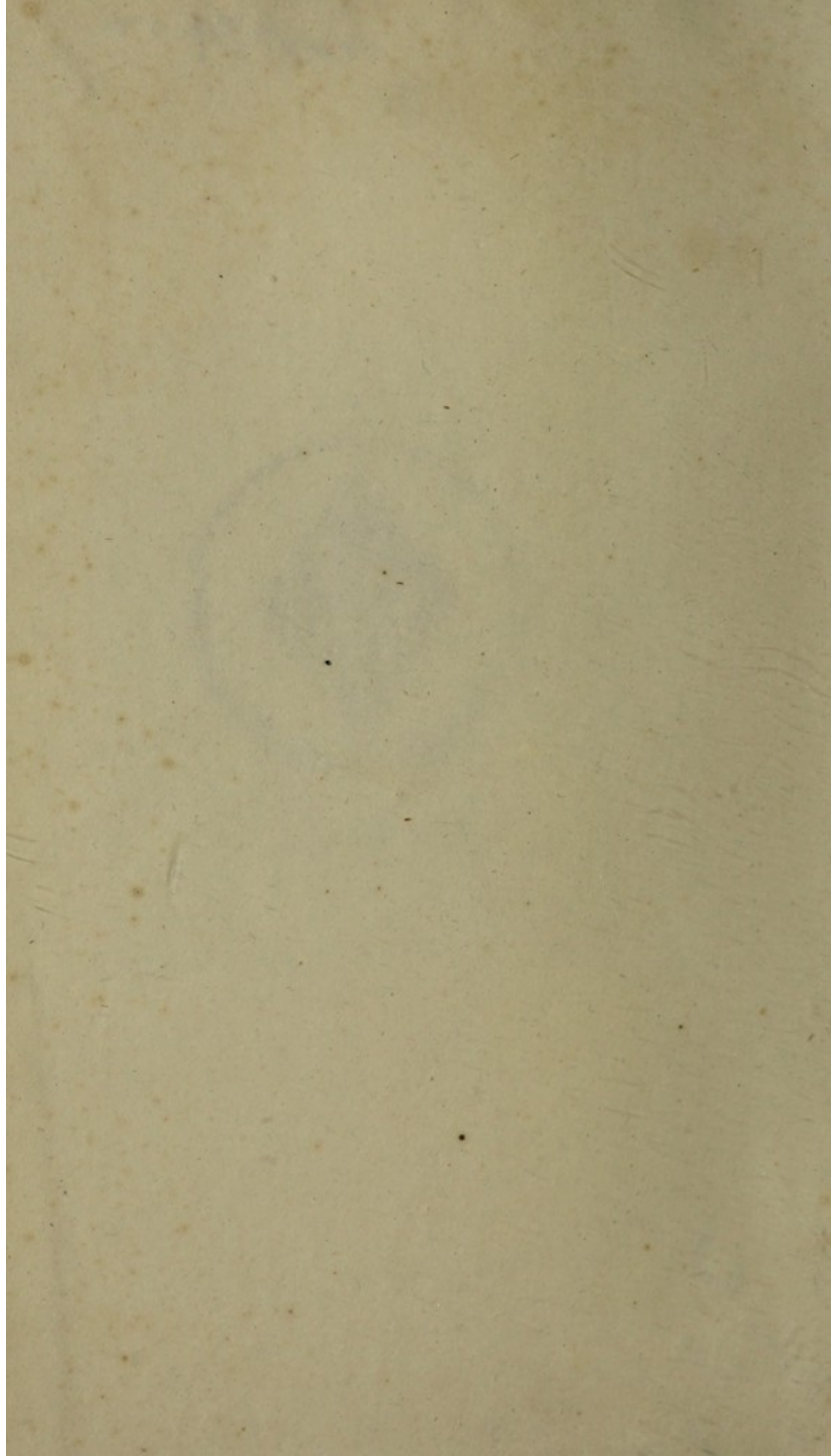
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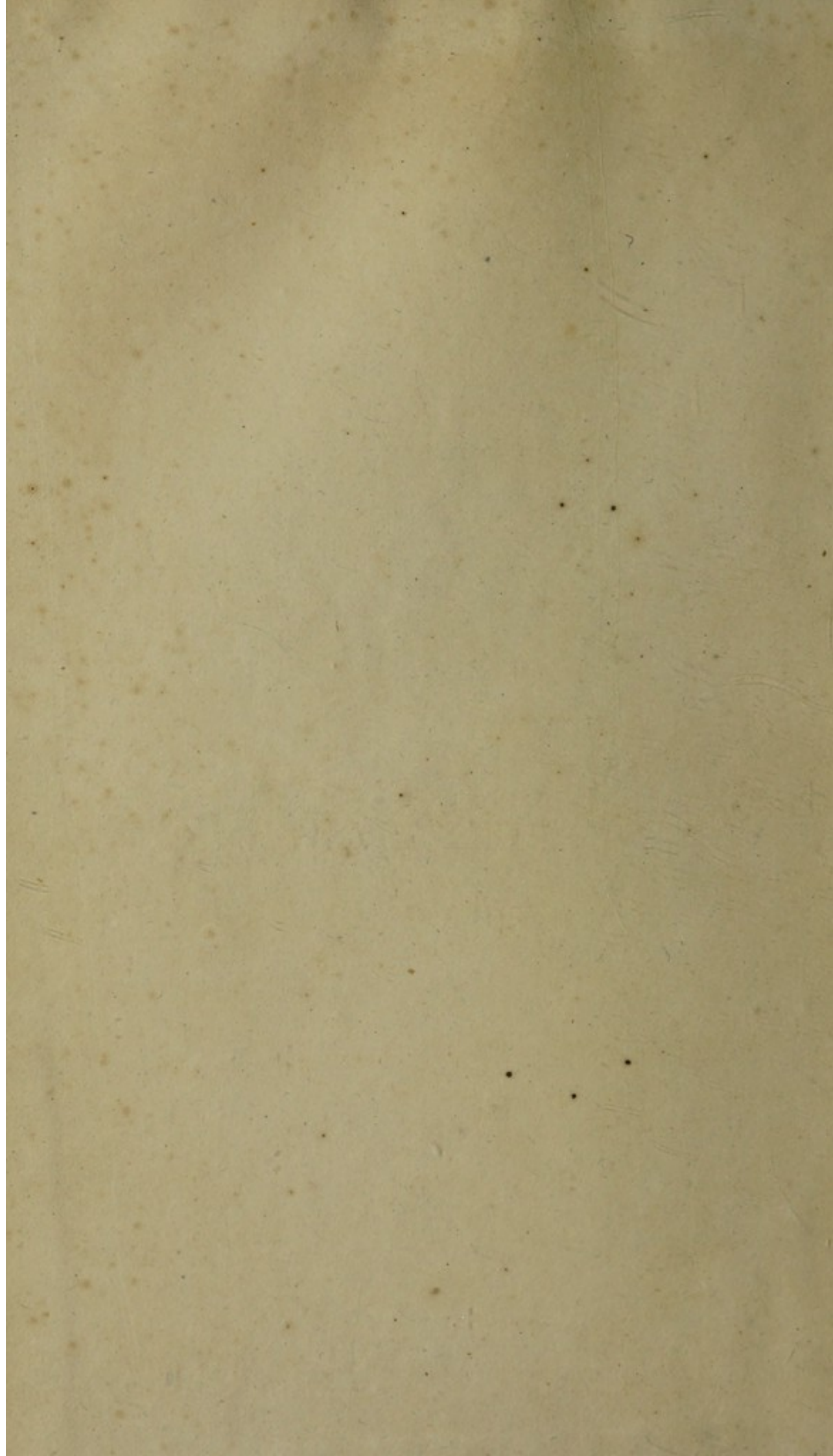


The A R T

OF

REARING AND BRINGING UP

WRESTICK FOWLS, &c.



Doyle, William
on
Fowls
1750

The A R T

OF

HATCHING and BRINGING up
DOMESTICK FOWLS, &c.

The A R T

OF

Hatching and Bringing up

DOMESTICK FOWLS

OF ALL KINDS

The A R T

OF

Hatching and Bringing up

DOMESTICK FOWLS, &c.

LONDON

Printed by G. Davis, over against St. Dunstons Church, in Fleet-Street, in the Strand, by A. Millar, and J. Noakes, opposite the Golden-Lion, in the Strand.

MDCCLXXI

The A R T
OF
HATCHING and BRINGING up
DOMESTICK FOWLS

Of all KINDS,

At any TIME of the YEAR.

Either by means of the heat of HOT-BEDS,
or that of COMMON FIRE.

By M. DE REAUMUR,
Of the Royal Academy of Sciences at *Paris*.

L O N D O N,

Printed for C. DAVIS, over-against *Gray's Inn Gate*,
Holbourn, A. MILLAR, and J. NOURSE, oppo-
site *Katherine-Street*, in the *Strand*.

MDCCL.

The A R T

Hatching and Bringing up

DOMESTICK FOWLS

Of all kinds

At any Time of the Year.

Either by means of the heat of Hot-Baths,
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L O N D O N.

Printed for C. DAVIS, over-against Christ's Church Gate,
Thomas A. MILLAR, and J. Nourse, oppo-
site the Katherine-Street.





P R E F A C E.



I was not till after I had actually hatched in hot-beds, and brought up a number of chickens sufficient to stock my poultry-yard, that I read at the publick meeting of the academy on St. Martin's-Day, 1747, a memoir that gave a general idea of the methods by which I had effected it. I was invited to this research by the many benefits that it seemed to me might accrue from that way of hatching and bringing up domestick birds. The public seemed to have judged as I had done of the advantages that were to be expected from it; they even expressed an impatience to see that memoir printed, which was to me the most affecting and most acceptable reward I could have received for the trouble and care bestowed on the experiments I had been obliged to make. However, this eagerness of the public, which I thought myself so much honoured by, had not been answered in a suitable manner had I indulged it in too great a hurry, by a speedy publishing of the said memoir. I

could not even have rendered it sufficiently instructive, by adding to it many particular accounts appertaining to the subject, which the short limits prescribed for the lectures of our public meetings, had obliged me to pass over in silence ; the methods mentioned in it for the hatching and bringing up chickens, require several branches of knowledge, and a great many small processes, the sum total of which constitutes the subject matter of an art, of which that memoir gave at the utmost only a part of the theory.

Besides, when I read it at the academy, I spoke only of experiments made in the most favourable months of the year both for the hatching and the bringing up of chickens. 'Tis true, I had been led to these experiments by principles that seemed to promise I might make them almost with equal success in the middle of winter. However, it was a material point to make myself certain by new experiments, that these principles had not led me to any too great hopes ; for there is always room for mistrusting consequences which extend the result of our experiments beyond what we have seen. I then thought it incumbent on me to try to hatch and bring up chickens during the harder seasons ; in order to be able to assert that the difference of the season required no alteration in the proceedings, that it might at most require stricter precautions than at other times ; nor did two successive winters seem to me more than sufficient time for a repetition of the experiments which I judged absolutely necessary.

In short, as it is but after a certain time we can hope to see all that can be done concerning a matter altogether new to us, I must needs have suspected that
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all the accidents against which it was proper to guard had not as yet offered to my inquiry ; I must have suspected that when the impression made on me by the first methods I had recourse to should be weakened, and leave me as it were at liberty to examine at leisure whether there were no others and even better methods for the same purpose, I might perhaps find some that ought to be preferred to them, or might contrive new means that might serve me to improve upon the first. These surmises have been confirmed over and over : successes very different from those I had expected, have informed me that I must still find out the causes which had produced them ; and after I had at last found out the said causes, I was obliged to contrive expedients to hinder them from producing effects like those I had been displeased with. I even thought then, that I must not content my self only with causing chickens to be hatched by means of the heat of dung ; I was resolved to see whether we could not usefully imploy for the same purpose the heat of common fire as they do in Egypt ; and I was convinced at last, that we had no reason to be jealous of the ovens that supply the Egyptians with such a prodigious multitude of chickens ; that we had ovens already made, by means of which we might hatch more chickens than are hatched by those Egyptian ovens so much talked of ; and that those of our bakers and pastry-cooks, and a great many others might be applied to that use ; without any hindrance of their common service, and without the least increase of the quantity of wood one must burn in them. In short, I had never been able to introduce into my work methods of making with dung chicken-ovens better than

P R E F A C E.

the first I had used, and new practices both to hatch and bring up the chickens, as well as new ways of rendering my first processes more certain, if I had published it in too great a hurry. I am nevertheless convinced I shall leave still a great many things to be found out concerning the matter treated on. However, as nothing essential seems to me to be now wanting in the new methods for the multiplying of domestick birds, I should be in the wrong to defer any longer giving them to the public, whom I should thereby deprive of the advantages that may result from thence. Nor will others be able to perceive what has escaped my notice, till these new methods shall have been put in practice.

There results from these several methods an art consisting of two parts, each whereof may be looked upon as a business by itself. The first has for its object the hatching of domestick birds, and even of birds of all classes and kinds: the second teaches how to bring up, without the help of any mother, those birds which are hatched out of eggs never sat on by a hen.

*The form of memoirs which I have given to my other works, seemed to me to be absolutely necessary for this: I thought myself obliged to tell the unlucky accidents that have made me lose a multitude of eggs, those that have caused a great many chickens ready to be hatched to die in their shells, and those that have procured the death of a number of others that were already come to light and even considerably advanced. Had I concealed these ill successes from the public, I had not been able to prove to the world the necessity of
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the precautions I propose to be used towards having a better, and as compleat a success as can be desired.

Six different memoirs will explain all that belongs to the first part of our art.

The rest will be delivered in four memoirs, the two first whereof will teach how to bring up and feed chickens so as that they may not perceive that they have no mothers. The ninth memoir shall treat of the several uses to which the new art of hatching and rearing chickens and other birds may be made to extend. And finally the tenth memoir shall point out to those who may have made it their pleasure to hatch and bring up chickens, and who shall have sensibly contracted a fondness for their poultry-yard, on that account, a variety of amusements it may afford them, some of which are useful, and the other at least curious.

However, let not the name of an Art, which we have given to the series of processes which are mentioned in this work, deter those which are averse to all application of mind, or who have no dexterity of hand whatever. All that this new art requires we should know is so very plain, that it is as soon obtained as read: nor does it require the least skill or practice of hand. It must be confessed however, that among those who shall be, and whom it better suits to be desirous to put it into practice, there are some who may think the precepts are drowned and absorbed by the observations and arguments which serve to establish the necessity of them, and others for whom all observations of mere curiosity are superfluous. I suspect that a great many
people

people of a certain class would be glad to have a work wherein the bare principles should be exposed naked and in a compendious manner. If I should ever hear the public would think such a short work necessary, I shall not make them wait long for it, it being already done: but, I am afraid, however short, it will be still too long for people to whom an almanack is a book: and it will certainly be wholly needless for those who can read no book at all. By good luck there are but few countries where all persons are incapable of being instructed by the book I am now publishing: there will infallibly be among those who shall read it, well-disposed people who will readily inform those they shall think capable of reaping the benefit of it.

The A R T OF HATCHING and BRINGING up DOMESTICK FOWLS

At any TIME of the YEAR.



MEMOIR I.

Of the ovens used in Egypt for the hatching of chickens; and of the conveniences nearly of the same kind which are to be found in most countries, and may with success be applied to the same purpose.



THE Egyptians, to whom other nations have been indebted for the elements of the greater part of the sciences, have kept one art to themselves, which to this time has been practised no where but among them, *viz.* That of hatching chickens, without having the eggs sat on by hens. They have a method of building for this purpose long and spacious
B ovens,

On Hatching and Breeding

ovens, very different in their form from those we apply to common uses: these are prepared to receive a very great quantity of eggs, and by means of a gentle and well managed fire, they communicate to such as are placed in them, a heat of the same degree with that which the hens give so equally to the eggs they sit on. After they have been kept warm in these ovens during the same number of days as other eggs must remain under the hen, the period arrives, when from each oven above thirty thousand chickens break, and come out of their shells at once; insomuch, that they are measured and sold by the bushel.

As this *Egyptian* art of multiplying at pleasure and with the utmost ease those domestick birds, of which such a vast number is consumed all over the world, cannot be too much propagated, I wonder that it never has yet been imitated in any other country. It is not for want of having had it hinted to us by accounts of authors of all ages: *Diodorus Siculus*, and others of the ancients, have told us, that the *Egyptians* had for many ages, the custom of hatching chickens in ovens, but they say nothing indeed of the manner in which it was done. And it is probable that *Pliny* had these *Egyptian* ovens in view when he wrote, that it had been found, that eggs laid upon beds of straw, in a warm place, might be cherished by a gentle heat; and after having been regularly turn'd from time to time, would, at the proper period, disclose the included animal; * *sed inventum ut ova in calido loco imposita paleis, igne modico foverentur, homine versante pariter die ac nocte, & statuto die illinc erumpere fœtus.*

Our modern travellers, *Monconys* and *Thevenot* (if these two may be ranked among the modern ones) with *Father Sicard*, *Mr. Granger*, and *Paul Lucas*,

* Book x. Chap. 55.

have given us further instructions on this head ; but these have not been sufficiently particular. Father *Sicard*, to whom we are indebted for the amplest informations on the subject, seems himself to be sensible of the insufficiency of his accounts. He tells us, that we ought not to wonder that this method of hatching chickens should not be known in Europe ; since it is unknown even in a great part of *Egypt*, it being a secret there except to a single village called *Berme*, situated in the Delta within twenty leagues of *Cairo*, and the few adjoining places. The inhabitants of this village teach the secret to their children, and keep it from all strangers. When the season that is found to be most favourable for eggs to be sat on, approaches, which is about the beginning of autumn, the *Bermeans* disperse themselves here and there in the kingdom ; and every one of them takes upon him the management of an oven. They alone are acquainted with the vigilant care needful to be taken of the eggs, during the whole time of their being kept in the ovens.

This art, so very advantageous to *Egypt*, and which the *Bermeans* keep so closely to themselves, has two parts : The object of the first is the building of the ovens ; that of the second consists in causing the eggs to be regularly heated in them, as they would be if sat on by a hen. The mystery of the art does not consist in what belongs to the first part : the out-side of the ovens is a building exposed to the eyes of all that go by, and foreigners are allowed to enter into, and see and examine the inside of them. The knowledge which the *Bermeans* have, and which they keep to themselves, is no other than that of causing the eggs to be so warmed, as that the chickens may gradually be unfolded within them, and be at last hatched ; the essential point to the succeeding in this, consists in keeping them in the

On Hatching and Breeding

proper degree of warmth, and in knowing how to manage the fire that heats the ovens.

To learn this art from the *Bermeans*, we need only attempt to do it. Their long experience cannot be so sure a guide to them for the procuring and regulating a constant degree of heat in a place closely shut up, as the thermometer may be, which doubtless is an instrument the use of which is unknown to them. It is an easy matter by the thermometer, to know what is the degree of heat, that brings about the unfolding and gradual increase of the Germ in the eggs on which a hen sits: we need, for that purpose, only to keep the ball of it immerg'd among the cluster of eggs she sits on. I have done this many years ago, and have recorded in the memoirs of the academy, that the said degree of heat is about the thirty second degree of the thermometer, made upon the principles I have given. It is then a heat of thirty two degrees, or thereabouts, which you are to preserve in the place where you would have eggs warmed in order to hatch chickens.

With this knowledge of the degree of the heat of the hen, and with the instrument that procures this knowledge, it will certainly prove an easy matter to hatch chickens in ovens like those of *Egypt*; and the description and drawings *Monconys* has given us of them, will be sufficient guides to those who shall attempt the building of these sorts of ovens in Europe. The vast utility they are of to *Egypt*, has made me wish these many years to have some built in *France*; and we should long ago have had the pleasure of seeing several thousands of chickens hatched at *Paris* in a day, in ovens like those of *Egypt*, had not a premature death taken from us a prince as well versed in all arts, as zealous for their progress, in whose hands the supreme authority had been

been deposited during the king's minority. The first trials, (which generally do not succeed, because it seldom happens that we foresee every thing) had thus been spared us. The late Duke of *Orleans* sent to Mr. *Le Maire*, while he was Consul at *Cairo*, a memoir which I had drawn up full of queries, concerning the *Egyptian* method of hatching chickens without the help of hens. In answer to this, Mr. *Le Maire* did not content himself with procuring a memoir of Father *Sicard*, containing many useful and curious instructions, and which has been printed since with a few alterations *; he besides offered in a letter which I have still in my hands as well as the memoir, to send over to *France*, and that at a small expence, one of those persons who make that art their chief employment.

What I so much wished to see attempted in *France*, has already been tried, and that with success, in *Tuscany*. *Thevenot* informs us, that the great Duke, in order to indulge a laudable curiosity, for which the house of *Medicis* had long been eminent, had sent to him from *Egypt* one of the men skill'd in the art of hatching chickens, who caused some to be hatched at *Florence*, with as much success as they are there: and he says also, that he has been told, that the same trial has been made with very great success in *Poland*. The experiment indeed which one of the *French* princes tried in this way not many years ago in his castle at *Chantilly*, was not managed by a *Bermean*, and did not succeed well; 'tis probable it ought to have been repeated with cautions not taken at first.

The assistance of one of those *Egyptians*, could not but be very useful, if one had a mind to undertake at once the hatching chickens in as immense numbers as they do in *Egypt*; if, for instance, one had a mind to warm forty or fifty thousand

* Vol. VII. *Of the Missions du Levant*.

eggs at one time : but considering how easy the thermometer makes it to regulate the heat, I cannot think the help of a *Bermean* absolutely necessary to us, so long as we intend only experiments at first on a few eggs, as it is always prudent to do. Those I shall have occasion to mention hereafter, will prove that I have not presumed too much upon what might be expected from what was known already ; and I doubt not but many useful trials would by this time have been made by others of the manner of hatching chickens, without the help of hens in several countries, and chiefly in those where natural philosophy is cultivated, had not people been stopt by many considerations.

The expence of the construction of an oven, and that of the people charged with the care of watching the broods successively to be hatched in it, cease to be an objection, when the quantity of the eggs of each brood is very considerable, and the same expence serves for the five and forty or the fifty thousand of them, which the *Egyptians* cause to be hatched at once : but this charge would deserve a greater consideration in proportion as the number of the eggs should be less. It remains to enquire therefore, how it may be possible in most of our villages to collect forty five, or fifty thousand eggs not over-stale, as they do in the Delta ? Hens have been rendered infinitely more common there, than they are among us ; and this, doubtless, is owing to the facility with which the *Egyptians* are able to multiply them : a thousand eggs, according to Father *Sicard*, are sold there for not above thirty or forty Medins, which is but forty five or fifty Sous of *French* money.

But were it as easy a matter for our peasants as it is for the *Egyptians* to collect a sufficient quantity of eggs, what could the inhabitants of cold, or even of the more temperate countries, do with so many chickens, produced in one and the same day ; with
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about thirty thousand, for that is the number commonly afforded by five and forty thousand eggs? What would become of all these absolutely destitute of mothers? They want hens to shelter them from the rain, and chiefly from the cold which is felt with us during the summer-nights, and even in many summer-days: whereas this inconvenience is not to be feared in a country, where it hardly ever rains, and where the air is always sufficiently warm. This difficulty, which appears to be much greater than it really is, may have been sufficient of itself to stop the course of many trials: however, had those who were engaged in them, attempted to remove it, they might have found certain expedients not attended with any great expence to rear motherless chickens, as fast as those that have mothers, and that even without losing so many of them as we lose of those who are under the tuition of hens. It is not time as yet to explain the methods by which I have done this with success, but I must not let the reader be ignorant, that there are among these methods some that never fail of it: he will read with greater pleasure the account of the attempts I have made towards finding easy methods, to cause as many chickens as are desired to be hatched in one and the same day, without the help of hens, when he has no apprehension that the pleasure he might have at seeing them brought forth, would be succeeded by the regret of seeing them die soon after; and when he is convinced, how easily the life procured them may be preserved, and their growth procured.

The degree of heat that has the requisite activity to cause chickens to be hatched, is very nearly that of the skin of the hen, and (what is remarkable) this is much the same with that of the skin of all the known species of domestick fowls, and probably of all other kinds of birds in general. I shall not here mention the experiments, by which I might

prove this assertion, and which I have made with such eggs, as very few hitherto have thought of causing to be sat on ; I am sufficiently exempted from this trouble by the experiments daily made in all poultry-yards. They frequently give turkey and duck-eggs to a hen to sit on ; they likewise give hen and duck-eggs to the turkey-hen, and hen-eggs to the duck. The young ones are hatched neither sooner nor later under the female of a species different from that of the female that laid the eggs, than they would have been under one of the same.

It is farther to be observed, that this degree of heat is also very near the same with that of the skin of quadrupeds, and even that of the human species : so that *Livia* must have succeeded, as she really did, according to *Pliny*, in hatching a chicken in her bosom, provided only that she had patience enough to keep an egg there during as many days as it must have remained under the hen.

A lady, whose name I heard from a gentleman incapable of asserting a matter of fact he was not sure of, found occasion for only half the patience of *Livia*, to hatch four gold-finches out of five eggs which she had out of the nest, one of which proved a rotten one, she was obliged to keep them warm only for ten days. Another lady has told me a like fact, which tho' much more extraordinary, yet has nothing incredible in it : she assured me, that she had seen a bitch that had sat on eggs quite to the time of the hatching of the chickens : the creature had taken an affection for the eggs, which she delighted to have under her belly, for some reason not easily assigned, but which to be sure was no desire of hatching chickens. Many bitches, whom an excessive fatness renders lazy, such as those belonging to the ladies usually are, might very easily, and without any constraint, be brought to sit on eggs

eggs night and day, and they would be warmed by their heat, as well as by that of the hen.

It is not only indifferent to the unfolding of the germ inclosed in the egg, of what kind or class the animal that communicates to it a heat of nearly thirty two degrees, is : it is even indifferent to it, whether it receives this degree of heat from an animate or from an inanimate being ; from a burning, or a fermenting matter : its unfolding and increase will always be procured with equal success by the proper degree of heat, let the cause that produces it be what it will, provided that cause has no other influence upon the egg than that of bare heat : for we shall, in the sequel of this work, have occasion to observe, that casualties very hurtful to the germ may occasionally attend the degree of heat which is in its nature ever so proper for the purpose. The antient *Egyptians* reasoned therefore upon a very good natural principle, when they determined that they might substitute the heat of common fire, properly regulated, to that of the hen, in order to warm and hatch chickens : the uninterrupted experiments of this kind that have, time out of mind, been made among them, need not be now confirmed by ours ; but it will be chiefly necessary for us to give an account of those which demonstrate, that the heat procured by the fermentation of several matters, may produce the same effect in the eggs, as the heat communicated to them by a hen or that by a common fire.

But why, some will ask, should we seek after heats that are in some degree artificial, to produce what nature does for us without putting us to any expence, care, or trouble whatever ? Why should we not content ourselves with letting the hens perform their usual operations ? Why, it is because here, as well as in a great many other cases, nature is not so liberal to us as we could wish ; she requires to
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be helped, and sometimes summoned and compelled to make us her presents : we should be very badly provided with wines, fruits, and esculent vegetables, if we were contented with those that are produced without art or culture. Birds, and chiefly the domestick kinds, are one of the principal stocks of food to us, a stock which it is of great importance for us to increase and multiply. If we compare the consumption made of domestick birds even with that made of butchers meat, the difference will not be found so great as one might be apt to think. How great soever the number of these birds daily consumed by large and populous cities may be, that of the birds consumed in the country, is far greater still ; in fine, the poultry-yards supply a much greater quantity of food to the gentleman, the wealthy tradesman, and the substantial farmer, than the shambles do.

It is not however, for the sound and delicate flesh which hens afford us, that we are most indebted to them : I think it might be demonstrated by calculations much too long to be mentioned here, that we are yet infinitely more beholden to the fowl-kind for the eggs they so lavishly bestow upon us. We shall be startled with the immense consumption made of them in roman catholick countries, if we reflect on the number of the days of every year, in which they become almost a necessary food to people ; and on the vast quantity of them made use of in other places, and on other days, when one is not absolutely bound to have recourse to them. By multiplying the chickens or the hens, we shall multiply the number of eggs. The procuring corn and cattle in plenty, has been a part of the views of the greatest ministers, nor is the procuring a plenty of domestick birds an object less worthy of their attention.

So long as we shall depend entirely upon our hens, we must not expect to see the multiplication
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of the species carried so far as might be wished : it is not nearly all the hens of a poultry-yard that are willing every year to sit. In some years, when I have wanted sitting hens for some experiments I would have made, I have had the mortification not to find above four such among fifty or sixty of them. Complaints of hens that refuse to sit are very common in the country. I think in general, that it seldom happens that the third or even the fourth part of them are so disposed. Beside this, they are not always willing to sit at those times when we wish they would, which is in part the reason why the early chickens are dear a great while, and why we have not every year a supply of them as early as we wish for it.

Why do we not try then to make up by art for the scarcity of what the hens are dispos'd to give us? The example of the *Egyptians*, who are so much the better for not depending upon hens to have chickens, seems to point out to us what we ought to do : notwithstanding the expence of the building of their ovens, and that of the people employed to look after them for the whole time, during which a gentle and equal heat is to be kept up in them, their broods are not by much so expensive as ours : for it would be a very great mistake to think that it costs us nothing to make our hens sit. A hen is employ'd in sitting on her eggs, and in the care of the chicks that come out of them for two months and a half at least, and sometimes for three, or three and a half of the months that are most favourable for laying, and during which she might have laid above thirty eggs at a medium. To have fifteen eggs set on, which is the number commonly given a hen in this country, we must of course lose, thirty others ; by which means the price of each of those that are put under the hen, becomes that of three eggs. This is one of those things that may seem to be small, or almost unworthy

unworthy our notice, when considered singly, but which appear of some importance, when we reflect on the prodigious number of times they are repeated. It would cost much more than a hundred thousand eggs to have only fifty thousand of them sat on by hens ; that is, above two thousand five hundred livres in those countries where eggs are sold for six sous a dozen, and twelve hundred and fifty livres in those where a dozen is sold for three sous. It would not cost us nearly so much to have the same number of eggs warmed after the *Egyptian* manner ; the whole expence indeed would be little more than the salary of one or two men for three weeks or a month at most.

However, I fear we ought not to expect to see the *Egyptian* ovens made use of in our country : the difficulty of collecting a sufficient quantity of eggs not stale, the first expence of the building of ovens, the want of men capable of looking after them, and the difficulty of bringing up any to that business, are obstacles not to be overcome but by a stock of resolution and constancy, much superior to that we generally shew when any thing is to be procured for publick utility. My earnest desire has been, that another method might be found out for hatching chickens, either in a very great or in a smaller quantity at once, at our pleasure, that would not require any previous expence, that might be easily practised in the country, by the simplest rusticks, and might procure an agreeable and useful amusement to men of another class there ; to all that take a pleasure in the variety of sights and operations which the poultry-yard may afford, and who delight in furnishing it in plenty with birds of different species ; to those who if asked why the care taken for that purpose should not be as reputable, as that we employ in cultivating plants, trees and flowers in a garden, would not hesitate upon an answer ; to those, in short, who being apt to think
that

that this object is ennobled by its utility, think besides, that animate beings, such as birds, may procure more satisfactory observations to a philosophical mind than those that only vegetate.

The care of multiplying fowls, which is now entirely left to the good women in the country, would then become an employment worthy of such among the naturalists as have in a superior degree the talent of observation, and that of contriving experiments; and the constancy necessary to pursue them: It were to be wished, that such would employ themselves about bringing to perfection what I shall be able to leave only in embryo. This truly important subject offers to us two principal considerations, *viz.* that of the manner of hatching chickens, and that of rearing them. The *Egyptians* have been exempted by the temperature of their climate, from making any researches as to the latter; but those they have made with regard to the former, have led them to a process, by means of which they are able to carry the multiplication of chickens in a manner as far as they please. Let us try whether we may not imitate them, or have recourse to expedients equivalent to their ovens, that might be better suited to our situation, and more easy for us to employ to advantage.

Tho' the modern travellers, who have attempted to procure us the knowledge of these ovens have not given us descriptions of them so particular as we might have wished; though they do not always agree among themselves concerning the number and proportions of the parts of those buildings; yet what they have delivered to us on that head, appears sufficient to assist us in the constructing some in Europe, in which we might warm as many eggs as need be put into those we propose to ourselves as models, and that with equal success. The authors who have given us accounts of them,

all agree as to the main point: what they differ from each other in is commonly of less importance. They all of them give us the whole scheme of the construction of these ovens, and no more than this is necessary to guide an intelligent man. With the assistance of *Monconys*, who has added the draughts to his short description; or better still with *Father Sicard*, who has given no draughts, but whose description is more particular, a man may easily build an oven in the manner of those of *Egypt*; which, though not perhaps like them in every respect, yet may be successfully employed for the same purpose. Matters of fact which we shall mention afterwards will prove this, and shew that we are not so strictly obliged as we might be apt to think, to give any certain form to the ovens, that are to serve to warm eggs and hatch chickens.

These ovens, which *Egypt* ought to be prouder of than of her pyramids, are not buildings that strike the eye by their loftiness; they are scarce above nine foot high, but they have an extent both in length and breadth, which renders them remarkable, and they are yet more so in their structure within. It is this inner frame and disposition which we are to enquire into most of any thing, and which when well known, will give us a sufficient idea of the whole form of the structure which is usually of brick. The middle * of the building is a very narrow gallery (usually about) three foot wide which extends from one end of the building to the other; and is eight or nine foot high. You come into the oven through this gallery, which commands the whole extent of it, and facilitates the several operations that are necessary to keep the eggs in that degree of warmth they would have under the hen; it has a door not very wide, and only as high as it is broad; this door and many others which we are going to speak of, are commonly no more than round holes. This

* Plat. I.
BK E.

This gallery is a corridor, or a kind of dorter, which has this difference from our common corridors or dorters, that these have only one row of rooms on each side at most, whereas this has always two rows of them on both sides, *viz.* one on the ground-floor *, and another over these. Every * Plat. II. room on the ground-floor has one over it perfectly Fig. I. and equal to it, both in length and breadth. The rooms ^{2.} of each row on the ground-floor are all regular and equal, not only in length and breadth, but also in height : we know of no other rooms in the world so low as these : they are but about three foot high ; their breadth, which is in the same direction with the length of the gallery, is four or five foot ; so that they are very narrow in proportion to their length, which is twelve or fifteen foot.

Every one of these rooms has its door or round opening, which is about a foot and a half in diameter, and opens into the gallery † ; this is a hole † Plat. I. wide enough for a man to creep through. All the K K K. eggs to be hatched are at first ranged in these rooms : Father *Sicard* informs us, that four or five thousand eggs are put into every one of them. These are the real ovens, so that the whole building which we have called a chicken-oven, and which is called a *Mamal* in *Egypt*, (a name we shall occasionally make use of hereafter) is an assemblage of many ovens set together by the side of each other, opposite or over against each other, and over each other ; and in the course of the process a part of the eggs are warmed in the upper-rooms, after having been warmed in the lower.

Father *Sicard* gives but four or five rooms to each row on the ground-floor, Mr. *Granger* insists upon their being seven, *Monconys* gives each of them ten, or even twelve, and *Thevenot* no more than three. Let not authors, who speak of nothing but what they have seen with their own eyes, be suspected

suspected of want of exactness on this account : it is more natural to think that there are in *Egypt* Mamals of different sizes, and that some of them are twice as large as others : and this is the more probable as Father *Sicard* tells us, that they warm only forty or fifty thousand eggs at once in them, whilst *Monconys* asserts, that they warm no less than eighty thousand ; a difference which is in the same proportion as that of the extent of the Mamals they speak of.

According to Mr. *Granger's* account, the eggs are laid on mats in each room of the ground-floor. *Thevenot* says, they are laid there upon a flock-bed, or on a layer of flax, but this is a difference of no consequence ; they are there to contract a gentle warmth, in which they must lye for a certain number of days.

The upper-rooms, that is, those one story high, the use of which has not yet been mentioned, have each of them fire-places, where the fire that warms the eggs in the corresponding inferior rooms is made : the floor that separates each of these from its inferior room, has a great hole, or aperture in it * ; the dimensions whereof have not been determined by any of the authors who have mentioned it ; but which *Monconys's* draughts make us judge to be considerably large ; it is through this hole that the heat is communicated to the inferior room.

The floor which separates the upper room from that under it, has on each side a gutter or channel continued its whole length † : These two gutters SS, T T. are the places where the fire is lighted. Mr. *Granger* § TS, TS. adds two more to these, that is, one § at each end of the room, which have been mentioned by no other author, and which may be not greatly necessary. He makes them six inches wide, and two inches deep.

Wood

Wood and coals would make too quick a fire; the matter they burn in the gutters, or fire-places, is cow-dung, or the dung of camels, or of some other animal, dried and mixt with straw: they make this into a sort of turfs: those made by our tanners would be no less fit to procure a gentle heat.

Every upper room has, besides the large aperture, through which it has its communication with the lower ones, two more holes, viz. A small one *, in the arch that supports it in lieu of a ceiling, and another in the wall, that separates it from the gallery †: This last serves it instead of a door, as the hole § placed in the same manner under it, does to the room below; and performs also the office of a chimney, giving a vent to the smoak, which has no other passage to go out at; for during the whole time that the fire is burning, they keep the hole in the arch or ceiling of each room stopt. The smoke by this means is carry'd into the gallery through the door of the upper room, whence it may go out through holes || which are made in its roof. They also stop the doors of the under rooms whilst the fire is lighted, that the air within them may be sooner warmed with the heat communicated to it from the upper ones.

There is no need for employing a joyner to shut up all these doors; not even those of the gallery: they are only so many holes to be stopt, but it is of importance to do this exactly; it is better done with plain wads, or bundles of coarse Tow, than with any kind of wood-work.

The heat of the air in the inferiour room, and consequently, that of the eggs, would rise to an excessive degree, if the fire was incessantly kept up in the gutters. Father *Sicard* says, that they keep it there only an hour in the morning, and an

hour at night, they call these heatings the dinner and the supper of the chickens. They give them however, two more meals according to *Monconys*, that is a breakfast, and an afternooning; for he says, that the fire is lighted four times a day. These differences in the accounts of our two authors, would perhaps be easily reconciled, had they told us what the temperature of the air was in *Egypt*, in both the times and places, in which they observed chicken-ovens. They have in that country eggs warmed, and chickens hatched for several months together: and as, in the hottest countries, all the months which follow one another have not an equal temperature of air: that of some of them may require, the fire to be lighted a greater number of times, or that they keep it longer in their ovens, than ought to be done either in the succeeding months, or in those that went before.

Chickens with us never come out of eggs set under hens sooner than on the twenty-first day; nor do they come out sooner than this in the *Egyptian* ovens: But what is very singular, is that for many days before that of their hatching, it would be needless and even dangerous to make any more fire in the oven. After a certain number of days heating, the whole extent of the place has acquired a degree of heat that may be preserved in it many days together, only by using a few easy precautions, notwithstanding the impressions of the outward air, and that without any sensible diminution, or at least without any that may be hurtful to the chickens. The period at the end of which they cease to make fires in the ovens, is another of the articles on which the travellers who speak of them do not perfectly agree. I don't know whether the observation we have already made on the difference of the temperature of the air in the several months of the year may be sufficient to reconcile

reconcile them, or whether we ought not rather to think, that not having been able to attend the operation during its whole course, they have been obliged to rely in some measure, on the informations given them, which may not always have been pertinent or faithful. Father *Sicard* and Mr. *Granger* assert, that the fire is only kept up during the first eight days. *Monconys* affirms that it must be kept up for ten days. *Thevenot* says likewise, that the oven must be heated for ten days running; but either for want of having been well informed, or for want of having well understood what was told him of the manner of managing the ovens, he adds, that the eggs are not put into them till after the said ovens have been warmed during those ten days, and that the chickens come out of them twelve days after. This last assertion shews that he mistook the removing of part of the eggs which we are going to mention, for their first introduction into the oven.

All these authors however agree in unanimously saying, that the eggs continue to be properly warmed in the oven for many days together, although no more fire is lighted there. On the day in which they give over lighting, part of the eggs of each inferior room are always conveyed into the room over it. The eggs had been too much heaped in the former, and it is now time to extend and give them more room. It is a task sufficiently hard for the chicken ready to be hatched, to have its shell to break and come out of, without putting it besides under the necessity of lifting up the weight of a great number of eggs laid over it; it would perish doubtless after many needless efforts made towards it were not they thus removed in time. The account given by Mr. *Granger*, differs in this farther respect from that of the rest on the article of the removing part of the eggs, viz. that he causes part
C 2 of

of those in the inferior room to be carried into the upper one six days after the fire has been totally extinguished ; that is, on the fourteenth day.

When the proper number of the eggs of each inferior room have been carried into the upper one, they stop exactly with bungs of tow all the apertures of the rooms and that of the gallery ; except that according to Father *Sicard's* account, they stop but half the apertures in the arches of the upper rooms : which is done in order to procure a circulation of air there. This precaution is sufficient to preserve for many days together in the oven the heat it has obtained : which is effected by barely preventing too great a communication of the inward air with the air without. In any country in the world, an oven of so considerable a bulk as these are, would cool but very slowly ; the cooling of it however must be so much the slower, as the temperature of the air without is less different from that of the air within, which difference is not vastly great in *Egypt*.

All the varieties which appear between the accounts of the several Authors, who have endeavoured to inform us of the manner in which chickens are caused to be hatched in *Egypt* without the help of hens, do not constitute any difficulties capable of staggering a man of understanding, who should be inclin'd to establish and manage in any climate whatsoever, ovens like those of that kingdom ; because all the difficulties concern only the regulating of the heat, so as not to procure any but the properest degree of it. The degree of heat, to be procured and kept up during the number of days necessary to bring the chickens to a timely birth ; would, in different countries and seasons, require the making of more or less fire, or keeping it up a longer or a shorter time : and thermometers

mometers placed in different corners of the oven, would inform us with certainty of the time when the fire ought to be increased or diminished, or when it should be put out or lighted again.

There are beside these, in the accounts of the several travellers, a few other differences, but they are too insignificant to deserve our notice. *Mon-conys*, for instance, places the eggs in the inferior room immediately under the great aperture of the upper one; and Mr. *Granger*, on the contrary, tells us that they leave in the lower room an empty place, which is right over against the aperture of the floor of the upper room, and that this is done because a man comes from time to time out of the upper room thro' its aperture into the lower one. These are proceedings each of which may be in different places preferred for some peculiar reason. The eggs placed immediately under the aperture, are in a more advantageous situation there to be warmed: but an empty space in that place is very convenient to the Bermean, who is turning the eggs all day long, and continually changing the place of those he finds less warm, and of those he finds to be most so, and in taking out of the oven those that prove to be spoiled, and such as he judges to be rotten.

Father *Sicard* has given us an account of the immense quantity of chickens hatched in *Egypt* in the *Mamals*. He informs us that the number of these ovens, which are dispersed in the several cantons of the country, is no less than three hundred and eighty six; and can never be increased or diminished without its being known. Each Mamal has its Bermean, and but one who is entrusted with the management of it: the Bermeans cannot absent themselves from home without obtaining leave so to do from the Aga of *Berme*, from whom they never get it but on paying him a sum of six, eight, or

ten crowns. The Aga constantly keeps a register of those he has granted that permission to : And the said register is his rent-roll in this respect.

It is then a fact known with some certainty, that there are every year three hundred and eighty six ovens at work in *Egypt*. Father *Sicard* assures us that they are employed for six months together : *Thevenot* indeed says, that eggs are warmed in these ovens only during four months and a half : but this perhaps is true of those only of some peculiar cantons ; Father *Sicard*, who must needs have been better informed of these things than any body else, continues to inform us, that each brood remaining no longer in the oven, than twenty or twenty one days, the time it would do under hens, the six months during which the heat is constantly kept in a *mamal*, allows more time than is necessary to bring eight broods one after another to a timely hatching ; so that one or two of these broods may be of either duck or turkey eggs, &c. the young of which are hatched seven days later, than those of the eggs of a common hen. Supposing then that they make in every oven each year, eight broods one after another ; the three hundred and eighty six ovens will afford yearly three thousand and eighty eight broods. The number of the eggs of each brood is not always equal, because they are not always able to collect the quantity of them necessary to fill the oven : Father *Sicard* says, it is sometimes of fifty thousand eggs, and sometimes only forty thousand : *Monconys* makes it much more considerable, and carries it as far as eighty thousand : Let us however take a quantity only that is a medium between the two numbers mentioned by Father *Sicard* : let this quantity be supposed to be forty five thousand eggs : he tells us besides, that the Bermean is not obliged to return the undertaker, who trusted him with the manage-

management of the mamal, more chickens than what are equal to two thirds of the number of the eggs he had received: so that for the five and forty thousand eggs, he is obliged to return no more than thirty thousand chickens. Nor is he in general a loser by such a bargain; it is rather a small benefit to him over and above the thirty or forty crowns paid him for his work during the six months, besides his board. Let us suppose therefore that each oven full of eggs does not afford any more than the thirty thousand chickens which the Bermean is bound to return the undertaker; we shall then only need to multiply thirty thousand by three thousand and eighty eight, the number of the broods, to be able to determine within a trifle the number of chickens which these ovens actually give birth to in *Egypt* every year; and we shall be amazed at seeing this rise to above ninety two millions of chickens: it amounts to exactly ninety two millions six hundred and forty thousand in one year.

I am almost afraid to advance a proposition which nevertheless appears to me very true, *viz.* that this quantity of chickens, which probably will be looked upon as prodigious, might be annually produced in *France*; and in all other populous countries, without having recourse to the Bermeans, without taking the trouble of building any ovens after the model of those of *Egypt*, or indeed of any other form, and without being at any expence in fuel; although the ovens which I would direct to be used, would be warmed by a constant and ordinary fire. Let us divest this proposition of the air of a paradox. My intent is that without diminishing any thing of the efficaciousness and utility of a fire, actually imployed for other uses, we might reap the benefit of a heat which it affords and which is lost, to warm eggs and hatch

C 4

ckickens.

chickens. People who were more industrious and more inquisitive than the generality of those who are obliged to keep a continual heat in stoves, or daily, and some many times in a day, to heat ovens either for pastry or for the baking of bread, have bethought themselves of trying to make use of the heat of the said stoves and ovens, to cause chickens, ducks, &c. to be hatched. Instances have been given me of the good successes of some of these attempts which I could no way question: yet I have some reason to think that the people who made them, have not sufficiently sought out all the means for securing the success of them, and that they have not conceived so high a notion as they ought, of the benefit the publick might reap from those trials; having ceased to pursue them, having had no imitators, and having not themselves made their experiments in a large way. There are many ovens and furnaces which are all the year round in use with us, and which might be made to receive a great number of eggs, in a heat fit to warm and hatch chickens out of them: such are the furnaces of glass-houses, and those where iron and the other ores are melted. The number of stoves fit to hatch chickens might also be multiplied infinitely more in large towns by the ovens of the pastry-cooks, and especially by those of bakers. We might also have stoves of this kind in all the places where there are common ovens which are heated every day, or even seldomer. The care of hatching and bringing up the chickens, might be made the occupation of the wives of the workmen employed in the ovens or furnaces just mentioned.

I have a long time very much wished I were in a situation to put the masters of the glass-houses, and those of the furnaces for the melting of ores, in mind of making use of a heat which they
suffer

suffer to be lost, to multiply domestick birds of all kinds: but I never yet had an opportunity of doing it; nor was I ever yet in a capacity of determining the places and the most proper sizes of the stoves which they might build back to back against, or on the tops of their furnaces. I have had better opportunities of informing myself what might be expected from the ovens of bakers, and of the situation and proportions fit to be given to the stoves which they might heat, so as to produce in the eggs the gradual changes wrought in them by the heat of a hen, in the space of twenty or one and twenty days: in short, I have had an opportunity of convincing myself, that these stoves are either all of them ready for use, or that to make them so would not require any expence worth minding.

A French Clergyman rector of *St. Sulpice*, who has done many great things out of a publick spirit, and who is ever shewing such an ardour for the multiplying of useful establishments, as might be wished in every statesman, and by which the name of the ministers animated by it, has always been rendered immortal, no sooner heard of the method I had found of hatching and multiplying chickens by means of layers of dung (which method shall be explained at large in the following memoirs) but he expressed an earnest desire to see it put in practice in the society of *L'enfant Jesus*, which is indebted to him for its existence and establishment. He desired me to have made for him, all the utensils necessary to warm eggs in a stratum of dung, and to go to the society of *L'enfant Jesus*, and among the several places where that dung might be lay'd, to chuse that which I should judge to be fittest for the purpose. That done, he would needs procure me the pleasure of seeing all the parts of such an immense establishment, all the things that contribute to the supplying the wants of this numerous

merous corporation, where occupations useful to the state are given to those whom age has deprived of the strength requisite to the doing of hard works, and to those who are still weaker because in their infancy. He there gave me the pleasure of seeing all the works, that serve to procure an honest and decent maintenance to a number of young creatures; who, being perhaps very happy to have been born without sufficient fortunes, have in that place an education above what their parents could allow them. The bake-house was one of the places to which the good rector was so kind to conduct me; this has at one end two ovens * in a line, where they bake for several months of the year, two thousand four hundred pounds of bread every day. A room † is built over the arches of these ovens, which shelters them from the injuries of the air; it is eighteen feet in length and eleven in breadth, and but five foot and a half high: this room has but one door which is in the same wall where the mouths of the two ovens are, and in the middle of the space between them: the threshold of this door, is but a few inches higher than the highest part of the arch of either oven: and a very plain stair-case which is in the bake-house itself leads up to the door. I went into the room: the heat I felt at my coming in, gave me a surmise that it might easily be made a stove as fit to hatch chickens, as any of the *Egyptian* ovens. I had not then about me the instrument to inform me, if the degree of the warmth of the air of this room was exactly that which the hen communicates to the eggs she sits on: I did not foresee I should have wanted a thermometer there; but I was determined to come again purposely to examine the temperature of the air of that room, not with one only, but with several thermometers that might be placed at the same time, at different heights in one and the same vertical

* Plat.
III. A B.

† NOPK.

tical line, and in the different parts and angles of the said room.

It was in the Easter-week that I was first able to execute the project I had made above a month before, of strictly examining the degrees of heat that were constant in the several parts of this stove. This inquiry answered my expectation : I was made certain that there were places in it where the heat was naturally very nearly sufficient for the warming of eggs with success ; and I doubted not but I could easily make the heat rise in it to the degree I desired ; that is, to the degree most favourable to the eggs ; because I had found the door open, and was told that it had been so for above an hour at that time : the cold air this accident had let in, must needs have considerably lowered the degree of heat in the stove.

I then made no scruple of assuring the rector of St. *Sulpice*, and the nuns of the house, that they had a place where they might warm eggs and hatch chickens with as much, and even more success than could be done in beds of dung, and that with less trouble, and in a manner more suitable to a society of maids who love cleanliness. I advised them not to think any more of beds of dung, and shall always give the same counsel to all those who have stoves of sufficient warmth about them, and that cost nothing the heating.

It remained to be examined, whether the heat would continue sufficiently equal in that stove, or new contrived chicken-oven ; whether it would remain in the same state from morning to evening and during the night : whether it would be equal from one day to another, and in case it should be liable to variations, how these could be prevented : the day on which I had examined its degree of heat, the fire had been lighted in both ovens ; and the last batch of bread was but just drawn

drawn when I made my experiment. Altho' more trials appeared to me necessary, I must own nevertheless that I doubted not in the least but that they might make a very beneficial use of the heat of the stove: I knew that there were walls and floors, in which after having been exposed for several months together to the continued action of the fire, or to such an action of it as had only interruptions nearly regular, the heat they were thus made to contract was not liable to any sudden variations, and that its diminutions and increases came on but slowly. The result of the trials agreed very well with my expectations. The Abbé Menon, a gentleman who has been so good to take upon him the inspection of all my cabinets; who does me the favour to live with me in order to assist me in my experiments, and who bestows upon those he makes, and upon all the observations resulting from them, a scrupulous attention which he carries almost beyond my wishes, being provided with a good number of thermometers went the very next day to examine anew, the several degrees of heat in the different corners of that stove and that at different heights. The fire had not been lighted in the ovens that day, he nevertheless found that the heat far from having diminished during the twenty seven or twenty eight hours in which they had not made a fire in these ovens, was even increased: some places of the stove, the heat of which we had judged to be about two degrees too weak the day before, had since acquired the said two degrees of heat: but then the people had taken care to keep the door shut, as I had desired.

Since then we were sure to have in that stove the sufficient degree of heat, even on the days on which the ovens were not warmed, all that could be feared was, that we should have too much of it on the days when many oven fulls of bread should be

be baked, and especially when this should be done for several days successively : But it was plain that the door just spoken of, and a window * not yet* Plat. mentioned might be made to afford us sufficient means III. K. to temper at our pleasure the heat of the air : it was easy to imagine that in order to do this with greater success, we might contrive both in the door and in the window several apertures of different sizes, and of any form whatsoever, to be shut with stopples or registers, to be taken off whenever the thermometer should indicate that the heat began to make the liquor rise beyond the degree prescribed : that we might take off more or fewer stopples, or open more or fewer registers, according to the directions of the thermometer, and that there might be times in summer at which there would be a necessity to open both the door and the window.

There was no necessity to defer making an experiment on a few eggs in that stove, till we had given it all the qualifications that might render the use of it surer and more commodious. I proposed attempting it, and it was accepted : the young women mindful of all the duties of their holy state : truly worthy of their spiritual father, by their zeal for the œconomising and increasing of revenues so very useful to the publick : women, in short, of the utmost ingenuity, readily took upon themselves the commission of pursuing the experiment, which I had all the reasons in the world to think would be as well managed as any first experiment possibly could be. They were contented at first to put in only a few dozen of eggs which I ordered to be placed at some distance from the floor, upon a small sort of wooden-bench fixed in one of the places where the thermometer shewed that the eggs would be warmed exactly as much as under a hen. But as that place was liable to become warmer at some times, and

colder at some others than would have suited the eggs; some of the nuns, the care and watchfulness of whom might be depended upon, where informed of the places of the stove whither the eggs must be removed according to the exigencies of either of the circumstances mentioned: and thermometers were left them as guides that would never mislead them. After having consulted them with great care, and even oftner than was necessary during the destined period, they on the twentieth day received the reward of their cares, and had the pleasure of seeing eight chickens break and come out of their shells, and of seeing a great many others hatched the next day. They did not indeed all succeed, some perished in the shells, which happens but too often to those of the eggs sat on by hens. Besides, we never think of every thing in the first experiment, we cannot know without trial all the things necessary to be minded: several precautions were omitted in this, because the necessity of them was not known.

The trial just mentioned, was sufficient to shew the benefit that might be reaped from the stove thus heated by the two ovens. This stove is so very spacious, that one might warm almost as many eggs, and hatch as many chickens in it at once, as in one of the *Egyptian* ovens, if one had a mind to use the whole room: but although they might afterwards have had a mind to use it to hatch that quantity of chickens at a time, it would not have been prudent to begin with working so largely. I advised them to make in the warmest corner of the stove a by-place by means of a few partitions of plaister, and to form there a small kind of closet, that should be the true chicken-oven. Instead of making it with plaister, they only did it with wood and made it

* Plat. IV. very little, constructing a kind of cupboard * five
Fig. 2. foot and a half high like the place it was in, and
only

only two foot eight inches wide and as much deep : the dimensions I am speaking of were arbitrarily taken, they might, if they had been willing, have more than doubled the breadth of the closet, and encreased its length even in a much greater proportion : let then the cupboard we are now mentioning not be looked upon otherwise than as a model of the stove, which might have been made larger, and which would have preserved the heat still better, had it been built of plaister.

Small as this cupboard was, it would have been sufficient to warm above a thousand eggs at once. However they contented themselves with keeping in it no more than two or three hundred at a time. Shelves placed one over the other, supported on baskets nearly square and shallow, wherein the eggs were ranged : the depth of each basket was such as might just contain the layers of eggs. Notches made an inch asunder at each end of the cupboard, served to hold the shelves, and procured the convenience of putting them either higher or lower at pleasure. This facility of changing the situation of the shelves, becomes a means of putting the baskets in warmer or colder parts of the stove, according as the thermometer shews that the place they are actually in is either too cool or too warm.

Beside this means of regulating the warmth of the eggs, there are a great many others which readily offer of themselves. The doors alone of the cupboard which may be called the small chicken-oven may afford many. It must have two doors at least in its height, the upper or under one of which may be opened as need requires. Each door may have besides one or two square apertures or windows to be shut or opened, as much or as little as is necessary, as each of them has its little shutter, that slides in two grooves formed without the cupboard
by

by a couple of wooden ledges nailed on it, the one under, and the other at top of the window.

Lastly, you also increase or diminish the heat within this cupboard in proportion as you increase or diminish that of the room it is in : and we have already observed to the reader that the room, I mean, the great stove, has a door and a window : that the heat is preserved in it by keeping the said door and the window close shut, and that they may be weakened at pleasure, by opening them more or less.

Ever since the ladies of the society of *L'enfant Jesus* began to warm eggs in this cupboard, they have always done it with success : however, they have not thought of substituting another cupboard of a larger size ; because they had at the same time other chicken-ovens which we shall mention by and by, and which borrowed their heat from a layer of dung. These had been constructed first, and a liking had been taken to them, as they had been attended with success : it was easy to examine and look after the eggs in these, without being under the necessity of breathing an air as warm as that of the stove. However, it being supposed equally easy to establish chicken-ovens warmed by dung, or to have some of those that are warmed by a baker's oven, I would always give the preference to the latter, as the use of them is equally certain and commodious. Those who shall be willing to have recourse to them, will infallibly contrive many additional conveniencies in them which I do not mention here. As the baking-oven has a larger capacity, the stove in which the cupboard for chickens may be contrived will be more spacious : the stove will also be better warmed in proportion as a fire is oftner lighted in the oven for baking. If they don't use the oven often enough to communicate a sufficient heat to the air of the stove, recourse must be had to an expedient that may

may render the air more easy to be warmed ; which expedient is to lower the cieling of the stove : we shall soon see instances of the good effects of these low stoves.

All baking-ovens have not like these I have just mentioned, a room built immediately over their arch : however, all those that have their arch covered, may afford a stove for Eggs at a very little expence. I am now going to mention two of these last sort of baking ovens, upon each whereof I have built a stove for the hatching of chickens. What I shall say of these may serve to guide any body to make the same use of any other oven he may have at his disposal, let the proportions and situation of it be what they will, provided that it is under cover, and has not its arch exposed to the injuries of the air.

One of these ovens happened to be so happily situated, that I could not omit attempting to make it serve for the hatching of chickens : it happened to be in a house just opposite to the door of my own ; my self and the people employed to look after what passed in the oven, had only the street to cross to get at it : the length of its hearth or fire-place from the mouth quite to the bottom was eight foot and a half, and its breadth one foot less than that, in the place where it was widest. A building had been raised over the arch of this oven one story high, which consisted of a bed-room only : the joists of the floor of this chamber * were * Plat. V. distant from the outward surface of the Arch †, † Fig. 4, q. q. but about eight inches : They could not very † Fig. 4, e. f. well have been placed nearer without taking away the liberty of making any repairs in the arch whenever they might become necessary. Probably it was in order to discover with greater ease, what of this kind was wanting to be done, that the extremity of the space which was between the joists of the floor of

D

the

the room and the arch of the oven had been left open : this extremity was diametrically opposite to that under which the mouth of the oven was placed. There remained then in that place an aperture seven foot and some inches long, and eight inches high. The great quantity of air this let in, appeared to me capable of diminishing very much the heat of the air that filled the capacity of the place where I had a mind to have eggs hatched. Thermometers were placed in different parts and corners of that capacity, which I shall hereafter call the stove or chicken-oven : they informed me that some of the said corners were less warm than others ; and that those that were warmest, had at certain times scarce the degree of heat which the hen is able to communicate to the eggs on which she keeps her belly close during many whole days together.

* Plat. V. The back part of the bottom of the oven *
 Fig. 4. c. was not here in the open air, as it very often hap-
 d. e. f. pens to be in the country. It was in a small room which had been designed for the reception of the ashes and small coals which were swept from the hearth of it. In order the better to preserve the heat in the stove, to render it more equal, and to have more power of moderating it, it was proper one should be able at certain times to shut intirely up the great aperture that bounded one of its extremities, in order to stop all communication of the external air within ; and that one might be able on the contrary at other times and at one's pleasure to give the air without, a more or less freedom of access into the stove.

Among the different methods fit to procure proper means of doing this, that I chose was to have a
 † g. i. k. wooden rectangular frame † fastened against the
 h. aperture, of which it took in nearly all the dimen-
 * l, m, p, sions every way ; this frame was to do the office
 of a door-case, and was to carry three doors.*

of

of equal size, which together were to fill up the whole empty space or void of the frame. These doors did not open as doors commonly do, they were lifted up like the cover of a trunk *, * p. but each of them severally, as each moved on hinges or turning-joints fastened to the upper-cross-beam of the frame : Finally three hooks fastened on the joists of the floor at proper distances from each other served to keep the three doors intirely opened or raised, when every one of the said hooks was put in the ring of an iron pin drove into the edge of one of the doors.

We were thus at liberty, when need required it, to lift up, that is, to open the three doors at once, or to open but two, or even but one of them, according to the quantity of air we thought proper to admit into the stove : we were at liberty also to vary the quantities of it in many other proportions, each door having a square aperture cut in it, five inches long and three inches high. There was above and under the aperture a sort of wooden rulers which did the office of grooves ; and a small and thin board § retained between these two § Plat. V. grooves might be moved freely therein : when need Fig. 4. n; required, this stopt the aperture of each door intirely, r, p. and when you pleased, it left but a part, and that greater or less, of the said aperture open.

As soon as the entrance of this stove was supplied with all the different registers above mentioned, I determined to have eggs warmed and chickens hatched in it. The eggs were put in a box longer than it was wide, resting upon four casters ; the bottom of the box would have given room for a bed of above a hundred eggs, and that bed might have supported a second of a like number : the box might also have been larger, and I might if I pleased have made use of many of them at once, but I contented myself for a first trial to

put into it only two dozen and a half of eggs, near which and in the box itself, I placed a thermometer which was to point out when it should be necessary to increase or diminish the communication of the outward air with that of the stove.

The baking-oven which warmed the stove belonged to one of those people, who bake bread only to carry it twice a week, on wednesdays and saturdays, to market. He began his first oven full on mondays about eleven o'clock at night, and continued to make fresh batches succeed each other without interruption till eight or nine o'clock in the evening of the tuesday following: eleven batches of bread were in this time baked in it successively. No fire was lighted in the oven all the wednesday, and the greater part of thursday following; for they only began to light it again on thursday about eleven at night, in order to bake eleven or twelve more batches of bread one after another, the last of which was put in the oven at about eight or nine at night on the friday. The fire in the oven was then again extinguished, and so remained from friday night till the monday following at eleven at night. These long interruptions of the heating of this oven, must naturally have caused much greater variations in the heat of the chicken-stoves, than those that would have happened in another that should have been warmed by an oven where fire had been regularly lighted every day: The more the long intervals between the baking-days seemed to be, contrary to the trials I proposed to make, the more the oven now in question will be fit to shew, what great hopes we ought to entertain of the utility of those that are warmed more frequently, towards heating eggs and hatching chickens with success.

One of the sides of the stove heated by the oven which I fixt upon for that purpose, was warmer than the other. It was warmer likewise towards the farther end than at the entrance; the bottom there being over the mouth of the baking-oven. It follows from the inequalities of the heat observed in different places, that by filling the stove but half, or by giving it but half or even less of the boxes it was able to contain, there was an additional manner of moderating, or of increasing the heat of the eggs, by conveying the boxes into places more or less warm.

I shall not lose time in giving a particular account of the accidents that hindred the chickens of the first eggs that were put into this stove, from being successfully hatched. I suspect that the persons whom I had commissioned to take care that the eggs should always have a proper degree of heat, might fancy that some negligencies might be allowed, that were nevertheless of much greater importance than they imagined. They had seen chickens already unfolded and alive in eggs which they had broken on purpose at the end of five or six days, and they had found some other chickens dead in other eggs they had broken on purpose also after a much greater number of days, in the last of which the heat had been suffered to rise and fall to an excessive degree. Both these experiments had their use, since the first chickens found alive, and the last found dead, evidently shew the necessity of the watchfulness I always recommended, and which I obliged the inspectors to have afterwards. The first thirty eggs were not warmed as they ought to be: their chickens perished before they could come to the term at which they were to be hatched. But happier broods were afterwards procured, and I had the pleasure of seeing chickens hatched out of the eggs I had trusted to that stove and to those who

were left to take care of them, with as much success as if they had been set under hens, and even in greater number: I have continued the hatching more in it for above three months together, although I have charged this oven but with an inconsiderable number of eggs in proportion to what might have been warmed there. I left hardly above a hundred or a hundred and fifty of them in it at a time, and that for one of the reasons which hindered very considerable broods to be produced in the stove of the society of *L'enfant Jesus*, that is, because I had at my house stoves made with dung, where it was still more easy for me to observe every thing, than it was to see what past in an oven separated from my house by the breadth of a street. In short I thought it necessary to repeat the experiments in the stoves made with dung, in order to find out remedies for many inconveniencies which they are subject to, and from which the others are free. Besides this, I had but a certain quantity of eggs for my experiments, I was resolved to have none try'd but those which had been laid by my own hens: as these were very well provided with cocks, there could not be among their eggs so many addle or unfruitful ones, as among those which I should have bought at all adventures: Many of these might have been too old, and I was sure the others were new-laid.

* Plat. V. The situation of the third baking-oven *, over
Fig. 1 and which I have caused a stove to be constructed, had
2. the following differences from that we last spoke of,
† Fig. 1. its bottom † and one of its sides § stood by them-
C D E. selves in the room where the body of that oven
§ E. A. was, for the mouth was, as usual, in another room,
in the wall that made the partition of the two.
Again, this oven differed from the last in this,
that the upper-part of its arch || was more distant
|| NXVT. from the floor of the room over it ¶, there being a
¶ Q. Q. space of two foot four inches from that floor to the
arch

arch : fo that it was much eafier to work upon this arch, than upon that of the foregoing oven.

Another advantage of this oven, independent of its pofition was, that one, and fometimes two oven-fulls of bread, were regularly baked in it every day : it fupply'd the bread of a very large convent of women, the monastery of *Bon-Secours*, that convent entertains befide boarders, a vaft number of nuns, thofe of *Malmonu* having been transferred to *Bon-Secours*. Madam *Rofignol*, the abbefs of the two reunited monafteries, honours me with her friendship. As I knew her good nature, I knew alfo, that it would be a very pleafing propofal to her, if I fhould offer her the means of having chickens in plenty, and of procuring fome for her fociety. Her baking-oven, of which the whole difpofition had been defcribed to me, feemed very fit for the hatching of chickens : and I happened to be at hand to make it ferve to warm a chicken-ftove : The monastery of *Bon-Secours* is near my houfe, and their oven is in a poultry-yard, which makes it ftill more convenient.

The upper-part of this oven is a flat-roof more than eight foot long and almoft fix broad : this fpace, which was wider than was neceffary to warm a very great quantity of eggs at once, was examined with the thermometer, which testified that it was with the upper-part of this oven, as with that of the two others I had already made ufe of, that is warmer in the places neareft to the mouth than any where elfe, * and lefs warm than in any other * Plat. V. place in thofe over the farther part. I marked Fig. 1. G. out the warmeft place for a chicken-ftove, I made the breadth of this two thirds of the length of the platform, and its intire breadth : the bufinefs was to have that fpace walled up round : two inclofures difpofed † at right angles, proved fufficient for this, becaufe one of the extremities and one of the

† M N,
K F.

sides of that space happened to be ready incom-
passed, one by a wall wherein the mouth of the
oven was, and the other by another wall against
which the oven abutted.

The stove, I mean the little room intended
for a chicken-oven, was then, by this disposal, in-
closed by two portions of wall, and by a couple of
inclosures*; I had rather have had these of plaister,
AB, BN. however it was judged more commodious to have
NM, KF. them of wood. The reader is already sufficiently
acquainted with the nature of these sorts of ovens
to suggest to himself, that these inclosures must not
have been without apertures, and that they must
have had doors and vents or registers: Two doors
were made in each of them, those † of the inclo-
sure at the end were opened and shut by sliding
grooves, and those of the inclosure || on the side
were supported by turning-joints. The place and
their size hindered them from being disposed like
the others; they were the longest as they were
designed to let in the egg-boxes: their length was
above two foot, and their height about twenty in-
ches. The four doors had each of them a square
aperture of six inches shut either intirely or only
in part at pleasure, by a wooden shutter § sliding in
grooves. The two doors at the end served not on-
ly to moderate the heat, but also to give light to
the inside of the oven whenever they wanted to
work or to see what passed there.

Besides the two uses of the foregoing doors,
those on the side-inclosure were, as we have already
said, capable of yielding a passage for the boxes in
which the eggs were ranged. The height of the
oven allowed also for the disposing several of these
boxes one over the other. The method I judged
to be most commodious to remove them from one
place to another when disposed in several stages,
to make them pass from a colder to a warmer part
of

* Fig. 2.
AB, BN.
NM, KF.

† Fig.
‡ and 2.
PO, PO.
|| L, L.

§ Plat. V.
Fig. 2.
R, R.

of the stove, or the reverse according as it should be necessary, was to have them supported upon a sort of carriage*. This consisted of four upright posts* Plat. V. kept at the proper distance from each other by four Fig. 3. horizontal cross-bars, joined near their inferior extremity, and by four others placed after the same manner near their upper-end. There was beneath the inferiour extremity of each upright-post a caster like those under the feet of chairs and beds, in order to move them with greater ease. There were in the inner sides of the upright-posts that faced each other notches almost an inch deep, and distant somewhat above an inch from each other. The notches of the two upright posts of the same end were designed to admit a wooden ruler, and it was by two such rulers placed in the same level that a box full of eggs was supported: each ruler was strongly fastened, because the notch it lay in did not extend quite to the inner edge of the upright post: and there was on the outer surface over-against the notch, a small wooden button which closed up the notch on that side when turned in an horizontal situation.

This carriage was loaded with one single box that contained a hundred eggs for the first trial that was made of the new oven. The charge of keeping them in an equal heat of about thirty two degrees, was given to a very ingenious nun, who was sincerely desirous to execute her commission well. However, a first experiment happens so seldom to have compleat success, that I thought it very extraordinary that out of the hundred eggs she had taken care of, above half of which proved to be unfruitful ones, there should have been hatched twenty chickens one day sooner than they would have been under a hen. When the first of them appeared, the nun to whom they owed their life was transported with a pleasure which she could not contain ;
she

she directly ran to tell this interesting piece of news among all the dorters, and in every other part of the convent where she might hope to meet with any body. This transport, however, was a little abated, when she saw that part of the chickens which ought to have been hatched, had perished in their shells almost at the end of their time; which was evidently occasioned by their having been exposed to too great a heat; from this time she became qualified to repeat much more successful essays: but the want of eggs, and some other accidents, caused them to postpone to another time, many trials that would have produced more chickens than the first.

Of these three forms of chicken-stoves built over baking-ones, the first bears a greater resemblance to those of *Egypt* than the two others, because in that the person charged with the care of the eggs may enter into the stove, examine and handle them without changing their place; but this conveniency is not of consequence enough to be much insisted on, and is counterbalanced by what the inspector is to suffer whenever he has a mind to get acquainted with the state of the eggs; as he is always in an air some degrees warmer than that we breathe in the hottest summer-days. He must for this reason take great care in winter-time, not to pass too suddenly from such a stove into the open air. This inconvenience was perhaps the reason that caused the nuns of *l'enfant Jesus*, to give the preference to chicken-stoves warmed with dung, to those that were warmed by baking-ovens, and to use the former much oftner than the latter.

The particular detail of circumstances we have here entered into, is not in itself very agreeable, and may appear tedious to those, who do not care to know more than the bare results of the experiments; but, those who shall themselves engage in the like attempts, will find on the contrary, that

we have not been particular enough. I have contented myself with examining three cases which are sufficient to inform the reader of the manner of constructing a chicken-stove over a baking-one; let the disposal of the latter be what it will: There are several articles on which I know I have not entered into a sufficient number of particulars, as for instance, the form of the thermometers, the proper limits of the degrees of heat, the inconveniences to be apprehended from the excess as well as the want of the heat, and with regard to the duration of either, and many other circumstances, whether favourable or otherwise to the birth of the chickens. But the ovens warmed with dung will give us occasion to treat all these different articles as much at large as is requisite.

Our chief object here has been to shew that every oven which has its arch covered over, affords a chicken-stove almost ready made: whence it is easy to judge, that people are actually provided in most countries with as many chicken-stoves as are necessary to hatch a greater number than there are annually produced in *Egypt*. 'Tis true the quantity of the eggs warmed at a time in one mamal is greater than that which can be warmed in one of our new ovens: but does not the number of those ovens which are heated frequently enough to serve to hatch chickens, vastly surpass that of three hundred and eighty six, which is the whole number of the *Egyptian* mamals? If nothing was wanting to us but ovens, *London*, or *Paris* alone with the suburbs, &c. would enable us annually to hatch more chickens than there are hatched all over *Egypt*. We may, without engaging ourselves in a calculation of the number of the ovens, that are employed to feed the inhabitants of these large towns, very confidently affirm that there are a great many more than three hundred

dred and eighty six: Nor are the ovens of the pastry-cooks to be forgot. In short, the stoves dependent on them might serve to warm eggs and hatch chickens all the year round, whereas the *Egyptians* themselves do not think they can use theirs for any longer time than six months.

It cannot then be denied that we have it in our power to hatch such an immense quantity of chickens, as would much surpass that which the whole kingdom can consume; by using towards the warming of the eggs a part of the heat of the ovens of our bakers and pastry-cooks, which has hitherto been absolutely lost. However, we are not to expect that all the people of these trades will at once fall into the practice; but when some of the most industrious and active of them shall have used their ovens with success for this purpose, they gradually will be imitated by others; and in time, none among them but those that are either too idle to be rich, or are overloaded with business, will neglect procuring to themselves an amusement as beneficial even as the most laborious occupation.

I shall explain at large in the succeeding memoirs, how it is possible, without the help of hens, to rear up chickens, to the birth of which they shall thus have contributed no further than by giving the eggs: but, though it should readily be granted me that I have found a sure and easy method to bring them up, yet I may be asked with great reason, if our method of nursing and feeding the chickens, may not, though very easy to be practised, take up too much of the time of our bakers and pastry-cooks, from their ordinary occupations: I may be asked also, if the greater number of them will not want the greatest part of the room requisite for breeding up the chickens. My answer is that their wives, or the women of their families, are the persons who ought to take upon themselves a care for which
they

they may always find time enough: and as to room they may have a little place in their house, or even make use of a part of the stove itself for that purpose where the eggs have been warmed, which alone would suffice to rear a very great number of chickens whilst they should be small, that is not above three weeks or a month old at most; and after this period, customers would be determined by the cheapness of the chickens, to come and buy them to bring them up themselves to their full growth. I am persuaded that the greater part of our cooks would willingly make their provisions of them there. Nor would it be difficult to make country-people sensible, that it would turn to their account to buy at a cheap rate such chickens as they could sell again two months after, for a price that would make them great amends for what they had cost them: the country people would come to town and buy the new hatched chickens of the very same people to whom they had sold the eggs out of which they were hatched, and this would be an increase of their little commerce, that would be useful both to themselves and to the publick.

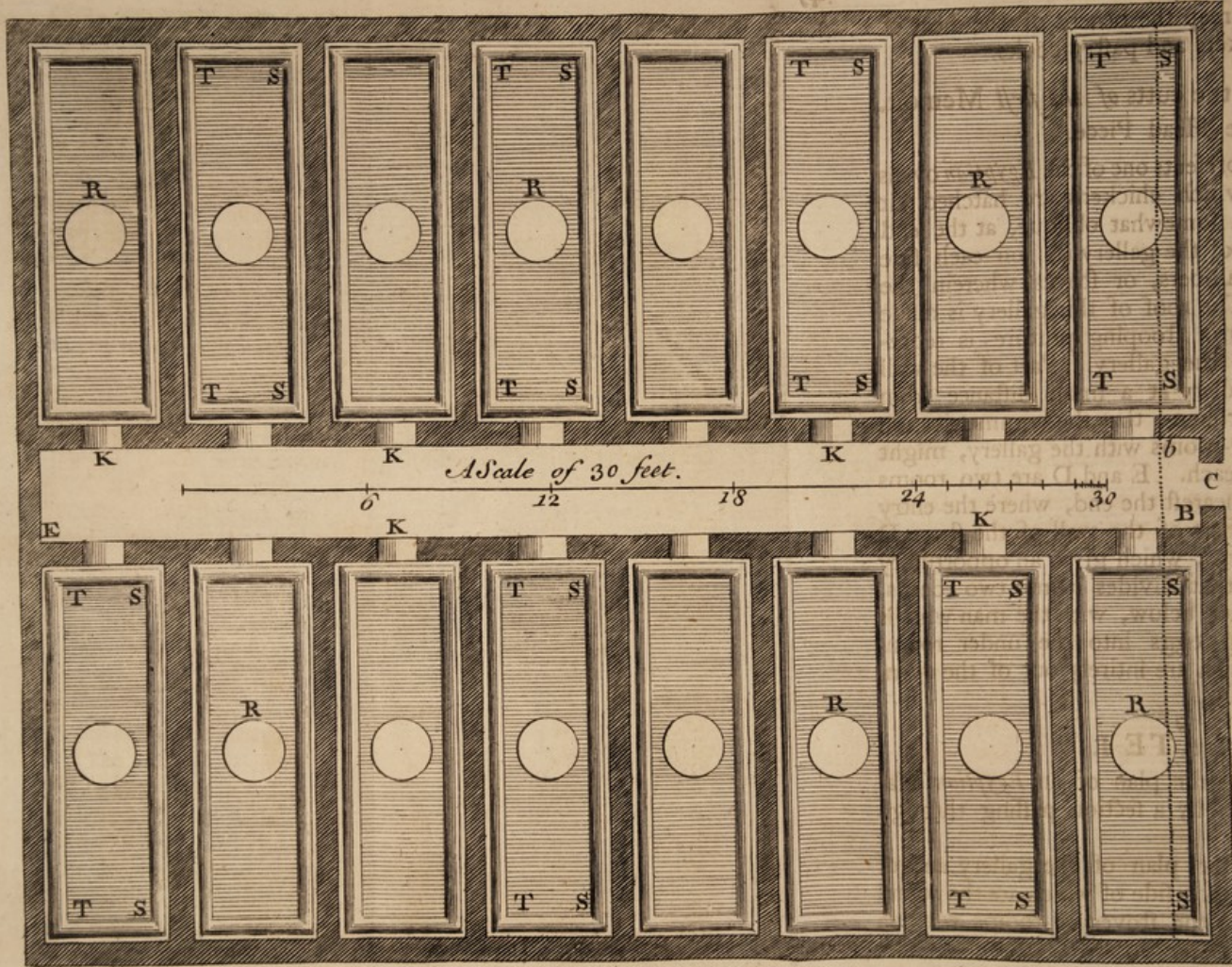
But this commerce could not be carried on by such of the inhabitants of the country, as are at considerable distances from towns. These might warm eggs and hatch chickens themselves. If there were no common oven in their town or village, if the ovens were warmed but seldom there, and if on each day of their being warmed, there were baked in them but two or three batches, between which very long intervals were left, such ovens indeed cannot supply them with stoves fit to hatch chickens. But the following Memoirs will teach them how to establish chicken-ovens, in which they will be able to preserve a heat equal to that which the hen communicates to her eggs, without consuming any combustible matter about it. However,

ever, we ought here to observe that there are many countries where wood is to be had almost for nothing. They would not look upon it as any expence in those places to burn every day a few faggots of small wood in the oven purposely to warm the chicken-stove that should be at top of it.

In all those countries where wood is thus cheap, where it costs little more than the trouble of gathering, and carrying to no great distance; people will not look upon it as a thing worth regarding, if they make their fires purposely for the use of the stove, and have no dependance on any oven at all: a very small room might be set apart to the warming of eggs in countries like these, without any danger of its bringing on an expence which the produce of it would not amply refund: If such a room were twelve foot in extent every way, it will be sufficient for very considerable broods. By means of a small stove placed in the middle of that room, in which wood may be burnt five or six times a day, and only two or three pieces at a time, you will cause the eggs to contract the degree of heat necessary to bring on the unfolding and increase of the chickens therein. Thermometers distributed in several parts of that stove, will inform when the heat must be increased or moderated; the lower this room shall be, the less wood will be consumed in it every day. It will be sufficient if its height is four foot; for it is not at all necessary that the person that carries the wood, and that goes from time to time to examine the state of the thermometers and that of the eggs, should come into the room upright. Several essays which I have made of such a warm room for another use which I shall mention afterwards, have convinced me that one might hatch chickens by means of it at a very cheap rate, even at *Paris*. However, it is still better to have no expence

ever, we ought here to observe that there are many countries where wood is to be had almost for nothing. They would not look upon it as any expense in those places to burn every day a few logs of small wood in the oven purposely to warm the chicken-house that should be at top of it.

In all those countries where wood is thus cheap, where it costs little more than the trouble of gathering, and carrying to no great distance, people will not look upon it as a thing worth regarding, if they make their fire purposely for the use of the stove, and have no dependence on any other fuel: a very small room might be set apart to the warming of eggs in countries like these, without any danger of its bringing on an expense which the produce of it would not amply refund. If such a room were twelve feet in extent every way, it will be sufficient for very considerable broods. By means of a small stove placed in the middle of that room, in which wood may be burnt five or six times a day, and only two or three pieces at a time, you will cause the eggs to contract the degree of heat necessary to bring on the unfolding and increase of the chickens therein. Thermometers distributed in several parts of that stove, will inform when the heat must be increased or moderated; the lower the room shall be, the less wood will be consumed, and every day it will be sufficient to keep it at 100°. For it is not at all necessary that the heat should rise the wood, and that good reason to raise to examine the state of the thermometers and that of the eggs, should come into the room opening. As the eggs which I have made of such a warm oven for which I shall mention after words, have convinced me that one might hatch chickens by means of it at a very cheap rate, even at Paris. However, it is still better to have no expense



pence at all, and to reap the benefit of the heat of the oven of our bakers and pastry cooks.

An Explanation of the cutts of the first Memoir.

The Head Piece.

The head piece represents one of the *Egyptian* ovens called *Mamals*, in which chickens are hatched: it is seen in a situation somewhat oblique, at the end where the entrance of the gallery is: on each side of this are the chambers, or stoves wherein the eggs are heated. The roof of this gallery is made shelving. A man in a stooping posture is represented entering into the gallery. Part of the wall of the end of the gallery at a small distance from the roof has been broken; that the communication of one of the upper-rooms with the gallery, might be seen thro' the breach. E and D are two rooms or stoves, the two nearest the end, where the entry of the gallery is. Part of the wall of the stove D has been pulled down; which gives an opportunity of seeing the floor that divides it into two rooms, one above, the other below, with the man who is busy about putting eggs into the under room. The two figures which are intirely out of the oven, are carrying eggs to it.

PLATE I.

This plate exhibits the plan of an *Egyptian* Mamel or chicken-oven, by a section passing through the upper-rooms.

B, K, K, &c. is the plan of the gallery and of the corrider, along each side of which are the round apertures or doors to the stoves or rooms wherein the eggs are warmed.

C, the entry of the gallery.

The K's mark, the apertures through which the gallery has a communication with the stoves or rooms. It would have been a needless multiplication of the K's,

K's, had they been put to all the apertures as to those represented by a few of them.

R, a hole in the floor which makes the separation of the upper room from the under one. Through this the heat of the air of the first room, communicates with the air of the other.

SS, TT, the two gutters of each upper room, where the fire is lighted.

ST, ST, are two other additional gutters, wherein Mr. *Granger* tells us, that fire is also lighted.

PLATE II.

The first figure is a vertical section of a Mamal made according to its length, or rather it is composed of different vertical sections, that pass through different parts of that oven.

The section ACBDFFF passes through the middle of the roof of the gallery.

C, the hole that serves as a door to enter into the gallery by.

F, F, F, holes of the roof of the gallery, that serve to give it light, and to let out the smoke.

K, K, K, holes through which a man may enter into one of the under rooms.

H, H, H, holes, each of which is the door of one of the upper-rooms.

The roof of this gallery is here in the form of an arch, although *Monconys* says, they are made slanting as we have expressed them in the head piece.

Beyond DL, the section DEM, NN, &c. passes from without the gallery through the rooms themselves, it abuts a little upon the entry of the rooms P, P, P, and passes through the middle of the rooms QQ. The inside of every one of these rooms is seen openly, because the part of the wall L which should hide it, and which (had it been left in its place) would exhibit nothing but a long series of holes H, H, H, and a still longer Series of holes K K K is taken away.

N, N,

Fig. 1.

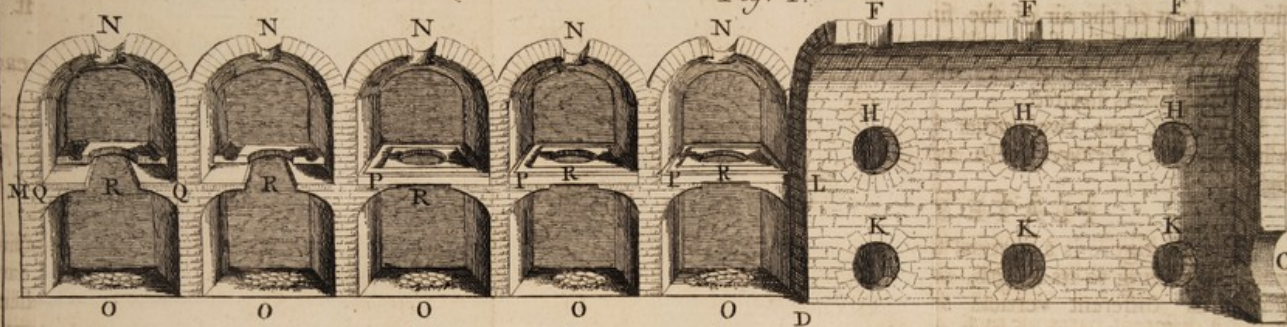
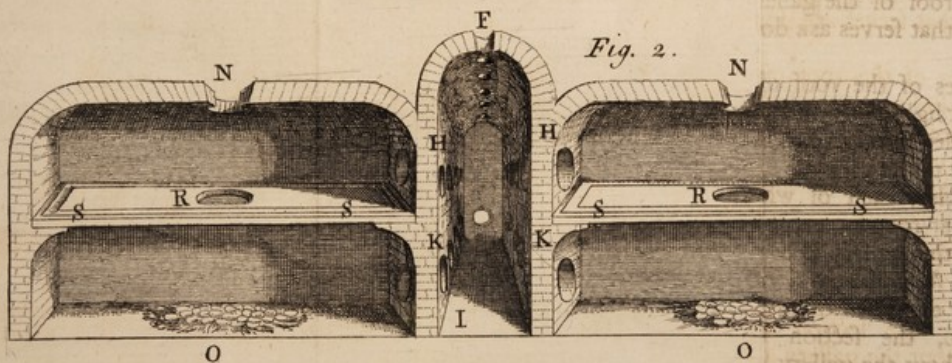


Fig. 2.



Domestic Fowls

R. N. 1. An aperture which is in the arch of every one of the upper rooms.

P. 1. For that which the separation of an under

front of the floor, that separates an interior

room from another

O. 1. The thickness of the interior room, which

all the eggs are laid on during the first days

R. N. 2. A hole through which the heated air

of the upper room has its communication with that

of the lower, and warms it

The second figure is a vertical section of the M. S. 1.

and made according to the line 258224

is the gallery, the lower part of which having been

taken off by the gallery, is seen here in a projected

that it shows it is a gallery, but which shows one to

although the holes of the arch through which

the gallery is formed, and on each side the holes

through which it has its communication with both

the upper and the lower rooms on the right and

left. The same section exhibits on each side at

the upper and lower and one upper-room, the

two rooms which have been taken off

is the hole through which the gallery

R. N. 2. A hole through which one of the eggs laid in

under the right hand, and into another on

the left

H. 1. Round doors of the upper rooms, which

are over the openings under-ones

O. 1. A hole of egg laid in each of the lower

chambers

R. N. 3. A hole through which the heated air of the

N, N, &c. an aperture which is in the arch of every one of the upper-rooms.

P, a floor that makes the separation of an under from an upper one.

Q, Part of the floor, that separates an inferior room from one above.

O, O, O, &c. the floor of the inferior room, which all the eggs are laid on, during the first days.

R, R, &c. a hole through which the heated air of the upper-room has its communication with that of the lower, and warms it.

The second figure is a vertical section of the Mammal, made according to the line aSSBSS f. I. Is the gallery, the fore part of which having been taken off by the Section, is seen here in a prospect that shortens it greatly; but which suffers one to distinguish the holes of the arch through which the gallery is lighted, and on each side the holes through which it has its communication with both the upper and the lower rooms on the right and left. The same section exhibits on each side at full length one inferior and one upper-room, the fore part of which has been taken off.

F, one of the holes through which the gallery is lighted.

K, K, holes through which one enters into an under room on the right hand, and into another on the left.

H, H, round doors of the upper-rooms, which are over the foregoing under-ones.

O, O, a heap of eggs laid in each of the lower chambers.

R, a hole through which the heated air of the upper room communicates with that of the inferior, and warms it.

S, S, a gutter in which the fire is lighted, and to which another is made like and parallel on the other side of the floor, quite close to the wall.

PLATE III.

This plate exhibits a prospect of the baking-ovens of the society of *L'enfant Jesus*, and of the stove fit for the hatching and rearing of chickens, which was built over the said ovens. In order to set this stove to view, the wall in which the mouths of the ovens are, is pulled down, which would have otherwise hid it.

A, the mouth of one of the ovens.

B, the mouth of the other oven.

C, the chimney of one of the ovens.

D, the chimney of the other oven. The two chimneys C and D have been pulled down, as well as the wall they lean against.

E, the stair-case that goes up to the little room or stove situated over the two ovens.

F, F, F, the height at which the wall that would have hid the stove from us is pulled down.

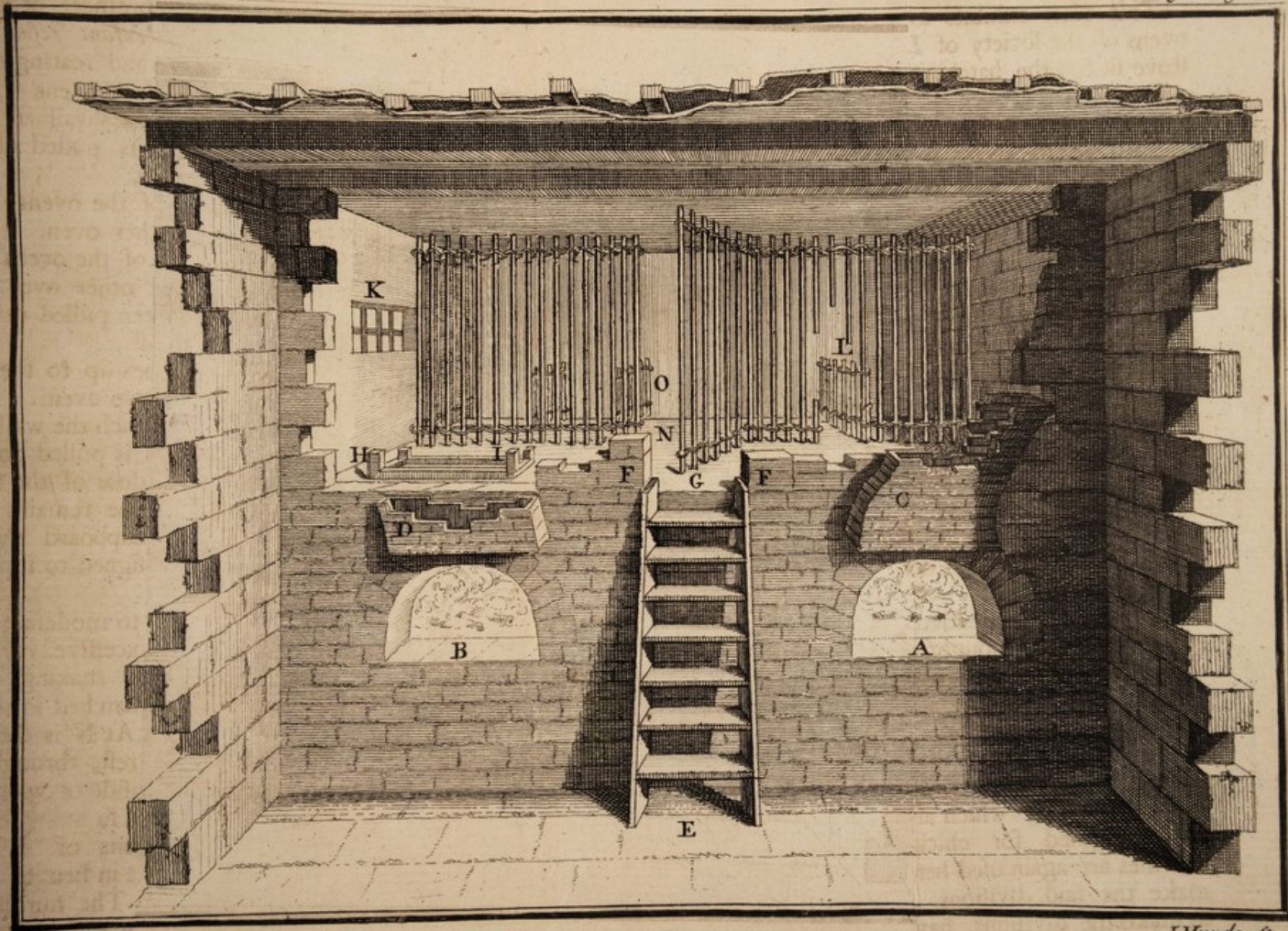
G, the place where the door of the stove is,

HI, the bottom and some remains of the upright-posts of a sort of cupboard that was furnished with the shelves designed to support baskets of eggs.

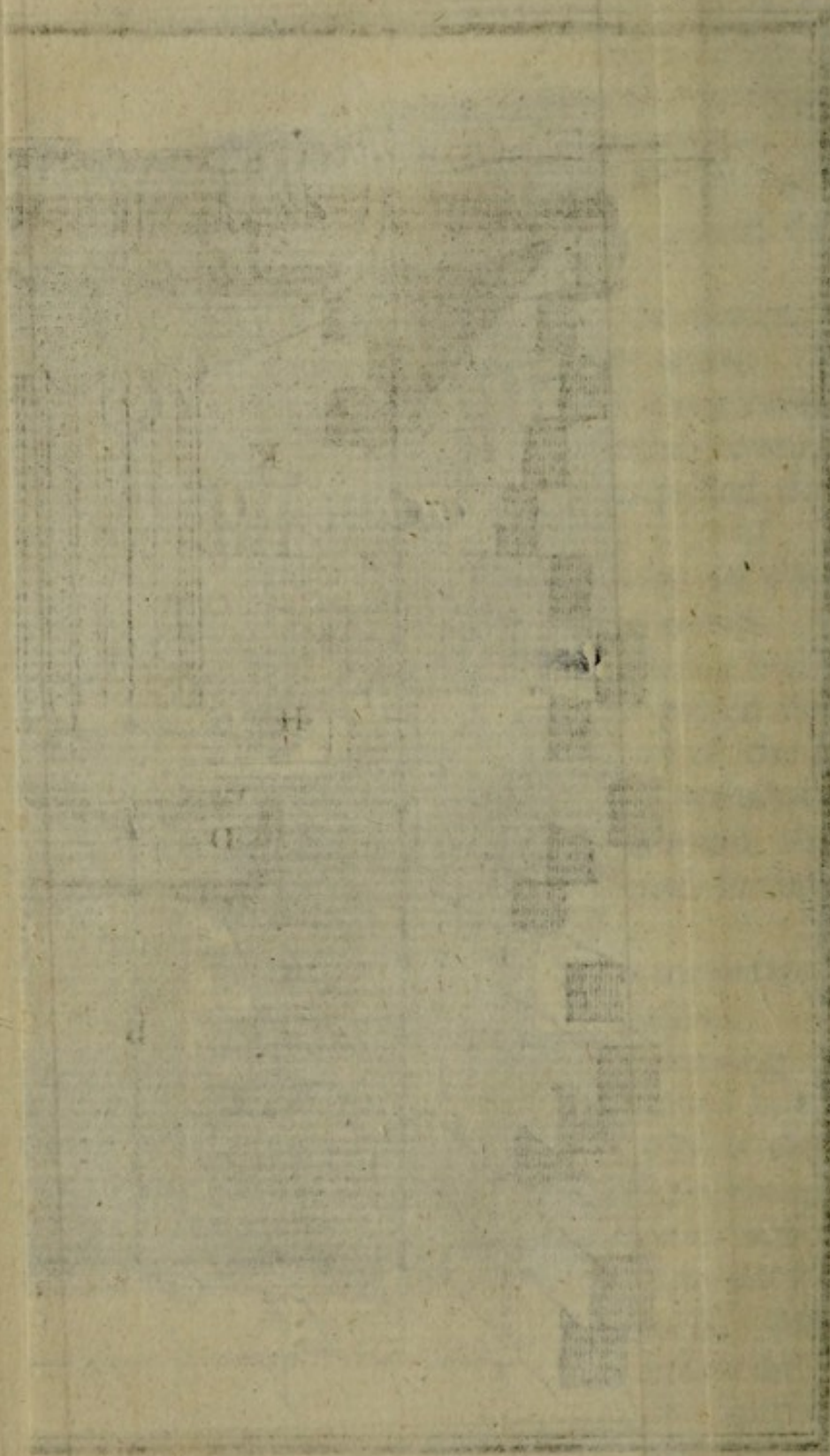
K, a window intended to moderate the heat of the stove, when thought excessive.

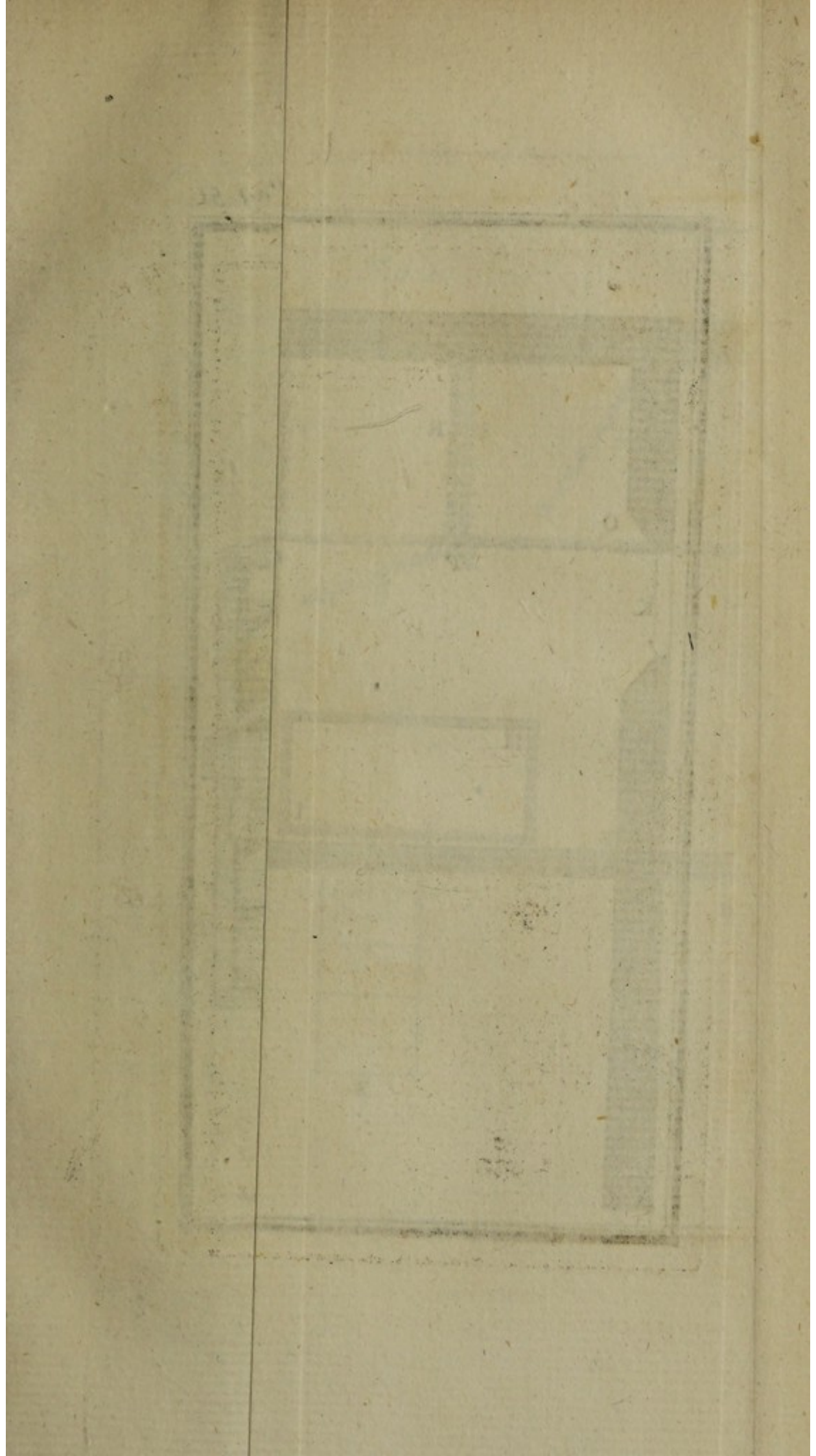
N, O, P, several hurdles making an inclosure within which the chickens hatched in the cupboard HI may be brought up. At N is the door made with hurdles as well as the rest, through which one enters the inclosure; the inside of which is divided into many parts, which are so many separate lodgings designed for chickens of different ages. Hurdles are again used here in lieu of partitions to make the said divisions. The hurdles that serve to make the divisions, have each of them a small door.

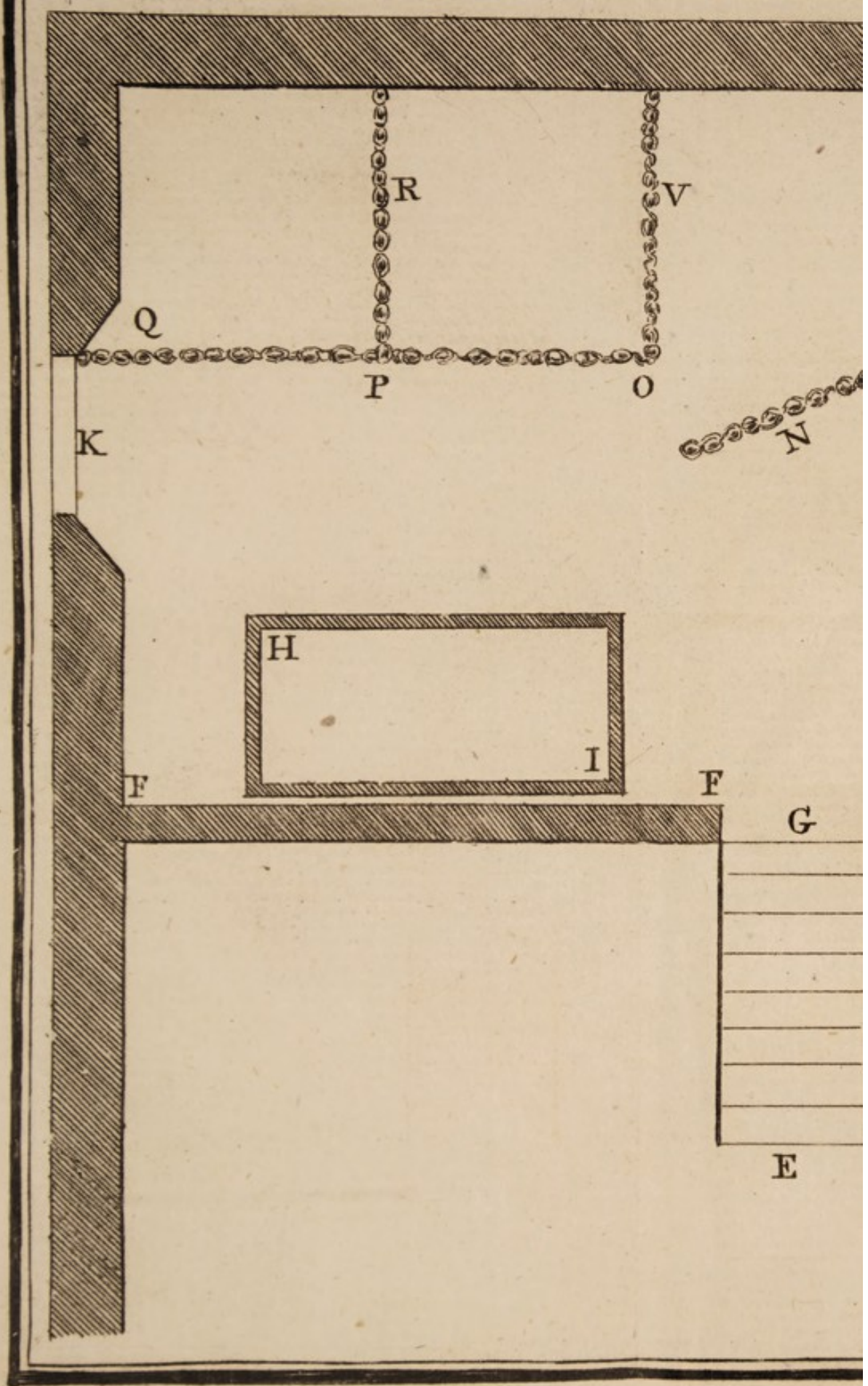
PLATE

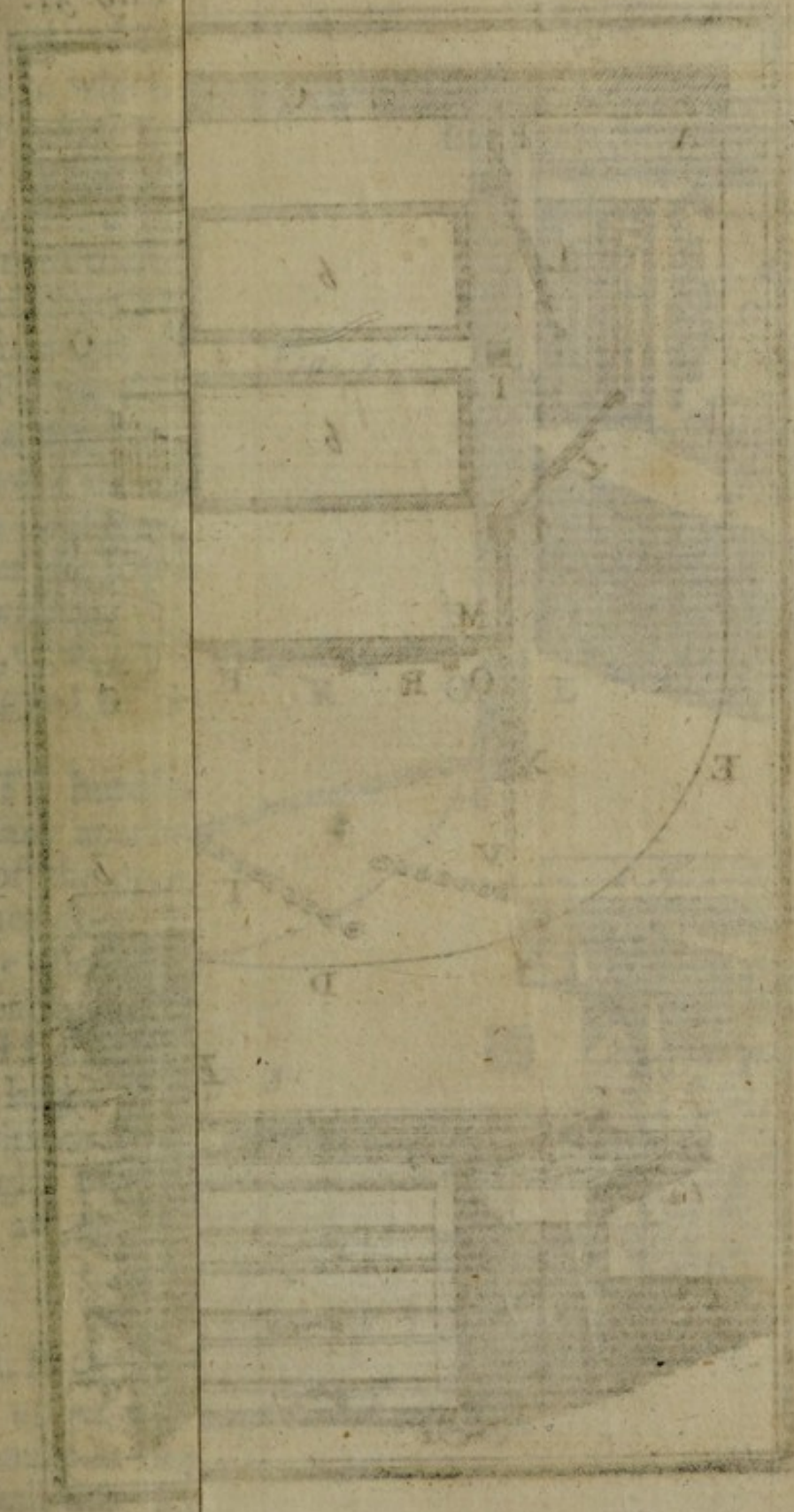


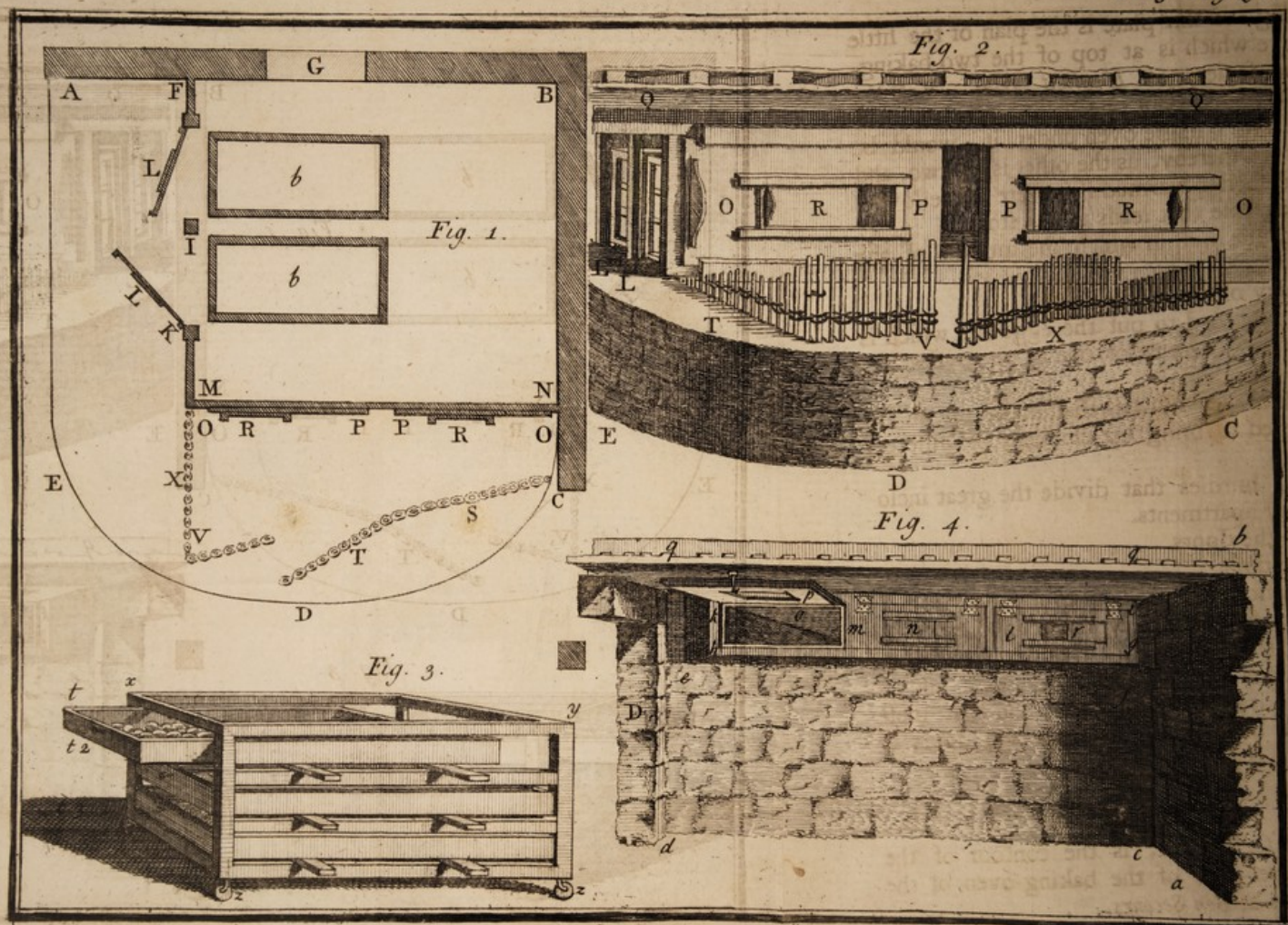
J. Mynde Sc.











J Mynde sc

PLATE IV.

The first fig. of this plate is the plan of the little room or stove which is at top of the two baking-ovens of the society of *L'enfant Jesus*. A stove whose plan should be but one half of this, and that should have but a single oven under it, would be as well warmed thereby, as the other is by two, and would be still better warmed if it were made lower.

E, the stair-case that leads to the stove.

F, F, F, F, the wall in which the mouths of the two ovens are.

G, the entry of the stove.

KL, the cupboard to put the eggs in, which is situated over the fore-part of one of the ovens.

K, the window.

L, M, N, O, P, Q, hurdles that make up an inclosure designed to bring up chickens of different ages.

R, V, S, T, hurdles that divide the great inclosure into many apartments.

N, one of the doors.

T, another door.

There are also doors at R, V, S.

The second fig. is that of the cupboard to be placed in HI the first figure; it is drawn here upon a scale larger than that of the plan, and is furnished with drawers full of eggs, and that these drawers might be in sight, the sides and doors of the drawers are not figured.

PLATE V.

Fig. I. A, B, C, D, E, A, is the contour of the plan of the upper-part of the baking-oven of the convent of nuns at *Bon Secours*.

A B, a wall that separates the room where the oven is from that where the bread is made.

G, the mouth of the oven.

E 2

BC,

On Hatching and Breeding

BC, a wall flanking one of the sides of the oven.

CDEA, the part of the contour of the oven that stands by itself.

KMNB, a portion of the upper-part of the oven that has been encompassed by means of the walls NB, BF, and of the inclosure NM, MKF, and fitted to stand in lieu of a chicken-oven.

L, L, a couple of doors which are opened to let the boxes full of eggs in or out of the oven. Each door has at L an aperture with a small shutter that slides between two grooves, may shut either intirely or in part, as shall be judged proper.

I, an upright post against which the doors open.

PO, PO, are the two doors on the other side, each of which slides between two horizontal grooves; they are kept at a distance from each other, whenever the outward air is let into the oven.

R, R, are moving shutters sliding between grooves, and which serve to stop either wholly, or in part, the vent or aperture contrived in each door.

S, T, VX, hurdles so disposed above the oven as to form an inclosure where chickens may be kept warm. This lodging would be still better and warmer for them, if the greatest part of the inclosure itself was not expos'd, but only its door, T, is the door of the place for the chickens.

b, b, Two carriages that hold boxes full of eggs.

The second fig. gives the elevation of what is only plann'd in Fig. 1.

CDE, the contour of the hinder part of the baking-oven.

L, L, the two doors that fill up a whole side of the chicken-oven, and open as all doors do.

OP, OP, the two doors that fill up another side of it, and which draw nearer or farther from each other sliding between grooves, they here leave between them the empty space PP. R, R, is a shutter by means of which the vent or aperture of each door may be stopt either intirely or in part.

QQ, one of the joysts of the floor of the room which is over that of the oven.

T, V, X, hurdles which inclose a space where the chickens may be reared.

The third fig. is that of a carriage loaded with boxes full of eggs. xyzz, the carriage; z, z, the casters of it.

t, t 2, t 3, Drawers full of eggs; the first is drawn in part, and shews the eggs.

The fourth fig. exhibits, only on the out-side, a chicken-stove built at top of a baking-oven, between the top whereof, and the floor of the room over it, there was only about eight inches space.

a b, Part of a wall flanking the baking-oven on one side.

d D, a part of another wall by which the other side of the oven is flanked.

c d e f, the back-part of the oven rendered flat by a wall that covers it.

e f, the horizontal line of the upper-part of the oven.

q q, A joyst of the floor of the upper-room.

g h k i, a wooden frame so plac'd to stop the long opening that remained between the floor q q of the upper-room, and the upper-part of the edge e f of the farther part of the upper sides of the oven.

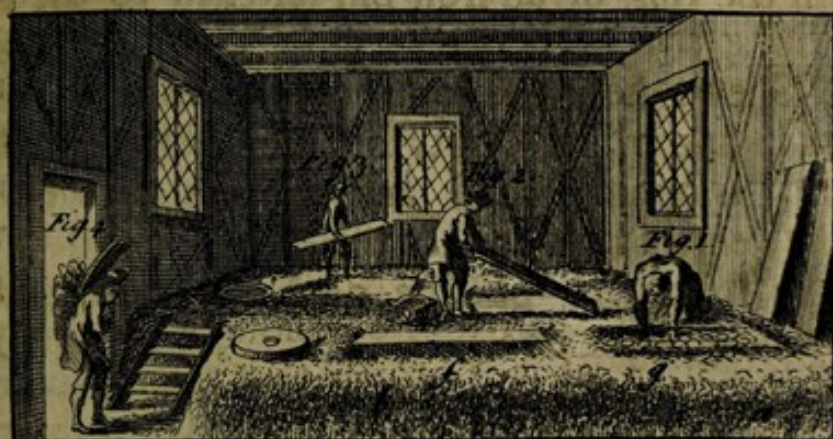
l, m, p, three doors joined together with turning joints, and filling the said frame.

p, One of these doors open, and lifted up like the cover of a trunk. It is kept horizontal by a hook put in the ring of an iron-pin fastened to the beam q q.

o, Shews the inside of the chicken-oven. The doors l, and m, are shut, but the shutter r, of the door l, is open in part, and exposes to view part of the vent of that door.

The shutter n, of the door m, stops intirely the vent of that door.





MEMOIR II.

A general idea of the manner of causing chickens and domestick fowls of any other species to be hatched at all times of the year, in beds of dung.

I Had not sufficiently reflected on the use that might be made of the heat of the ovens of bakers and pastry-cooks, of that of the furnaces of glass-houses, and of those used for the working of iron ores, or that of any of the like kind, in the hatching of chickens, when I thought of using beds of dung for that purpose. I have been very well pleased since that I saw but late, what I might indeed have perceived much sooner: for I had not perhaps tried my last experiment, if I had employed myself about the other first: or at least I had not incounter'd so earnestly as I have done the difficulties it has thrown in my way to conquer, if I had been sufficiently persuaded that we had already chicken-ovens, easy to be made, or in a manner already constructed, that would cost no expence in the warming, and that would warm eggs and hatch chickens in a quantity

far greater than our ordinary consumption. The attempt by means of dung, which is to be the subject of this memoir, would be perfectly needless, if the ovens wherein bread is baked frequently enough to preserve the degree of heat in them necessary to supply that of a stove or a chicken-oven, were distributed in a sufficient number in the country. But the number of the villages and towns where ovens kept for the publick use are wanting, is infinitely greater than that of those where they are to be found. As it is proper that the inhabitants of all places should have easy methods of hatching chickens and other domestick fowls in what quantity they pleased, and as it is besides expedient, that they should have choice of means towards it, I cannot but be pleased that I have applied myself so closely to a work which has inabled me to teach them how to do it even without ovens, and without burning of wood, by exciting only the action of the heat, which proceeds from the fermentation of dung.

If a man has been ever so little conversant with authors that treat of rural œconomy, with the ornithologers, or with those books which are filled with collections of wonderful secrets, he must have read, that one may cause chickens to be hatched from eggs kept in dung: this is a fact which a great many motives have prompted me in particular to verify. The collection of birds which I began some years ago, and which I have at last rendered very numerous, has necessarily ingaged me in the peculiar study of ornithology; I could not see without great concern, so noble a science so little cultivated; that so little notice should be taken of the many utilities it procures us, and so little care bestowed on the extending of them. There are perhaps a great many who are indifferent to the knowledge of the immense quantity of the different species of birds which ornithology offers us, although

though the greater part of them have particulars very fit to excite our curiosity; but there are none but with the species generally known by the vast benefits we reap from them were multiplied, I mean the species that administer so great a part of our food. I could not but have had a desire, not only to make myself certain if one could not warm and hatch with success in dung, the eggs of these valuable and useful birds, but also to examine if dung might not be made to do the office of the *Egyptian* ovens, for the hatching of the chickens of birds also of every other species. I was invited to engage in those researches, at a time when I had not leisure enough to give myself up to them, by a lady very well quality'd to make others fond of the things she likes, who is adorned with every amiable qualification, at the same time that she is fond of making a thousand experiments: among others of these she had attempted that of hatching chickens in dung: but not having had in her trials the success she merits in all her undertakings, she thought I might perhaps have better luck, and pressed me much to consider of the proper means to accomplish it.

Gesner and *Aldrovandus* have collected the passages of the ancients, and the authors of their own time, that have made mention of the manner of hatching chickens by help of dung, but not one of those that mention it says he had himself put it in practice; and I dare affirm that none of them ever had the good fortune of hatching one single chicken that way: I am even apt to think, that none of them ever attempted that trial. They talk, however, as if nothing was plainer, nothing easier than the doing it; it seems according to them that the whole secret consists in burying eggs in a heap of common dung, and in leaving them there for three weeks together, without taking any further care of them.

Aristotle,

Aristotle, who had not been properly informed of the *Egyptian* methods of hatching, after having advanced with as little probability as truth, that eggs may be warmed and chickens hatched in the earth, adds, that in *Egypt* they cover eggs with dung to hatch chickens out of them. *Democritus* gives more punctual instructions about it; he would have us fill up a vessel with hen-dung pass'd through a sieve, then add hens feathers to it, then lay the eggs upon it, with their smallest ends upwards, and then cover it intirely with the same dung; and *Cardan*, who has quoted that passage of *Democritus* in his treatise on Subtilty, has commented on it, and pretends that the said dung ought to be put in a couple of pillows, and that the eggs must be placed between these two pillows, which must be kept in a warm place. The more modern authors, who have spoken of the use of dung for the hatching of chickens, have told us nothing more exact or more particular than the rest, nothing in short that could make us certain, that they had not given us a mere flight of fancy for a matter of fact: had any one of them try'd it, he would not have failed assuring us of it, nor would he have omitted to mention the difficulties he must have met with in the attempt: Very likely he would have met with at least some of the obstacles, on account of which I found myself unable, notwithstanding a world of experiments repeated without interruption and with the utmost assiduity, and which almost tired out my patience, to see my very first chicken hatched in dung till after a whole year's vary'd attempts.

All who are fond of kitchen-gardening, know that beds of dung become hot a few days after they have been made, that their heat after this increases more and more every day, till it becomes so considerable, that if you thrust your hand into them,
some

some inches deep, you catch it out : the pain the fingers feel, soon warns one not to leave them any longer there. This heat is much stronger than that which must be employed in the warming of eggs. It almost dressed those fit for eating, which I first put into a hot-bed, altho' they were in a pot. It is to be observed also, that the same degree of heat is not to be met with in the bed of dung at different depths ; and that, after each part of it has gradually increased in heat, it diminishes in the same proportion : between the degrees only through which it passes, whether in its increase or decrease, are those which are fit to hatch eggs : But do these last degrees hold long enough to bring on the hatching of the chickens ? Are they the same during one and twenty days ? Certainly no, their duration can never be for a single day ; at the same level of the bed : whence it appears that those who said, that it was possible to hatch eggs in dung with success, ventured the assertion too rashly, without having at all examined the possibility of it.

Nor is it indeed by keeping eggs buried in dung, that I imagined the efficacy of it to warm and hatch chickens out of them was to be tried : I judged that if dung could be applied with any success to that purpose, it must be by constructing a sort of chicken-oven with it ; that is, by disposing it so that it might surround some great cavity which it should warm the air of, and by contriving methods of knowing from time to time the degree of the heat of that air, and of increasing or diminishing it as one should find proper ; and that in that air the eggs ought to be placed because of its being always kept in an exact temperature, and because it was there, and no where else, one might hope to see chickens hatched. I thought it proper to begin by trying if two beds of dung, not so wide as those of our kitchen-gardens, and that should, like those,
be

* See the
head piece
of memoir
II.

be parted by a narrow path, would not completely answer all these views. All I added to so plain a construction was, that I filled each extremity of the path with dung for about two foot and a half. I had by this means an oblong oven *, or a long deep cavity of nearly three foot and a half, the air of which was continually warmed by the dung. A cover made with a couple of broad boards, completed this oven: It was design'd to hinder the air from being too easily renewed, and to confine it long enough to give it time to grow warm. Rough and coarse as this construction was, it wanted no essential part of what the intended experiments requir'd. The sides of this long and rectangular oven being warm of themselves, warmed the air which they helped to confine. The cover, at first, was not made with any greater art and nicety than the rest; the two boards it consisted of were not joined in one, to the end, that by keeping them more or less distant from each other, it might be easy to moderate or increase the heat of the air in the oven: In fine, it was easy to know at any instant the degree of the heat, by consulting thermometers placed in the different parts and corners of the oven.

The beds where this oven was, were rais'd under the shelter of a coach-house: it would have been improper to have placed it in the open air, because the rain, tho' favourable to the beds wherein plants are to vegetate, would have been hurtful to those designed for the warming of eggs. A few days after it had been constructed, the thermometer informed me, that the heat of the oven was much superior to that I wanted, although the two boards left a very large opening between them: as soon as it abated and was reduced to the degree desired, I introduced two hundred eggs into the oven, which was large enough to contain above a thousand: that quantity, however, was sufficient enough for a
first

first experiment. It is not necessary here to mention, that the greater part of the said eggs were ranged upon shelves, and that the rest were put in baskets: but I must not forget to observe that I made myself very certain, that they were all kept very nearly in the same degree of heat they would have had under a hen.

I could hardly let the first four and twenty hours pass without attempting to view the effect which a well proportioned and well managed heat had produced in the eggs; I broke two, in which I had the pleasure to see the beating of the little heart, which was by this time unfolded, to see the small drop of blood that was sufficient to fill it enter into it, and then to see it go out of it; this was a sight which a naturalist cou'd not be tired of, were it to last much longer than it does; it always ends too soon, generally lasting but seven or eight minutes. During the four or five days after this, I had the satisfaction to see that I had succeeded in the point which had appeared to me the only important, the only decisive one, and the only one I had been uneasy about, which was the preserving the equality of the heat: and I had the satisfaction also to see the several progresses which the embryos had made in the eggs, which I broke daily: I even began at length to break them with some regret; methought it was so many chickens taken out of the number of those I reckoned I should have. However, for fear the heat of my bed should come to fail, not knowing as yet whether I should be able to warm it again with sufficient speed and success; as well as to multiply my experiments, I caused a second chicken-oven, of the same kind, to be made. My intention was to convey into this new bed the eggs of the first, as soon as they should be in any danger of not being well warmed: Several experiments have taught me since, that this precaution was perfectly

fectly needless ; that there are means of warming the oven again when it begins to cool, and of preserving in it the proper degree of heat, not only during the whole time required for the hatching a brood, that is, three weeks, but even during that of a great many broods successively, nay, for more than six months, without interruption. How easy soever my methods of warming the beds anew were, they are too long to be explained, and must not for that reason be dwelt upon at present ; as we should be under the necessity, in going through them, of mentioning all the dangers resulting from each renewal of the heat of the stoves, and of explaining the manner in which they are to be prevented. I had not discovered how those new supplies of heat were to be procured, till after I had the mortification of seeing whole broods, and those very considerable ones too, perish intirely, some at greater and other at less distances from their full time ; this happen'd sometimes from their having undergone an excessive degree of heat, and sometimes from their having been deprived too long of a sufficient strength of it : for I have and must necessarily have lost chickens a multitude of ways, to be able to obtain such rules as will now serve as sure guides, to guard against all the accidents which the shell, the chicken is inclosed in, cannot possibly defend it from.

But the accidents I experienced from the excess or from the want of a proper degree of heat, were not what stopt my progress in these attempts ; I even attributed some to these two causes that proceeded from another, and that in the very first brood. The eggs of this, and those of a great many other broods, began at the eighth or tenth day to fail my expectations. I had till that time found the chickens as much forward as I could wish, in the eggs I had broken : the scene began to change afterwards ; and the bad smell that after this diffus'd

diffus'd itself all over the oven, informed me that some of the eggs at least had contracted an infection there. These were easily distinguish'd from the rest: for, the matter that gave them that fetid smell, by being rarefied, had burst the shells of several of them, and run out; and the same matter, without breaking the shell of others, had made its way out of them through the natural pores of the shell which it had only widen'd. These rotten eggs were all carefully taken out of the oven the next day, but it was full of stench, no less offensive than that of the day before, and I then found again as many broken or rotten eggs to be taken out as there had been at the last examination. Each day continuing thus to supply me with more rotten eggs, I was compelled to conclude from it, that some fatal accident had happened to them all, and that I did myself no injury in breaking the remainder of them, though they had not as yet given any tokens of corruption. All the eggs which ought by this time to have contained forward chickens, diffused a most offensive smell as soon as the shells were opened: the chickens in them were dissolved, and reduced to a kind of black liquid paste in some, and to a greenish one in others: they were, however, entire and pretty large in some of them, and already covered with feathers in a few others.

I should have been tired too soon if I had been disgusted by the bad success of my first brood: It seemed even to promise better, since I was advanced so far in it as to cause chickens to be unfolded and to grow for fourteen days together, as well as they would have grown and been formed if the eggs had been kept all that time under a hen: since these eggs had in fact been properly warmed during two thirds of the time they ought to have been so, there appear'd sufficient hope, that by redoubling my

my attention, I might afterwards arrive at a method of warming them with equal success during the remaining third of the time they were to have been in the oven. I then put some new eggs into it, and continued every day to put in those which my own hens produc'd me, after having taken the precaution to write upon every one of these the day on which they had begun to be warmed. All this care did not produce the effect I had expected from it: several of the eggs, after having been warmed during ten or twelve days, informed me by their bad smell and by the stinking liquor which had transfused from them, that they were corrupted: others seemed to become so later, there were even some in which the chicken did not die, but a day or two before the full time was out. All the trials that were thus constantly repeated for above two months and a half together, had no better success; they had but the appearance of it, which always failed at last, though it always invited me to begin again: so that I did not cease repeating them till the vacation made me leave *Paris*, which I went out of with regret, not having seen one single chicken hatched.

At my return in the month of *November*, I resumed all the same trials. I caused chicken-ovens of different forms to be constructed one after another. I had some made which were of the form of those wherein bread is baked; but not having had any reason to be pleased with these, I had again, in the beginning of *February*, an oblong chicken-oven made like the first I had made use of; but in order to render the heat of this more easy to be preserved, I was not contented with placing the hot-bed under a coach house, but had it erected in a stable large enough for six horses. When I knew that the oven had no more than the exact degree of heat I wanted it to have, I put my eggs into it. The dung it had
been

been made of was very moist, nor was the season very fit to dry it; and the inside of the oven seemed to be filled with a vapour much like a fog whenever the cover was taken off. This vapour was so very considerable, that the eggs were continually bedu'd by it as if with water: Some of them had been put into boxes uncovered at top, the bottom of which was covered with sand, which was turned into mire as much as sand could be. However, the germ unfolded itself in eggs kept in this moist place, where they were as if in water: but the unfolding of it lasted only seven days, after which term, at farthest, the embryos perished every one of them. This experiment seemed to forbid my making another, which might otherwise have seem'd worthy to be tried, I mean one to inform me whether eggs could be warmed with success in water that should have the same degree of heat as that communicated by the body of the hen: I however made it, and in another place I shall give an account of what happened to eggs kept in a liquid of this temperature.

The sides of the last mention'd chicken-oven grew dry however in time; and there was no perceptible vapour in the cavity of it: the shells of the new eggs put into it, seemed perfectly dry: but these were again spoiled as well as all those which had been used in my trials before the vacation, and this was also the fate of every one of those I had the perseverance to put day after day into this oven for two months and a half together; because I daily suspected and imagined some new cause of this bad success, which I proposed immediately to remedy, and which I in vain tried to remove, none of these being the true cause to which I ought to have ascribed the evil.

I at last recollected, that the eggs had decayed sooner in the oven, when the sides of it had been moister: my repeated experiments were not then

useless, since they taught me at least that the chickens had been brought nearer their time in proportion, as they had been in an air less loaded with vapours. These observations corroborated by many others of a more nice kind, which it would be tedious to enumerate, and which were supported by several unanswerable arguments, opened my eyes at last, to the unravelling of the latent cause of my bad success, which I had so long fought after to no purpose. I at last clearly perceived, that all I was to regard was the means of causing the eggs to be sufficiently and properly warmed by the heat of the dung, without being exposed to the vapour it exhal'd; and that the said vapour pervaded the shell of the egg, and became fatal to the young chicken within it.

There offered a very plain method of stopping, at least in a great measure, this mischievous vapour, and of preventing its reaching the eggs: which was to line the sides of the oven with boards join'd close together, and forming a kind of a very close box: but it seeming very insignificant here, whether the cavity of the oven should be oblong in a parallellipedal manner, or cylindrical; a cask was still a more simple vessel, more ready, more commodious, and less expensive than such an oblong box. I caused one of those that are called half hogsheds to be sunk into the bed of dung, after having had a hole dug in it large enough to admit it: the empty space that remained round its circumference was filled with dung, and I took great care to keep its edges raised three or four inches above the surface of the hot-bed. The reader would suggest to himself, if I did not tell him, that the upper end of the cask only had been opened. But, I must add, that I caused a cover to be prepared for this, which was made with the round head taken out of its extremity or orifice.

The

The several boards which this cover was made of, were fastened together by a couple of cross-pieces. I caused an aperture to be made in the middle of this cover, about four inches square, and eight other holes that might be stoppt with large bottle-corks: These holes were the registers that were to serve to moderate the heat: and the great middle hole was contrived to be covered, either intirely or in part, by a small flat-board. In fine, I got round baskets in diameter about two inches less than that of the cask: some of them were deep, others shallow: these last could hold but one bed of eggs, and two of them might be put in the former. I shall content myself with saying, I caused three of these baskets to be placed in the oven, which contained about two hundred eggs, that the lowest was some inches distant from the bottom, and the highest a few inches lower than the upper edge. These may be supported different ways, which I shall not for the present undertake to explain. I spare the reader a detail of many other minute particulars, in order to hasten to tell him, that the periods of time in which I had seen the other eggs rotten, passed over, and not one of those I had put in this new oven gave the least token of corruption: and at the end of twenty days, the gardener who had taken care of so many unsuccessful broods, but whose hopes had now been kept up as well as mine, came in the evening to tell me, with the greatest emotion imaginable, a piece of news which I had so long waited for, and which he knew must be vastly agreeable to me, *viz.* that one of my eggs was cracked, that is, that there were some small fractures in one part of the shell, so that one could hear the chick which had made them exert its voice, and that I might expect to see it hatched the next day.

This chicken did not disappoint our hopes next day, its hatching was even preceded by that of some others, and followed by that of a great many more; and from the time I began to see some of them hatched, I had afterwards the same pleasure every day. I had not contented myself with the cask I have mentioned, I had buried some others in the hot-bed, among which there were some whose content was double of that of the first cask. Every day I introduced into one or other of these casks, or chicken-ovens, the eggs laid by my hens the day before: but then, at what hour soever of the day I went to lift up the cover of the cask, the upper-basket in it offered me a sight that might have amused any other man besides the person who had at length procured it to himself: It sometimes happened that the several testimonies of the hard labour which a chicken is obliged to undergo in order to its birth appeared. I saw shells which had as yet but one short plain crack, the work of the first strokes of the chick's bill; the cracks were multiplied in the shells of other eggs; there were some the shell of which had been in part broken, and had left the first membrane in open view: I heard here and there small squeakings, which I could not but be moved at, by which the chickens seemed to try to express their regret at seeing that their efforts seconded so faintly, and the impatience they had to get out of prison: but I was at a loss to find out whence some other squeakings proceeded, that came from within eggs whose shells were very sound and intire. There appeared at the out-side of some other eggs the point of the beak: the squeaking from these was stronger and more distinct. The chickens of others were yet nearer the time of procuring themselves their liberty; the shells were fractured almost all round their circumference: another chicken had done more in some other place,

place, having torn his membranous envelopements, separated one half of his shell quite from the other, and procured himself a wide space, through which he began to enjoy the light. There appeared in another place a chicken very wet, that could hardly drag itself along, or stand on its legs, as yet incapable of supporting its body: lastly, I looked with the utmost satisfaction upon some other chicks perfectly hatched but a few hours before, standing on their legs, and prettily clothed with the finest down, their plumage being now quite dried and strait. The few eggs sat on by one hen can never afford such a sight when she is taken from them, nor can one without some danger, leave uncovered any time those eggs where the chickens are ready to be hatched, because they are not at that time in a warm air, like those of the chicken-ovens, of which the cover has been just removed.

The satisfaction I had to see daily, a number of the chickens, of the first eggs warmed in the casks, hatched, was not, however, so durable as I imagined I had reason to expect. I had no doubt of a continued series of success, but I was to be exposed to the mortification of seeing whole broods perish in the new ovens, of seeing others whose eggs would yield me but a very few chickens, whilst those of other eggs should dye after having almost reached the term at which they were to be hatched, and in short, of having many other broods in which the number of the chickens happily hatched at the proper time, should always be inferior to the number of those that had died in their shell.

Some of the broods however, having had as good success as I could possibly wish, it was very certain that all that should be managed in the same manner would succeed as well, and that the only point to be got at, was the understanding the circumstances

which had occasioned the differences between the successful and unsuccessful broods. The too great degree of heat which some new additions of dung had caused in the air of the oven, had been hurtful to the eggs of certain broods, and the eggs of many other broods had, on the contrary, been considerably damaged by their not having been warmed enough; the dung of their ovens not having been refreshed in due time. These two causes, so very fatal to the life of the chickens, had always been very well known to me, the thermometers having always informed me of them: and their dismal effects have rendered me more diligent and attentive since that time, in watching over the consequences of the several renewals of the dung, and in procuring them to be made at the proper time.

But after having at last completely informed the man, who was charged with the management of the ovens, how to preserve there a constant degree of the heat requisite, and after having had all possible reasons of being satisfied with the equality of the heat he had been skilful enough to keep therein, I was amazed to see that the chickens of the eggs of several broods had not been the better for it, but had all, or almost all of them, perished. The cause of the death of these, which could not be shewn me by the thermometer, might, however, have been discover'd by an instrument which is of the same use to the naturalists, and which they have a long time wished to see carried to the same degree of perfection; I mean the hygrometer, that is, by an instrument which gives a sort of measure of the moisture of the air it is placed in. The air of these ovens had sometimes been too moist, as might be seen from drops of water that hung under their covers. This moisture is always fatal to the chickens inclosed in the egg. In short, very disagreeable

disagreeable experiments several times repeated, have shewn me, that even when there is not in the oven a moisture that manifests itself by forming sensible drops, adhering to its sides and top, it may nevertheless be filled with a vapour moist enough to be fatal to the embryos. Before I made myself sure of the existence of this vapour, before I had experienced how dreadful it was, and before I had thought of means to prevent its gathering and remaining in the ovens, I must needs have lost a multitude of eggs in a vast number of successive broods. The memoirs that immediately follow this, are designed to inform the reader of the precautions to be taken, for hindering the excess or the want of heat; or a sensible moisture, or even imperceptible vapour, from killing the chickens in the eggs before they come to see the light. The necessity of these precautions shall be evidenced, in order to convince such as are apt to think they may be neglected, that they can never with safety be dispensed with.

Let not those who would pursue these attempts be terrify'd beforehand, however, at the vast attention and care which I recommend as necessary to cause eggs to be warmed with success in ovens heated with dung: the whole amounts only to a small number of plain and easy rules. If the experiments of all kinds, which I have busied myself about these many years, had not too well convinced me that slight difficulties, seemingly very easy to be removed, have been often sufficient to stop my progress for a considerable time; and that it seldom happens that we begin by considering objects in the light in which they ought to be viewed; I should be very much ashamed to acknowledge the having made so many fruitless attempts, before I could discover methods equally sure and commodious for causing chickens to be hatched merely

by means of the heat of dung. The processes that succeed in it, do not require a degree of ingenuity superior to that of the class of persons whom it suits best to make use of them, I mean the common country people. Why should not all our counties afford among the peasants, men and women capable of doing what my gardener has done? He is the person that has been charged with the care of causing the chickens to be hatched at my house, nor have my flower or kitchen garden been less cultivated for it. This care did not take up much of his time, he used to go at several hours of the day from his other work into the poultry-yard, to take a short survey of the chicken-ovens in the hot-bed: and if I have been under the necessity of directing him, it was only at the time of the trials: his assiduity has never once been owing to my presence: and during the two years in which I passed the two months of the vacation at above a hundred leagues from *Paris*, he has hatched chickens out of eggs which had been laid in my absence. There are also among the people of the first rank, who have attempted to make trial of the new method of warming eggs and hatching chickens, with no other guide but the bare extracts given in different periodical works of the short memoir which I read at our publick meeting of the academy the day after *St. Martin's* 1747, some who have had much reason to be pleased with those of their servants, whom they had charged with the whole care of making the experiment: These servants, though far from being sufficiently instructed in my methods, have nevertheless often succeeded. Those who shall make themselves acquainted with the several processes and methods I shall deliver in the following memoirs, and with the principles on which they are founded, will be able to go through these experiments, and
to

to cause others to do so without being exposed to any disagreeable accidents.

The *Explanation* of the head-piece of the second Memoir.

This head-piece represents a place prepared for erecting chicken-ovens to be warmed with dung: The front wall, which bounds the inclosure of it, is supposed to be removed. This wall is to have a window opposite to that in the rear; so that the structure has four windows and a door, by means of which it is easy to receive into it currents of air fit to prevent that of the upper part of the hot-bed from being too much impregnated with the hurtful vapours exhaled from the dung.

a, b, is a hot-bed of dung.

The two oblong square holes f and g dug in the hot-bed, are a couple of the said chicken-ovens, the sides whereof were of dung, in which I began my experiments for the warming of eggs by the heat of dung.

The first figure is of a person ranging and turning the eggs of the oven g.

The second figure holds a board wherewith he is to finish the covering of the oven f, which is as yet but half covered.

The third figure carries a board designed to cover the oven g.

The fourth figure is carrying in his scuttle dung to warm again the hot-bed now grown cool.

There is at t, one of those ovens that have had better success than the oven f and g. It is made with a cask buried in the dung, and has a wooden-cover. There is another of the same kind behind it, which is not very perceptible in the figure.



MEMOIR III.

Of the construction of chicken-ovens warmed with dung alone, and consisting of a plain cask.



THE general idea we have given in the foregoing Memoir, of the manner of causing chickens to be hatched in ovens, warmed with hot-beds of dung, will seem too succinct to those of our readers who wish to be guided in every step, and would be spared the trouble of contriving and experimenting for themselves; and who having too great a mistrust of whatever they may have themselves thought on, will never take upon them any thing in the form of a trial. The general idea would not indeed be sufficient, even to those who are more willing to work themselves, who love to repeat new experiments, and are capable of adding to them something of their own: probably they would, as well as we, make some experiments that would have a very poor success. Those that succeeded best, and those that succeeded otherwise, were all equally necessary to me: It was only by comparing them together that I have been able to learn

learn both what was to be practised, and what was to be avoided; the theory of our little art is equally grounded upon the latter and the former, and it is from this theory we are to borrow the principles which every one ought to go upon in the practice. 'Tis requisite that one should previously shew how to construct the ovens which the eggs are to be put into: this is what we are going to explain in this Memoir; nor is this the most difficult point to be learnt: the cares and precautions the ovens require towards the good success of the attempts made in them, have something more nice and more difficult to be attained to: these however do not require any very great trouble when we are informed what they are; the plainest principles in the world will acquaint us with them: but we shall be under the necessity of employing two Memoirs for the explication of the several matters of fact, which procure the philosophical theories these principles are built upon.

It is necessary, even when we have a mind to cause but a small quantity of eggs to be hatched at a time, to have two ovens ready at least: of these one may be a relay-oven as it were, which may be had recourse to whenever we have reason not to be satisfied with the other, which if grown too cold, is sometimes not easily to be warmed again with that expedition, that is absolutely necessary to the life of the chickens. This supernumerary oven may also be usefully employed as soon as the chickens begin to be hatched in the other.

The construction of the ovens is not by much so important as the choice of the place where they ought to be fixed. A thousand experiments will shew hereafter, that the chief thing to be had in view is to hinder the air which is over the ovens from being at any time impregnated with the vapours, which are continually exhaled by the bed of dung.

* See the
head-piece
of the sixth
Memoir.

dung. It were to be wished that the said air might remain intirely free from them; and it will always be so much less injur'd by them, as it is more frequently refreshed, and that form greater and more lasting currents. For this reason the ovens could never be better placed than under an elevated shed*, supported only by four pillars, and open on all sides, provided their heat did not on that account become more difficult to be preserved, or the oven partake too much of the variations of the external air: this last consideration requires that they should be put in a place inclosed in part, and the first requires that the place should not be clos'd so much as to retain the air in it.

† See the
head-piece
of the
fourth Me-
moir.

Of all the places, I know, where chicken-ovens to be heated with dung have been established, ever since I read at the Academy, the Memoir wherein I shewed how they might be made use of to warm eggs and hatch chickens, there never was any better chosen than that of the ovens of the society of *L'enfant Jesus*. The rector of St. Sulpice having left several places to my choice, I fixt upon one of the ends of a barn†, which is high-built, and has a large cart-way on one side, and on the other, a window that shuts only with wooden-shutters. The vapours of the hot-bed of dung were here dispersed, and as it were diluted in a great quantity of air by means of the extent of the place, of the elevation, and of the door and windows.

The president Ogier's lady, would needs be one of the first that should cause chickens to be hatched with dung, and she desired that the experiment might be immediately made in her sight. A hot bed happen'd to be very well situated in her yard, under one of those coach-houses which are open quite through and consists of only a single roof in the manner of a pent-house, supported by no pillar,

lar, but fastened against the wall that forms one of the sides of the building *.

I had a hot-bed made at my house under a coach-house that was open only at one end, and was not by a great deal so well situated as that just mentioned. The place where the chicken-ovens were put at the Menagerie at *Versailles*, is also nearly in the same situation as my coach-house; it was little larger, and open only on the fore-side, where it was in part also shut up by an inclosure of boards, which by good luck, however, were but badly joined.

A great princess has lately also had no reason to be pleased with a hot bed she had caused to be made in a place that was low, small, and not very airy. The inside of the oven made there was continually filled with a vapour thick enough to be very sensible to the eye, and which could not but be very fatal to the embryos in the eggs, as we have demonstrated elsewhere by experiments, the events of which have given me sufficient uneasiness.

Whoever then has choice of places, should always make the chicken-ovens to be warmed with dung in some lofty spacious place, that has a free draught of air. If you are reduced to the necessity of using a small place no higher than a common room or a stable for horses, you must open at least in two of the opposite walls, a couple of large windows; nay you must even open three or sometimes four, that is one in each of its faces, if the position of the place will allow of it †; in short, the ovens will be more advantageously situated, in proportion as the vapours of the hot bed shall continue a less while, and in a less quantity over them.

The facility one has of finding casks in every country, is a very great reason for chusing to give the chicken-ovens, that have a cylindrical cavity
the

See the head-piece of this Memoir.

† See the head-piece of the second Memoir.

the preference above the rest: that form has even some advantages over the others, when the oven is to be in a vertical position: besides, a cask with a head out is an oven ready made to our hands, that wants only to be put in a proper place.

Although the oven may thus be intirely of wood, it will be better to line the sides of it with a layer of some matter, that may hinder the offensive vapours of the dung it is to be warmed with, from penetrating into the cavity through the chinks that may be between the staves in case they happen to warp. A coat of plaister of paris must be preferred for the lining of the sides of the cask in all the countries where it is common. Masons know very well how to apply this with great ease and small expence, and those who are obliged to do their work without them, may be informed, that in order to make the plaister adhere to the inside of the cask, it must have long stumps of nails driven into the wood at four or five inches distance from each other; or else the cavity must be lined with small laths fastened to it at equal distances.

The casks that have been put into hot-beds of dung at my house, bound with several common hoops, have lasted above a year; however, one might make them last longer, by binding them with a few iron ones: if the bandages of the wooden hoops should even happen to rot, the cask would remain intire, being supported on all sides, by the dung; and should the very staves themselves come to decay, which could not indeed happen but in many years, the oven thus coated within, would still remain intire, and would, in that case, be a chicken-oven of plaister.

Ovens may also be constructed intirely of plaister, or even of bricks: these would be longer than the others in contracting the requisite degree
of

of heat; but then they would in return not lose it so soon. I have not however tried these last ovens; the facility with which the others may be managed, is a strong motive with me for giving them the preference. In the countries where no plaister is to be had, the inside of the cask may be coated over with any kind of clay, taking the precaution to mix it with such a quantity of sand as will make it dry without cracks. Cows hair or hay cut short and blended with the clay, will keep it still better from cracks: or common mortar made only with lime and sand, may be employed to line the inside of the cask.

We may in fine be contented with a lining thinner than any of those just mentioned. No stronger a matter than thick coarse brown paper pasted all over the inside of the cask, will be sufficient to hinder the noxious vapour from creeping too easily in through the chinks it might have contracted. I have with success made chicken-ovens with casks lined sometimes with a single lining of this kind, sometimes with many such one over another.

The common sheet tin used by the tinmen, or thin plate iron, will also make a thin and durable lining to it: the oven may indeed be made solely of this tin or iron, and in general the thinner the lining or the whole substance of the oven be, the more easily it will be warmed, and in any of these methods it will retain the heat very well. It will be necessary in order to render an iron or tin oven more durable, to paint with oil colour, or what is better still, to daub all its outward surface over with tar: but the cheapness of wooden-casks give them a vast advantage over the chicken-ovens of any other materials. I have not even had any demonstration of the necessity of the linings I have just proposed for the inside of these. I have had chickens as
happily

happily hatched in casks perfectly naked within, as in those with the thickest linings; and it is for the sake of greater security only, that I have advised the reader to give them an inward coat.

The cask, whether lined within or not, is to be set on end the bottom downward upon a bed of
 *Plat. VI. hot dung, a foot and a half or two foot thick *.

Fig. 1. If its whole outward surface is afterwards surrounded with dung, making a bed extending to a distance of two feet all round its circumference, it will become an oven having its mouth vertical†.

† Fig. 3. and 8. This will be the sooner warmed in proportion as the dung that surrounds it, is itself hotter. The air within its cavity would be too easily cooled, if the wide orifice of the oven was quite open: that air would in that case with difficulty contract the degree of heat required in it for the warming of the eggs: it is therefore necessary to prevent the communication of the inner air with the air without; which is effected by means of a cover.

The first covers I made use of, were, as has been observed in the preceding Memoir, nothing but the bottom itself which had been taken off one of the extremities of the cask, all the pieces of this being joined together with a couple of cross bars to which they were nailed§.

§ Plat. VI. Fig. 8. This bottom of the cask, in order to be made a proper cover, was also bored through with several holes: one of

|| d. these holes was in the center|| and was equivalent to a great many of the others: being four inches square, ten other holes were made round it which might be stopt with large bottle-corks: these were placed at middle distances between the great central hole, and the edge of the cover. It is plain that all these holes are appointed to do the function of the registers of the furnaces of chemists, that the communication of the outer with the inner air was greater in proportion

portion as the number of the holes opened was greater; that in this case the air within lost a greater portion of its heat, and that it contracted a greater degree of the same when a lesser number of them were left open. The middle one might be either intirely, or in part shut up by a small board ^{** Fig. 9.} which was also square, and was something more in diameter than the hole it was designed to be an occasional cover to.

Though I have seen many chickens hatched in ovens, which had no other but the plain cover I have now described; I thought it proper afterwards to make a small addition to it; to render it more like the cover of a cylindrical box, and to make it so as that the edge of the cask might be jointed into it, by fastening to it a circular broad wooden-hoop three or four inches wide, into which a part of the cask of the same depth should be received after the common hoops that bound it had been taken off. A cover into which the cask is thus in part received has several advantages over the other; it preserves the heat better in the oven; the external air cannot get into, nor the enclosed and heated air get out of it so easily as it does through all the places where the other cover is not exactly fitted to the edge of the cask: the air which enters along the sides of the cask must be impregnated most of any with the vapour of the dung; and we shall see hereafter that the passages opened to the air going either in or out, are always the more advantageously situated for the maintaining of an even heat within the whole capacity of the oven, in proportion as they are nearer the center of the cover.

I have even been determined from the motive just alledged, to cause covers to be made that consisted of four zones like four wide circular rings, ^{† Plat. VI} which when joined made a perfect cover ^{Fig. 2 and} †, when a ^{wooden-} ^{4.}

* Fig. 6.
b, a.

† Fig. 5.

§ Fig 6.
t. t.

|| Fig. 7.

wooden-stopple was put into the central piece : this rests upon a circular groove cut round in the second piece ; the second rests in the same manner upon the third, and the third upon the fourth *. Each of these circular bands has its inferior surface lined with an iron plate † to prevent their warping any way ; for which purpose small wooden pieces have also been fastened at top of each piece § near its joining to the next : Finally, each circular zone is bored through with two or with four holes, that cannot be stoppt but with corks bigger than those of common bottles ||; these holes multiply the means for the regulating of the heat ; but these more perfect and elegant covers are only for the virtuosi : the difficulty of the making of them, raises the price of them to a degree, that their superiority over the others hardly pays for. In short, these are not the covers fit for the chicken-ovens of our country-people.

Each of my first chicken-ovens was made of a half hoghead ; those I have had since made, were all of them made of hogheads, as well as those I am at this time using. Although the latter have a capacity double to that of the former, I have never found any greater difficulty in warming them or in preserving in them an equal degree of heat. I have not indeed yet made any of the experiments fit to inform me how far their dimensions may be increased without being rendered difficult to be sufficiently heated within, and kept constantly in the same degree of heat ; but those I have made give me room to think, that none of the kinds of casks wherein our liquors are usually put, and which are known by the names of pipes, punch-
ons, hogheads, &c. have greater dimensions than may be advantageously given to a chicken-oven. One might indeed probably give it even a greater diameter and depth than the largest of these casks have,

have, without any inconveniency as to the difficulty of warming it. I have made some trials of an oven that was a sugar-cask, whose diameter was considerably larger than that of any of the others: the diameter of this was indeed no less than seven and thirty inches, and yet the air of its cavity was heated almost as soon as that of the smallest ovens I ever used; but some difficulty would be found in such large ovens as these, in the managing the baskets, that should contain the eggs, when they come to be ranged one over the other; I therefore am of opinion, that we ought not to think, at least at present, of making any chicken-ovens of a larger size than the largest of our ordinary wine-casks, such as our pipes, hogsheds, puncheons, &c. The puncheons are even of a capacity much fitter than that of the pipes for the first establishments: and it was for this reason I did not carry the trial of the sugar-cask so far as to attempt the hatching of any chickens in it.

Those who may have been sufficiently informed, by what has been hitherto delivered with regard to the form of the oven and its cover, will now require the same instructions with regard to the quality of the dung to be made use of for the warming of it: this is a question which very few people have failed asking me, whenever chicken-ovens have been brought upon the carpet: all the world knows that there are many different kinds of dung, and there is no man but knows also, that the same dung is very different from itself at different ages. I do not imagine however, that any body would chuse to employ the oldest kind of dung, or that which is ready to turn into mould. This has ceased fermenting in the brisk manner in which the heat dung contracts at certain times shews that it does, and which we are now thinking of employing usefully for the hatching of chickens.

That which cannot long afford any heat, must always be rejected: and on the contrary new dung, which will supply us with the greatest stock of it, must be preferred to any other.

That kind of dung which is most common in all towns, and almost the only one known there, shall be the first treated of. Large towns hardly know any other dung than that taken from under the horses. Gardeners however distinguish two different kinds of this dung; the one is hardly any thing more than the straw trod upon by the horses, they call this the *straw dung*; this is the kind they are fondest of, and it is on account of its being much in request, that coachmen are apt to give their horses better litter or beds of straw, than the interest of their masters allows: one part of the litter which is picked up again and separated from the rest, has but a very small quantity of the dung of the animals among it: but the second kind is more full of it; this is that taken from under the horses that have had less straw for their litter, and that which remains after the long straw has been shook and separated from the shortest stalks. The kind to be chosen for our chicken-ovens, is that which is not destitute of the lumps of dung; this has a quicker disposition to grow warm than the other. The pure dung of horses would not be better than that of which it makes but a part: If the cask was surrounded with nothing but the pure dung, it would sometimes be the sooner warmed indeed; but its heat would not be so lasting as that procured from the dung that has a right quantity of straw in it, which may supply a much longer fermentation than matters that have already fermented in the body of the animal.

New litter in which the straw is mixt with the dung, is then the kind to be chosen for the warming of a chicken-oven. Although this dung has
been

been taken out of the stable and heaped up for several days and even for some weeks together, it may nevertheless be still looked upon as new, if it be found very warm on thrusting the hand into it.

In order to keep the oven warm afterwards, and to renew its heat in a speedy manner when it seems inclined to cool, prudence requires that one should always have a heap of this hot dung ready, from which some may be taken at any time.

It is not so easy to stock one's self with horse-dung in all places, as it is about large towns, and in countries where the ground is ploughed with horses: in the provinces where oxen are put to the plough, very few horses are suffered to lye in the stables, and it would be very difficult to heap up a sufficient quantity of their fresh dung there for the supply of many chicken-ovens. The dung taken out of the stables of oxen and cows is to be our resource in those cases. I never made any absolute use of this kind of dung; but I have made experiments that leave me no room to doubt but that one may use it with as much success as horse-dung to warm chicken-ovens. In the month of *October* I caused several pyramidal heaps, that were nearly three foot high, and about four or five foot in diameter at their bases, to be made with dung just taken out of a cow-house, and in four or five days time it became as warm as any horse-dung would have been after an equal number of days.

I have had opportunities of making observations more at large upon the heat contracted by this kind of dung: because I have happened to be in places where there is hardly any other to be got; in that time of year when they destroy those large dunghills which have been formed by the product of a whole year, in order to scatter the matter of them over the lands designed to be sowed. The

dunghills I speak of, were seven or eight foot high, and sometimes as much wide, and more in length; I have sometimes thrust my hand four or five inches deeper than the vertical surface which had been just uncovered. I have even thrust it deeper than that, to try the degree of heat which they had contracted, and have found at several depths a heat much more considerable than that which is necessary for the warming of eggs and the hatching of chickens.

The countries where it is customary to let large flocks lye under cover during a considerable part of the year, are provided also with a kind of dung, which I presume (for I have not tried it) may be employed to these purposes with as much success as horse-dung.

Dung, to which we compare all the things we look upon as most abject and most despicable, deserves to be ranked among the greatest presents nature can possibly make us. *Bernard Palissi*, who was born with an inquisitive disposition, at a time when men had no notion of what we call observation, has published a work with a title to it, very fit to excite the curiosity of the world. *viz. The means to grow rich.* The whole purport of the book is to teach the art of multiplying dungs of all kinds, to recommend all the proper care and methods towards preserving their good properties, and to inform the reader how to use them to the best advantage. Rendering the lands more fertile than they naturally are, is undeniably one means, and a very laudable one too, of growing rich. Had *Palissi* known that it was possible to warm eggs and hatch chickens also in dung, he had undoubtedly added to the list of the treasures it may procure us by the multiplication of corn, that of domestick birds, which we may be indebted to it for, whenever we please.

The

The inhabitants of the country need not be convinced by dint of arguments of the vast utility of dung. There are among those who are obliged to till lands that require more dung of the three principal kinds, *viz.* of horses, of large horned cattle, and of sheep, than can be bestowed upon them some ingenious farmers who make amends for the deficiency of these by the fattest marles, which they are at very considerable expence in the digging: others make a kind of artificial dungs as it were; they cut and mince to pieces the common weeds, such as fern, heath, furzes, thistles, &c. They lay these in heaps, knowing that the whole will in time turn into good manure. I have examined vertical sections of dunghills, as they are called, of this kind, (which had been mixt only with a very small quantity of the dung of sheep and cows) from the part that lay at a foot and a half from the ground, to the three or four next feet, that is, within a very inconsiderable distance from their upper-surface; my fingers have felt on these occasions a heat which they would hardly have been able to bear for a small space. Though I cannot say any thing very exact or positive concerning the time since those dunghills had acquired such a considerable degree of heat, yet it seems to me very evident from the then state of the matter of them that there had been in them a degree of heat, sufficient for the hatching of eggs during many months together. The said hills at that time consisted in great part of a matter as compact almost and as soft to the touch as potter's earth. Intire bits of wood bigger than my thumb were indeed still perceived in several places, but the leaves and small sprigs of wood had been altered to such a degree as made it impossible to know them again. The fermentation, or that heat which is the consequence of it, must needs in this case have exerted

its action for a great while together, to produce effects like these. Some observations I afterwards made upon a heap of this kind of dung, and which I might also have made upon many others, informed me of something yet more positive. The matters of which this dunghill was formed, had been brought thither at different times; those of the lowest strata, which were too warm for my fingers to remain in, had been brought thither about the middle of *May*; during the remainder of *May*, and the whole month of *June*, new strata had from time to time been laid over the old ones, and they had never ceased to raise the heap during the three months following almost up to the fifteenth of *October*, when it was broke up for use. This dunghill was very hot within, at the height of four foot and better than a half, and the lowest strata within that height were nearly as warm as the highest of them. These first strata had nevertheless been laid three or four months at least sooner than the last, and undoubtedly had grown as warm as the others in as little a time after their having been laid. From this we must necessarily conclude, that they had preserved a considerable degree of heat for several months together, and it is probable that they would afterwards not readily lose the heat they had actually contracted.

It seems then that in the countries where horse-dung is scarce, one may substitute that of other cattle, and that of rotten herbs and shrubs in its place: I am even apt to think that these last dungs have an advantage over the former in preserving their heat much longer, because their substance is infinitely more compact; and therefore leaves much less room for the external air to get into its mass and cool it, and also as it does not suffer the evaporation of the same quantity of the particles that have an inclination to rise. However, this

this property, which would be very advantageous towards preserving with greater ease an even degree of heat in the chicken-ovens, deserves to be more accurately enquired into by experiments which I have not yet had leisure to make.

The botanical people who are fond of raising plants that grow naturally in warm climates, prefer tan to dung for the keeping up a warm air in their glazed green-houses: this substance might also be employed instead of dung to warm the chicken-ovens; but this being a matter not very common, I did not chuse to make any trials of it, because of the small number of those that might have reaped the benefit of them.

We are sensible that what we have here said of the quality of dungs, may appear too vague to people who would have more exact determinations than those it is necessary to give in this place. If the first litter wherewith the chicken-oven is surrounded is faulty by want of a sufficient quantity of dung among it, or in general for not having a sufficiently quick disposition to ferment, all the inconveniency of it will be, that it will produce some days later within the oven the heat necessary for the warming of the eggs: But when the oven shall at last have contracted the requisite degree of heat, there will be no room left for being uneasy about the quality of the dung to be employed for the keeping up, or the renewal, of the heat, provided recourse has previously been had to the precautions we have already shewed the necessity of; that is, provided we have in reserve a small dunghill in some place under cover. You may, by trying this with the hand, make yourself certain of the degree of heat it has contracted: but as you take dung from such a hill to warm the oven again when too cool, you must take great care to add new dung to it, or even to make new dunghills in its place. By so doing you will always be provided

vided with very hot dung, that will of course be very fit to renew the heat of the ovens.

We shall mention in the following Memoir, the critical time at which it is proper to renew the heat of the chicken-oven, and the manner of doing it: but what we shall have to say there, requires that we should now premise to the reader, that while one is surrounding the oven with dung, one must not endeavour to render it very compact by beating, or treading it down hard. Several parts of it will be drawn sufficiently near each other, by treading lightly a little upon that which has been brought and spread with the pitch-fork: and it will not afterwards remain so loose as you left it, but will settle of its own accord, and so make room for the dung you will be obliged to add for the reviving the heat of the oven.

The conveniency of having room round the cask, and of keeping it there for above a month, and the advantage there is in keeping the vapour of the dung at a distance from the rim of it, are sufficient reasons for not raising the surface of the dung much beyond the three quarters of the height of the cask at first.

An Explanation of the figures of the third Memoir.

The Head-piece.

The head-piece of this Memoir represents one of those coach-houses which are open on three sides, and are covered with only a roof in the manner of a pent-house. Eggs may be hatched with great success in ovens surrounded with dung built under such a place. The men who appear at work under that which is represented here, are about making ovens, that is, burying casks in dung already

ready.

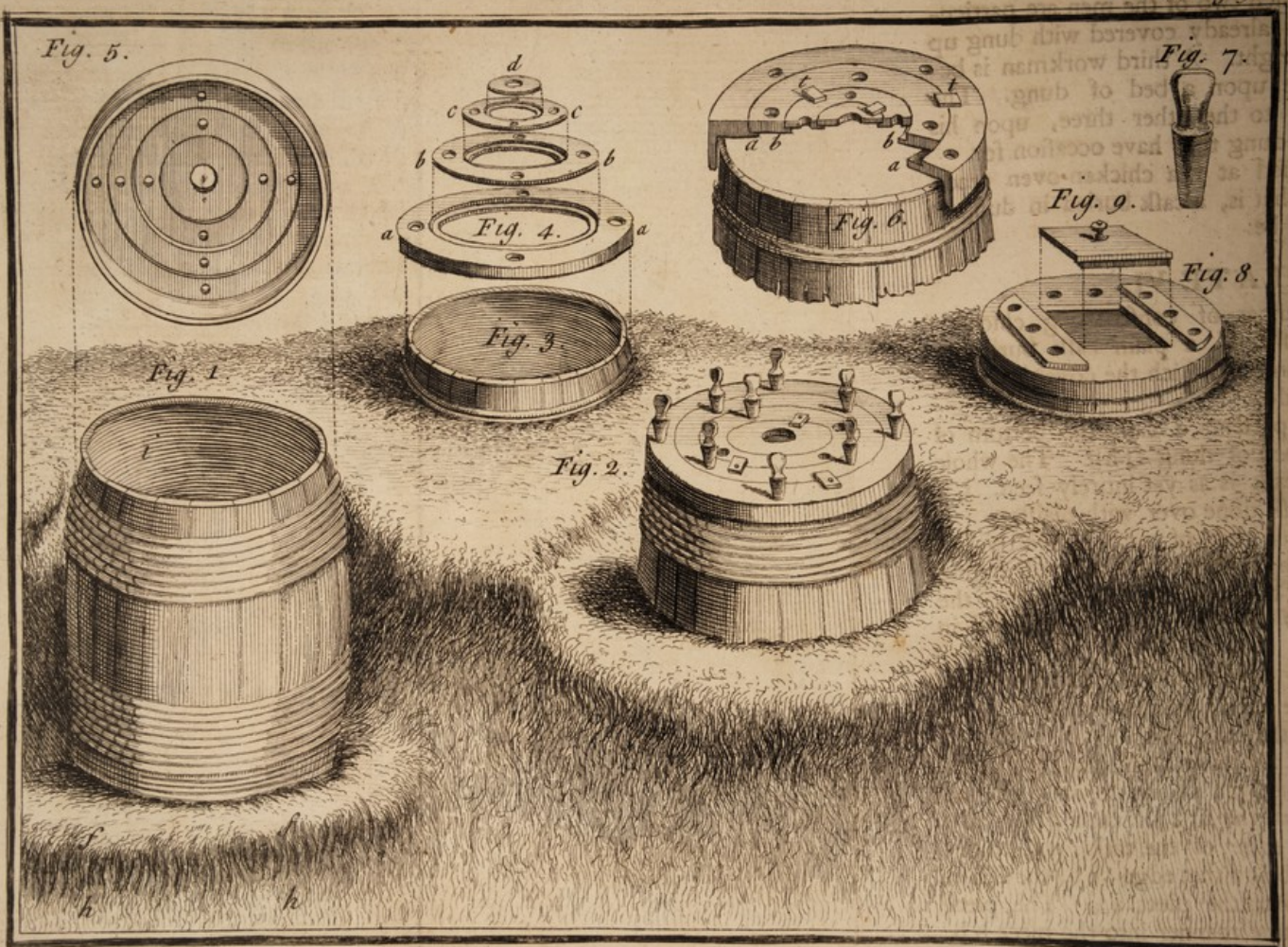
On Hatching and Breeding

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The convenience of having roosts round the sides and of keeping it there for above a month, and the advantage there is in keeping the vapour of the dung at a distance from the rim of it, are both reasons for not raising the surface of the dung much beyond the three quarters of the height of the cask at first.

An Explanation of the figures of the Memoir.

The Head-piece.

The head-piece of this Memoir represents one of those coach-houses which are open on three sides, and are covered with only a roof in the manner of a barn-house. Eggs may be hatched with great success in ovens surrounded with dung built under such a place. The men who appear at work under that which is represented here, are about making ovens, that is, buying casks in dung and



ready warm, or in such as has a disposition to become so. That which two of the men are particularly busy about, is already covered with dung up to about half its height. A third workman is beginning to set one upon a bed of dung. The fourth man brings to the other three, upon his wheel-barrow, the dung they have occasion for.

There is expressed at f a chicken-oven ready made with dung, that is, a cask buried in dung as deep as it ought to be.

PLATE VI.

Exhibits the manner of constructing chicken-ovens, which consist of a plain cask buried in dung, and the manner in which the covers of these ovens are to be made.

The first fig. represents a cask the bottom of which is laid on a bed of dung ffhh. The whole fore part of this cask is as yet intirely seen. i is the inside of the cask done over with plaister.

The second fig. is that of a cask perfectly like that of the foregoing figure, but covered higher up with dung. This cask has its cover; the pieces it consists of are separately represented in fig. 4.

The third figure represents a cask somewhat deeper buried in the dung than is required for a proper warming of the eggs in it.

In the fourth fig. the several pieces that compose the cover of the oven of fig. 3. are separated from each other. a, a, the first of these pieces that receives the upper edge of the cask, and comes down an inch or two below that edge. b b, the second piece which enters into the piece a a. The piece c c enters after the same manner into the piece b b, and the piece d is received likewise into the piece c c. These pieces serve as different registers, either to diminish or to increase the heat of the oven.

The

The holes that have been bored in each of the said pieces, serve also as so many registers, and have certain other uses to be mentioned in the following Memoir.

The fifth fig. represents the cover with all its pieces put together, and seen underneath. The surface it represents is covered with iron-plates.

The sixth fig. shews the upper part of a cask that has but one portion of its cover: this was broken purposely to have sections fit to expose to the eye the manner in which a smaller piece is supported by one larger that receives it. One sees at a the thin hollow circular edge which the circumference of the inferior part of the piece b rests on. One sees likewise that the rim of the cask is within the circular band of the cover, and how low this comes down. t, t, are a couple of pieces that serve to fix the piece b, and to make it remain level with the piece a.

The seventh fig. is that of a cork, such as those of fig. 2, drawn upon a larger scale.

The eighth fig. is that of an oven, the cover of which is more simple than those of fig. 2 and 3. This cover, which is nearly like the first covers I made use of, has but one large square aperture in the middle, and ten round holes considerably smaller made about it.

The ninth fig. represents the wooden-piece with which one shuts either intirely, or in part the square aperture of the oven of fig. 8.

MEMOIR



MEMOIR IV.

Of the ranging the eggs in the ovens, and of the attention and care required to keep them in the degree of heat fit to bring on the hatching of chickens.



IF the cask, which is all our chicken-oven consists of, has been surrounded on all sides with dung of the quality of that mentioned in the foregoing Memoir, as to be chosen preferably to any other; the air contained within its cavity will begin to be warm, and this the sooner in proportion as a smaller number of the registers of the cover shall have been left open. The thermometer which is now to be our guide, will inform us of the progress of the heat within the cavity of the oven.

One may apprehend, that the figure of this instrument, or its name alone, might be enough to frighten people not much used to the handling of such things: It must be confessed however, that there is no man, but may be very soon brought acquainted with it: there is no man breathing but will understand the person that tells and shews him

him at the same time, that the red liquor in the tube ascends when the ball to which this tube is fastened is in a warmer air, and that the same liquor descends when the ball comes to be in a colder air: there is no man again but will understand his instructor when he is further told, that when the liquor of the instrument kept in the oven a quarter of an hour is right against such a mark or thread, the heat of the oven is fit to warm the eggs; and that the point to be gained is, that the liquor must never be higher than a certain thread which is above the foregoing, and never lower than another thread below the same. As there is no man but may be taught thus much if he is not absolutely an idiot, I am under no apprehensions of the common country people's being able to make use of a thermometer; very plain and very cheap ones * may be made for them, on which the places only they want to know may be marked: and they will not then be puzzled or embarrassed by the series of the degrees which are of no signification to the object they have in view.

* Plat.
VII. Fig.
1.

This objection therefore is easily got over, but there is still a better founded motive of uneasiness behind. There are workmen, who, in order to sell a greater number of their thermometers which are made with very little care or exactness, have thought of carrying them into our country places: Some they sell to the nobility, to the ministers of parishes and to trades people: There are even many of them that do me an honour which I very much disapprove, they put my name to their thermometers, and affirm that they are made upon my principles. These pedlars will soon offer their instruments to the country people, and will probably try that way to increase their trade, by selling thermometers for the hatching of chickens: and how can men so little skilled in the knowledge of these instruments be

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preserved

preserved from being cheated? They may be taught a method equally easy and sure to know whether the thermometers offered them are good, or at least whether the degree of heat communicated by the hen to the eggs she sits on (of which it is an essential point for them to be certain) is placed on the tube as it ought to be. To verify this, you must put the ball of the thermometer under your shirt, and clap it close to the skin of your breast; or (which is better still) put the ball under your armpit, and keep it there for about a quarter of an hour; this being a fit place for the warming of an egg with success; the instant you take the ball out, examine whether the surface of the liquor in the tube is above or below the thread that points out the 32d degree; if it be either above or below it, the degrees of the thermometer are wrong marked. A second experiment will enable you to rectify the marking out of the said degrees. You must fix a thread at that part of the tube where you shall have seen the surface of the liquor, at the instant when the ball has been taken from under your arm. You may be guided herein by a thermometer in which that particular degree is exactly determined; which done, you must moderate the heat of the oven as soon as it rises too much above that known degree, and increase it by stopping a proper number of registers, as soon as it descends lower. This expedient will enable you with the utmost facility to change the worst of thermometers into one that may be depended on.

Altho' it is very certain that our country pedlars will be very desirous to supply many of the villages with thermometers, yet a great many years may pass, and all the villages that might wish to have them may not be provided with them, especially those that are at a great distance from large towns; besides, that a thousand accidents may occasion the
loss

loss of the thermometer that has been bought; and a moment's absence of mind is enough to cause so tender an instrument to be broken: I have therefore endeavoured to procure for the country people a thermometer that shall not have the air of a philosophical instrument, that may not surprize them by an appearance of something above their understandings; which they may make themselves, and which shall cost them nothing, or at the utmost no more than a bit of butter not bigger than a nut and half as much tallow will cost them. Let them melt and mix together these two ingredients, and pour them into a common drinking-glass, (and that may as well be without a foot as with one) and this shall be their thermometer.

* Plat.

VII. Fig.

3.

If they can procure any of those small bottles * that are usually filled with sugar-plums, and sold at fairs to children for a half-penny, or a penny at most, bottle and all, they may still make a more commodious thermometer. After having taken the sugar-plums out of one of these, it must be filled only in part with the mixture of butter and tallow just mentioned; and this instrument, coarse as it is, will teach them whether the chicken-oven has the right degree of heat, or whether it has too much or too little of it. The heat of the oven will render the matter of the thermometer as fluid as oil when it is excessive; and it will be known to be too weak when it remains perfectly coagulated; it will have the requisite degree when the matter in the glass has the consistence of a soft piece of dough, a small portion of which may happen to run when the glass or bottle is inclined, in the same manner as a syrup grown too thick would. One may easily arrive at a knowledge much more exact than we can possibly convey by words, of the degree of fusion which will point out the exact degree of the heat of a hen in this new thermometer. If the body of the instrument

strument is made of the little bottle we have just mentioned, or of any other vessel fit to be put under the armpit; keep it there about a quarter of an hour, and the moment you take it out observe the state of the matter which the glass is in part filled with, and what degree of fluidity it has acquired there.

There is some choice in the butter towards rendering this thermometer more perfect: you must always prefer that which has been carefully melted to separate its foulness, or in more exact and philosophical terms, to separate from it a sediment, which is no more than the caseous part of the milk which it had retained. That caseous part may deceive you, if it happens to be in the thermometer: it is not near so fusible as the pure butter; and the butter out of which it has been taken will keep a much longer time without contracting a strong taste. It is the corruption of the same caseous part that causes butter to lose its first freshness: but this is not a place for insisting upon this observation so much as it deserves.

We shall content ourselves with having contrived for the country people these coarse thermometers, which may be very usefully employed, tho' they have not all the accuracy that might be desired; those we shall mention hereafter will always be common thermometers. The manner in which the degrees shall be marked upon these will procure us the advantage of expressing with a much greater exactness the observations we shall have to give an account of. The size of these thermometers is very arbitrary. If you use those that have a symmetry with barometers, and are above two foot and a half high, the part of the tube where the necessary degrees are marked, may be left without the cask, and rise above the cover of it, the hole at the center of this will yield a passage to the

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tube. But an instrument so brittle and of this length would be cumbersome, whenever you would take off the cover of the oven to examine the state of the eggs: and would run the risk of being broken at any time, should one not recollect with how much care it ought to be handled. This motive makes me give the preference to a small kind of thermometers, which are eight or nine inches long at most.

Let the size of the thermometer be what it will, it ought never to be put upon a broad board, the width of it being always very cumbersome. As it is to be used very often, it is proper that the ball of it should not be exposed to blows that may break it, at such times when its easy destruction is not sufficiently thought on. It may be sheltered from all danger by means of an easy addition, which is not necessary in the common thermometers. A tin-pipe * about one inch long is fastened to the lower extremity of the board; the ball is lodged within it, because that pipe may receive in safety many a blow which the ball could never resist. This pipe is open at the lower end, and has besides several apertures cut in its height; so that the air has an access to the ball sufficiently free to make it contract very suddenly the temperature of the air of the place it is in.

* Plat.
VII. Fig.
1 and 2.
b. c.

The operation for the use of which these thermometers are designed, does not require that they should have the long series of degrees which is necessary in those which are to inform us of the several changes that happen in the temperature of the air in the hottest as well as in the coldest days: One single degree is essential to them, viz. the 32d. These words, *The heat of the hen*, are written against that degree, because it indicates that. However, the addition of a few more degrees to it will not be useless; as they may point out how much

the heat of the oven is at certain times above or under the requisite degree: Let then the degrees extend from 25. to 40. This, which is sufficient, is the usual number of degrees of the thermometers of that kind, which are made by the *Abbé Nollet*; and he is the fittest person in the world to be applied to for thermometers that may be intirely depended upon. There is written over-against the 30th degree *A weak heat*, and over-against the 28th, *A too weak heat*: There is written over-against the 34th degree *A strong heat*, and over-against the 38th, *An intense heat*.

How short soever the tube of the thermometer may be, there is a very plain method of consulting it without being obliged to take off the cover of the oven, which will always occasion a cooling of its inward air: They may fasten to the upper-end of the board of the thermometer †, a pack-thread that † Plat. lets it down as low as they please; the other end of VII. Fig. the same pack-thread is fastened to a small stick, 8. t. which is longer than the diameter of the hole at the center of the cover *; this stick laid across the said * b. b. hole, holds up the thermometer, and helps them to pull it up higher than the cover, whenever they have a mind to see to what degree the heat of the oven has caused its liquor to rise; for the hole at the center of the cover must be large enough to yield a passage through it for the ball of the thermometer: and when it has been thought proper to take off the cover of the circle, the round piece which is nearest to its center, the pack-thread that suspends the thermometer, may be fastened by a longer stick laid across the aperture thus increased.

By consulting a thermometer so suspended, and having its ball about the middle of the height of the oven still left vacant, we are informed of the degree of the heat its inward air has acquired since it was surrounded with dung. Sometimes at the end of four and twenty hours, and seldom later than

after two or three days, the instrument will inform you, that the eggs that shall be put in the oven, will be as warm there as they would be under a hen. Before you trust them in it, you must again examine if its internal air is not charged with too much moisture. The sides of the cask, and even the plaister may have preserved some former moisture, or they may have borrow'd new humidity from the dung. This moisture never fails rising in vapours which adhere to the interior surface of the cover, and wet it in several places. One must defer putting the eggs into the oven, till the under part of the cover, of which a few registers are left open appears perfectly dry; which usually happens about four or five days after, sometimes sooner, sometimes later, according to the time of the year and the quality of the dung. But what belongs to this article of the moisture and the vapours, deserves a very strict examination, and shall be enlarged upon in the following Memoir.

When you have found out that the oven is sufficiently warm and dry; there is no reason for deferring putting into it the eggs intended to be heated but the utmost care must be taken not to introduce into it eggs stale or of too old a date, from which chickens are no more to be expected than from the eggs that have no germ in them.

The shell of an egg has a kind of transparency, which allows you a faint insight into the egg when placed between the eye and the light. This transparency, which is not considerable enough to let you discover whether the germ is wanting in it or not; is however of great use to you to judge if the egg is old. If you hold it straight up, with its biggest end upwards, and fix your eyes upon that part, you will perceive how high the substances contained in its cavity rise, and what empty space they leave in it; the older the egg is, the larger that
empty

empty space will always prove. But, at what time is the said space large enough, to be an indication that the germ is either destroyed, or absolutely unable to unfold itself? This is a question not very easy to be decided; all we know is, that a very large empty space there, is a very bad omen. The surest method towards having as few addle eggs as possible, and to avoid running the risk of warming eggs too old to be fruitful, is never to warm any but those of one's own hens; which must have been carefully provided with good cocks, never giving the eggs time enough to grow stale. The time in which this happens varies according to the season; for eggs grow sooner stale in summer than in winter; this time ought indeed to be determined in a less vague manner, by experiments which I have not as yet carried far enough: however, I have made some that prove, that in summer-time an egg three weeks old is still fit to be sat on.

It has been easy for me however to make other experiments, that shew no credit is to be given to one of the directions which *Pliny* gives those who have a mind to cause eggs to be sat on. He asserts, that new laid eggs are as unfruitful as stale eggs: and will have us look upon eggs about ten days old as the best of any to be sat on: *ova incubari infra decem dies edita, utilissimum; vetera aut recentiora infœcunda* *. The impatience I had to cause chickens * *Lib. 10. cap. 54.* to be hatched, especially at the time when the pleasure of seeing them come to light was perfectly new, would not allow me to stay till the eggs were ten days old, in order to warm them, I often introduced them into the oven the same day they had been laid, and sometimes the very instant after, whilst they were as yet warm: the greatest number of those I have caused to be warmed had been laid the day before. However, I never had any reason to suspect that they had afforded a less number of
H 3 chickens

chickens for having been heated too soon after they were laid.

Whenever you have a sufficient quantity of eggs to be able to pick and chuse, you must always give the preference to the biggest, because the largest chickens come out of them. What I have judged most commodious as to the arrangement and disposition of the eggs in the oven, was to range them in flat-bottomed wicker-baskets of a circular form *, being an inch or an inch and a half less in diameter than the oven into which they were introduced. They must be chosen more or less deep in proportion to the greater or less quantity of eggs you have a mind to hatch at a time, because you will save a deal of room by distributing the same quantity of eggs in a lesser number of baskets. Nevertheless, if they are made deeper than is necessary for their holding two strata of eggs laid on their sides, they will be rendered cumbersome and unhandy for the many small operations to be made during the whole time of the warming of them: the state of the eggs is even better seen in a basket that contains but one stratum. I would then advise the reader not to have any baskets made but of these two sizes, *viz.* some not deeper than is necessary for one single stratum, and some deep enough to hold two strata at a time: what happens at the time of the hatching of the chickens, even requires that the second or upper-stratum be not of as many eggs as the under-one, and that intervals be left between them.

The bottom of the baskets may either be thin or close-wrought: nor is it material that they should be very neatly made: the choice of the pliable wood of which they are formed, is also quite indifferent: it is always easy to render them sufficiently strong and solid, but they are the more handy for being slightly worked. You will render them

* Plate
VII. Fig.
4. and 5.

them still more easy to be managed by giving them a couple of handles diametrically opposite, being each of them one inch, or one half inch raised above their upper border. You will also procure to yourself another additional conveniency which I shall speak of soon, by giving them four* Plat. handles, that may divide their upper edge into four VII. Fig. equal parts*. 5.

A very thin bed of straw must be spread on the bottom of each basket: this has no other use but to hinder the eggs ranged upon it from rolling too much about, which they might do if they were put upon the naked bottom of the basket. If you have not eggs enough to fill the whole basket at once, and intend to put daily into it the eggs laid by your hens, you will be very glad afterwards to have taken the trouble to write near the smallest end of each egg before it is put into the basket, the day both of the week and the month on which it was introduced into the oven, as for instance, *Tuesday May the sixth* §: this short note will prevent your § Plat. forgetting the day on which the eggs have begun VII. Fig. to be warmed, and will put you in mind of the 6. days on which you may expect to see some chickens hatched.

It is not without a reason that I advise that the note written upon the egg to be placed near its smallest end: the chicken comes out much nearer the biggest end of the egg than the smallest, except in some accidental and uncommon cases; and the note written near the biggest end would be no longer legible on the shell after the hatching of the chick, as the writing would be in part upon the broken pieces which it might have caused to fall off the shell; and the more curious observers will be glad to be able to read it when the chicken is hatched, as it informs them whether that birth happened at the exact time, or before or after it; which some-

times is no indifferent thing, and may suggest many a curious and even useful observation.

There is another minute care to be taken at those times of year when the hens afford so very few eggs, that you cannot fill a whole basket with them under the space of several days; this care consists in ranging them in a certain order, that may spare you the trouble of looking them out, and fix your eyes at once upon those that began to be first warmed. These are to be placed at the center of the basket, those of the day after must surround them, the circle growing larger and larger every day will contain more eggs in proportion, and sometimes those of two or three different days. You will be able, by means of this disposal, to cast your eyes at once upon those whose chickens will be ready for hatching, as well as on those from which chickens are not any longer to be expected, the time being expired: and you will never be obliged to handle them first one then another, when you have a mind to find the egg whose chicken is squeaking, and has but just begun to crack its shell.

A very rational presumption ought to make us think the best situation that can be given to the eggs, is that which they naturally assume when they are left to themselves upon a horizontal plane, especially as this is likewise their position in the nests of the hens: their make requires them to lye on their side: Nothing then seems fitter than to leave them in a reclined position; which is in reality the most commodious of any. I thought it, nevertheless, incumbent on me to make experiments, whereby I might be informed of what would happen to eggs that should be put in a vertical situation, some with their biggest end upwards, and some with the same end downwards, during all the time of their being warmed. In order to fix a few eggs in these two
contrary

contrary positions, I thrust the small end of part of them, and the biggest end of the rest, into bran or sand with which I filled a small box, which was put into a basket where a number of other eggs were laid on their side. The chickens were hatched out of the vertical eggs in the very same number of days as those that were hatched out of the horizontal ones. The author of nature who foresaw every thing, would not permit that the chickens of the eggs happening to be in a vertical, or a nearly vertical position under the hen, which may happen in a great many cases, should have a different fate from that of the other eggs. This fact is particularly remarkable, with regard to the eggs that have their biggest end downward: for in that end it is that an empty space is made, which increases from day to day in proportion as a greater quantity of matter has perspired out through the shell. The membrane which the biggest end of the new-laid egg was lined with, separates from that part of the shell; and when this portion of that membrane is gone off, the portion still adhering to the shell follows the matters that fill the remaining part of the cavity of the egg. It is a wonderful thing that this membrane should always assume the disposition it needs must have to apply itself quite close to the matters within the egg, so as not to leave the least empty space in them: but, it is a far greater wonder, that it should continue to rise further and further from the shell of the biggest end of the egg, whilst that very end is turned downwards. This, I say, is much more surprising in this than in any other position of the egg, since whilst the biggest end of the egg is directed downwards, the whole weight of the substance contained in the egg opposes the displacing of that membrane. It is very odd, in short, that, let the position of the egg be what it will, the chicken should never seem affected by it, and that the

the circulations and the several unfoldings which are to be performed within that embryo, should always be effected with the same regularity. This wonder, however, is of the same kind as that of which we see continual instances among us, and which does not so much affect us as it ought to do. Let us either lye down, be sitting, or stand upright; let the vessels of some parts of our body, or those of other parts be pressed, the general circulation of the blood is not a whit retarded for that. Hydraulick machines that are never disordered by positions so very different, must needs have been framed by a most surprising artifice.

A few of the eggs which I caused to be heated with their biggest end downwards, proved to be rotten ones; and in these, where the embryo had been wanting, the membrane separated from the shell and followed the fluids of the egg as well as the others.

A basket whereof the diameter is proportioned to that of a chicken-oven made of a hoghead-cask, and the depth of which affords room for only one stratum of eggs, will hold about a hundred; and if it is nearly twice as deep, it will easily hold above a hundred and fifty of them. As I am always for beginning experiments in little, I would advise all those that shall try for the first time the warming of eggs and the hatching of chickens by means of dung, to be contented with one single basket having a hundred eggs in it at most.

You may, after a first experiment, make more use of the heat of the oven, as you may do it with greater security. Absolutely speaking, you may give an oven made of a hoghead-cask five or six of the baskets that hold about a hundred eggs each: however, I would advise to give it but three, and to be contented with warming three hundred or three hundred and fifty eggs at a time in each oven:
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for it seems to me much better to multiply the number of the ovens, when you have a sufficient quantity of dung at your disposal, than to multiply too much the number of the baskets in the same oven; because the brood is the more difficult to be managed as it consists of a greater number of baskets. Although it happens sometimes that the heat is equal from the very bottom quite to the distance of three or four inches from the upper edge of the oven, as I have found it by a perpendicular row of thermometers hanging one above another on the same string, I have observed on many occasions that it is not exactly the same at different heights: It will then be by so much the more difficult to procure the same degree of heat to several baskets, as the number of them shall be greater, or as their series shall fill a greater portion of the height of the oven.

If you have but one single basket to place in the oven, you must put it a few inches higher than the middle of the height of the said oven; as this is generally the best place. There are many different means to keep the basket up at what height you please: the first I have made use of was to fasten to each of its opposite handles a string to be hooked on a nail drove into the side of the cask. My nails had the form of hooks, but I had caused them to be made longer than our common hooks, and their point like that of a gimblet; to the end that this being a kind of screw, it might be made to pierce into the wood of the cask, without risking either the shaking or splitting the plaster within; for you would infallibly make cracks in it, or even cause flakes to fly from it, by driving a common nail into it with a hammer. I moreover took care to put on each string several buckles distant a few inches from each other, that I might

be able to place the basket lower or higher as I should think proper.

You may, by multiplying the above-mentioned nails, or even without multiplying them if they are but long enough, hang up after the manner here described two or three baskets one above the other.

There is a method however still plainer than this of hanging up the basket, it consists in preparing a support for it in the oven itself, as high as you would have the bottom of it: a pillar of bricks laid one upon another, will supply that support, which is easily raised or lowered the thickness of a brick, according as you would have the basket stand higher or lower. You must not defer the ranging of the bricks appointed for a support to it, to the critical moment it is to be put upon them: these masses, which have not the warmth of the air within the oven when first they are introduced into it, would cool the air considerably, and would not suffer it to re-assume its first heat before they had themselves contracted a like degree of it, which they would not do till many hours after: the bricks must therefore be placed several hours, or even a whole day before the basket is put upon them.

There is another support also of a matter not very compact, which one has always at hand in the country, and which is full as good as the bricks. A day or two before the time you intend to introduce the eggs into the oven, you must fill the cask with straw not very close up to the height you think proper to have the basket placed at, that is, a little above the middle of the said cask, if you have a mind to keep the basket exactly in the middle of it. The straw needs not be long there to contract the degree of the heat of the air within the oven; but the space of two days is
often

often necessary to make it lose all the moisture it hath imbib'd. It is more easy to diminish the height of this support than to increase it : nevertheless, you will increase it without any danger, by introducing into the cask straw that hath been dried, and which you may dry in a spare oven by way of caution ; for, as we have already observed, it is always proper to have a spare oven ready.

When you intend to put two or three or even more baskets into the oven, you must put the first or undermost nearer the bottom of the cask than you would do if it was to be there alone, this will stand in the place of a support to the next, which may be the support of the upper one *.* Plat. But, as I think it proper always to leave a free circulation of air round the eggs of each basket, I am of opinion that the bottom of the upper basket should not be suffered to rest immediately upon the edge of the under one : It was in order to prevent this close junction of the baskets, that I advised the giving to each of them four handles rising half an inch at least above their rim. By setting the upper basket upon the four handles of the inferior, there will always remain an empty space between the eggs of the latter and the bottom of the former. There were no handles at all in the first baskets I made use of : a couple of wooden rulers about an inch thick stood in the place of them : these two rulers were laid across the lower basket, parallel to each other, and each of them at a distance nearly equal from the center and the extremity of the diameter to which they were perpendicular. VII. Fig. 8.

The supports that fill part of the capacity of the oven, as the straw and the bricks, have the advantage of contributing to the keeping up the heat in it. Solid bodies are indeed more difficult to be warmed

warmed than the air, but then they are not near so apt to lose the heat they have once received: the more the cavity of the oven is filled with solid matter, the less room will be left for the air; and the easier it will be to preserve in it the degree of heat it shall have been made to assume: it is true, it will require a longer time to be warmed, but then this inconvenience ought not to be reckoned as any thing, it can have no influence but upon the time when the first brood may be begun, the warming of which will perhaps be postponed one day: and it is of no manner of signification, whether eggs begin to be warmed a day sooner or a day later.

I had made an examination of the variations which may be observed between the several degrees of heat to be found at different parts of the height of the oven; and I thought it proper to make the same inquiries concerning the heat of the several parts of each of its horizontal sections: I judged it necessary to examine whether the eggs placed near the center of a basket, were as warmly situated as those that should be nearer the circumference of it, and consequently nearer the sides of the oven. These sides are here the focus, and a circular focus too: The contour of the basket which is nearest to that focus; ought, it seems, to be sooner and more intensely warmed than the center of the same basket, which ought for the same reason to be warmed the last and least of any other part. In order to know whether there really was any considerable difference between the degree of the heat of the center, and that of the heat of the other places, I put a thermometer in the middle of the basket; four other thermometers were then distributed near its brim, each whereof was distant from the next one quarter of the circumference, and I put two others in places equally distant

distant from the center and the circumference. I never should have expected that the liquor in the tubes of these different thermometers should be much at the same degree as I have often however found it, and I have experienced contrary to my expectation, that when there were any places more intensely warm than the rest, it was generally the center, and the places nearest to it.

This kind of equality of heat throughout the extent of the basket being thus ascertained, we are to inquire into the causes it proceeds from: we judge that the whole body of the air within the oven must have a tendency to put itself nearly in an equal degree of heat every where. The portion of that air which touches the sides is more advantageously situated to grow warm, but then as soon as it becomes warmer it acquires a lightness which makes it leave its place immediately: it rises and is directed towards the open registers of the cover which are near its center. There comes in a colder and consequently a heavier air through the same registers: this air is directed towards the sides of the oven, because the direction towards the axis of the same oven is not so free as that. There are in their full strength the draughts of the air, which is for ever ascending in order to arrive at the sort of chimneys which are near the center of the cover: finally, there result from the several motions of the ascending and of the descending air other motions which serve to mix well together the several parts of the air contained in the cavity of the oven.

One might, strictly speaking, be contented with putting one single thermometer into the oven, and the experiments just mentioned shew that it is at least sufficient to put one in each basket. There are two different ways of placing it there: it may be kept in a some what reclined position*, or else perfectly vertical†: if you will have it in the former

* Plat.
VII. Fig.

4. t.

* Fig:

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former position, you must contrive a place for its ball between the eggs that are nearest to the center, and put its tube upon other eggs, so as that the end of it which is empty of the coloured liquor may be higher than the ball : for, if it was lower, part of the said liquor might run too far in the tube, and leave a passage for air that would cut the column of the liquor and divide it, and would perhaps creep into the ball : in which case the thermometer would be disordered, it would no longer point out the temperature of the air, and would of course be useless. And as the same or a like accident may happen in thermometers belonging to people who may be ignorant of the manner of putting them again to rights when they are out of order, we think ourselves obliged to teach them how to do that. They will succeed in it sometimes by barely laying hold of the frame of the thermometer with one hand, and by shaking it and making it go swiftly up and down for the space of five or six inches : such shocks repeated for a few minutes together, will help the air to disengage itself out of the column of liquor, which will thus become continuous again. Altho' there should be a great deal of air, even in the ball itself, that should divide the column in a great many parts, you will always arrive at making it pass quickly again into the upper portion of the tube, if instead of shaking the thermometer up and down in a straight line, you move it circularly, and make it turn as a stone in a sling. You may make it whirl in this manner, by holding in your hand the end opposite to that where the ball is : but you will imitate the swinging motion of the sling much better, and will procure a much quicker re-union of all the parts of the liquor in one, if you fasten a string to the frame of the thermometer, and whirl it round so as to cause the ball of the

thermo-

thermometer to describe a larger circumference with greater ease.

When there are several baskets in an oven placed one over the other, and furnished each of them with a thermometer laid cross it, you cannot be informed by this instrument of the degree of heat of an inferior basket, before you have previously drawn the upper-baskets out of the oven: Nor can these be taken out without causing a cooling of the air. This consideration may hinder you from examining into the state of the heat of your several baskets as often as you might think it proper: but the second manner of placing the thermometers, that is, in a vertical position, procures you the liberty of observing their actual state at any instant, without opening apertures which you may have thought proper to keep shut, and indeed without altering the heat of the oven in any manner.

You must, in order to procure yourself this conveniency, leave at the center of the bottom of each basket a hole having nearly the diameter of a common egg, that is, a diameter larger than that of the balls of the thermometers you have a mind to make use of. This hole must have at its top a ledge about an inch high, made with wicker twisted and rolled up*; this ledge serves to stop the* Plat. eggs that would incline to roll over the hole. VII. Fig. The reader will be sensible, before I mention it, that^{5. e.} this hole is designed to let the ball of a thermometer through. If the oven contains three baskets placed one over the other, you must fasten three thermometers on a small stick in such a manner, that when the ball of the inferior thermometer is come into the basket that serves as a support to the two others, the ball of another thermometer may be in the middle basket, and the ball of the third thermometer in the basket at top. The stick
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* Plat.
VII. Fig.
7. b b.

that bears these three thermometers must be hung on the cover of the oven *, in the same manner as we would have the string of the vertical thermometer of the upper-basket be suspended, when that basket is the only one that has a thermometer.

The country people may be contented with having the butter-thermometer: nay they may even do without this, and find an equivalent in the warmth of their own skin. They need but clap close upon the skin of their breast, or convey under their armpit one of the eggs at the instant of its being drawn out of the oven: if they find it warmer than their skin, they are thereby forewarned to moderate the heat of the oven, and they are warned to increase it, if the egg has made an impression of cold upon them. They may also accustom themselves to judge of the degree of the heat of the oven, by barely putting one of the eggs upon one of their eye-lids. Nay they may even judge of it with their fingers, by taking care not to use them but after having rendered them nearly as warm as the other parts of their body which are not uncovered.

I have many a time found out with my fingers, that some of the eggs were colder than any of those that surrounded them. I could not even guess the reason why they were so, till I afterwards broke some of them, because many days had passed after chickens ought to have been hatched, and nothing came of them. These eggs, colder than the rest, were commonly those in which the chicken was dead, and sometimes they were rotten ones. They had none of them that principle of heat which is in the eggs wherein a chicken is alive: whenever the heat of the oven decreased, these eggs which had nothing alive in them, lost their heat much sooner, and must of course

course have appeared much colder than those wherein there was a vital principle preserved.

Altho' you should have introduced but one single basket into the oven, this must needs have caused a diminution of the heat of the air contained in its capacity: this air loses that part of its warmth which it communicates to both the basket and the eggs, and is soon cooled very sensibly. You must, in order to make it regain the sooner the heat it has thus lost, stop all the registers of the cover, except that of the center which must always be left open, because the circulation of the air ought never to be totally intercepted. Not a single hour at most must pass, without going to consult the thermometer of an oven in this situation, which will inform you by the degree its liquor stands at, if you must continue all the registers shut up, or if it is time to open one or more of them. It will be proper to make a like examination an hour after, and to repeat it for five or six hours together.

You will not be obliged afterwards to pay so frequent visits to your oven, when you shall have brought its heat to the desired pitch, and it shall have assumed a certain equality. It will suffice then to go five or six times a day, and see in what state it is, but particularly it must be visited late at night, and in the morning as soon as possible: for this will not hinder the interval between these two last visits from being longer than the intervals between the others of the day: there have been times indeed when my gardener has thought it proper to rise in the night, to go and examine the degree of heat of the oven. Before I knew how to govern this, some nights have been fatal to the embryos in all the eggs.

The hours at which you make these visits must not be so fix'd but that you may sometimes alter them according as the circumstances and incidents shall seem to require it. The place where the oven stands is affected by the variations of the external air; and those of the air of that place occasion some changes in the air within the oven. Therefore the sudden transitions from warmth to coldness, and from coldness to the heat of the air that surrounds us, will occasion changes in the heat of the cavity of the oven. In summer-days when the heat becomes excessive, and at the hours at which it is most intense, you must watch over your oven to hinder its heat from increasing to a degree that might prove fatal either to the germs, or to the chickens in the eggs. On the contrary, you must always think of the means of preserving its heat, when the external air has been considerably cooled in a few hours: moist weather may after all this require a new degree of attention, for this sometimes increases the fermentation of the dung of the hot bed, and causes it to grow warm beyond the degree you would have expected.

Notwithstanding all the care you may take to keep up the heat, you will always find at the end of some days, that it is inclined to slacken, that you cannot arrive at keeping the liquor of the thermometer up to the intended degree, but by shutting up a greater number of registers than you used to do some days before at the same hours of the day; this shews that the bed of dung has lost part of its heat, and must needs be repaired. This is no difficult operation, the whole of it consists in spreading a thin stratum of hot dung all round the cask: a sufficient quantity of this may be taken at three times with a pitch-fork, which must be loaded at every time with as much as it can carry: this will presently form the intended stratum; and this is
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to be taken out of the small and very hot dung-hill, which I said was to be kept in reserve to be used when need required.

In summer time, and in all the months in which the air is most commonly above the degree of heat, which is observed in the vaults of the French observatory, one is not obliged to warm the oven anew as frequently as in the months in which the air is constantly under that degree. During many of the warmer months, and during all the temperate ones, I have not caused the oven to be heated afresh above once a week; two renewals of the heat have proved sufficient to bring a brood to the end of its time. In the cold months renewing the heat every three or four days is not too much; and there have been times when my gardener thought it proper to renew the heat every day; which I was not against, as he did it but very slightly, and added no more new dung at a time than a pitch fork could take up.

If there is any time that requires an extraordinary attention and care on the part of the person that watches the oven, it is the day and the night that come immediately after the heat of it has been renewed by a considerable addition of hot new dung: sometimes very great danger threatens the brood from this change, which does not shew itself till many hours after, sometimes sooner, sometimes later: it is an accident that has disconcerted me more than once unawares, and has made me lose the eggs of many a brood. Very often many hours will pass after the new stratum of dung has been spread, without the least appearance of any dangerous increase in the heat of the oven, and even sometimes without any appearance at all of an augmentation; one is even afraid the hot dung newly spread will not produce its intended effect. If you depend too much on these first appearances, you

will not suspect that the new addition of dung was capable of producing an excessive augmentation of heat, till perhaps it is much too late to apply a remedy which ought to have been made use of in time. This heat becomes sometimes so very considerable, that to moderate it, it is not enough to open all the registers, you must take off the whole cover, and even sometimes draw your basket full of eggs out of the oven for a small time. When you have not had any suspicion of this sudden increase of heat, and it happens to break out in the night: going the next day to pay your eggs the first morning visit, you'll find them so immoderately hot, that you'll not doubt a moment of the utter destruction of every embryo. The consequences of the slighter additions of new dung are not by much so dreadful, and ought always to be preferred for that reason.

But it will be asked, will not one, by these continual additions of dung, soon accumulate it in such a manner round the cask, that the brim of it shall at length be below the surface of the hot-bed, above which we have ordered that it always should be kept? Nay, will it not even be buried in it at no inconsiderable depth? We answer no. The brink of the oven still remains above the dung: this is a kind of little phænomenon which no body would have expected, but the cause of which is not difficult to be found out. The first dung which the cask is surrounded with, has small *vacua* between its parts, which it does not afterwards preserve: it is light and spongy at first; but it sinks gradually, and becomes more compact from day to day: old dunghills are not by much so high as they were when the dung was new, they sometimes are not half so high as they once have been. What the hot-bed that surrounds the oven, loses daily of its height by sinking, it leaves in room for the dung
added

added to it at every renewal of its heat, and this again sinks in its turn. I have seen the same hot-bed subsist for six or seven months, during which it has been renewed with fresh dung every week, without ever having its surface raised quite to the upper edge of the cask.

If the hot-bed was covered all round the oven, with a floor made of boards put close only to each other without any other joining, this would preserve the heat still better: the surface of that floor would not be so much exposed to the impressions of the air; and it is highly probable that it would excuse our recurring so often to new additions of hot dung: however, I have not practised this, because the heat of the oven becomes by it more difficult to be renewed, as it would be a laborious operation to take the boards off and put them again round the cask. Nevertheless, this expedient might be useful to those who having not a sufficient quantity of dung, should be obliged to use it for the sake of oeconomy.

Another means of warming the hot-bed afresh without any addition of dung is to water it: this revives in it the fermentation which had been extinguished, or enlivens that which had been too much slackened: but the hot bed must be only moistened, not drenched, if you would be safe from the risk of cooling it intirely at a time when it wants to be warmed.

When a new supply of hot dung which has been administered too late, does not answer your expectation quickly enough, and the eggs are in danger of being cooled to an excess, and of remaining too long in that state: there is again in such a case, a remedy to save the chickens within them; which is extremely sure, and so very plain that it ought indeed to offer itself to every body's imagination of its own accord: I did not however, myself

think of it on the first occasions in which I stood in need of it : it barely consists in replacing the heat of the bed of dung by that common fire. Warm ashes, or ashes mixt with a few small and well kindled coals, are to be put in a vessel, the matter and form of which are very indifferent ; it may be one of those small fire-pans, which women obliged to remain during the winter in places exposed to the air, to sell ordinary things, make use of to keep a little fire by them. A handle is an essential part of this kind of pan, that these women may carry it more conveniently ; but it is yet more indispensibly necessary in the pan to be let into the oven, to hang it up on the cover, in the same manner as we said a thermometer was to be suspended. With the assistance of the small quantity of fire contained in such a vessel, which may as well be an earthen as a brass pan, you will be able to bring the heat of the oven up to the desired degree at any time ; at which you may keep it by putting new fire into the pan whenever the thermometer shall shew it to be necessary, quite to the time when the fresh dung of the hot-bed shall have contracted a sufficient warmth to render the further use of this pan needless. However, this precaution will appear of so little consequence to those who shall make trial of that manner of warming the oven again ; that I suspect many of them will try not to renew the warmth of it any otherwise than by using these sorts of pans of fire, and will make continued use of a few burning small coals, to supply the heat of the oven which the-hot bed now grown too cool, cannot communicate. The fire-pan which we have directed to be hung up on the cover, may also be placed at the bottom of the oven : it would be more advantageously put there than any where else ; but that such a position of it would put one under
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the necessity of drawing the egg-baskets out of the oven whenever there should be occasion to renew the fire.

Our thermometers, which have indicated in the above-mentioned experiments a much greater equality of heat than one might have expected to find in each horizontal section of the oven, and in sections taken at different heights, have nevertheless shewed us sometimes differences between the degree of heat on one side of a basket, and that of another, and sometimes between the degrees of heat of different baskets. It is only surprizing, that these varieties should not be more common and greater than they are, considering the many causes that may contribute to produce them. The dung of the hot-bed may grow warmer, by a greater fermentation, on one side than on the other; and it is considerably warmer at a certain height than any where else; that which the bottom of the cask has rested on for whole months together, is but faintly warm, whilst that of the last stratum laid at top to renew the heat of the oven is burning hot: there may also be according to the strength and the direction of the wind currents of air that enter at certain times into the oven through the registers, and strike against one of the sides of it, or at least against one of those of its cover, more than against the other, and these may occasion a cooling of that part. These causes, and many others which we need not mention, do not produce, however, any very dangerous varieties in the degrees of heat of the cavity of the cask, because, as we have already observed, the portion of air less warm being continually mingled therein with the warmest, by its incessant circulation, there results a middling temperature from the whole, as there is very soon an equal temperature in boiling water, into which cold water has been poured.

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However, that the eggs may not be exposed to these inequalities of the heat, that they may share it regularly, they must be made to change places every day; so that the basket that bore the weight of another one day, shall, in its turn, be supported by it on the day following. Each basket must also be made to turn one quarter or one half of a revolution upon its own axis, that every portion of its circumference may change its place as often as possible with relation to the sides of the oven.

By this frequent shifting of the place of the eggs, we shall do for them what the hen does for hers, and she is for certain very fit to give us good instructions on that head: she not only shews her affection for the eggs by sitting motionless on them with so much constancy, but she also shews that her affection is equal towards them all; she expresses the same desire of causing a chicken to be hatched out of every one of them: she behaves as though she were informed that by keeping to the first position she had given to the eggs, some of them would be more favourably treated than the rest. Those which have been placed nearest the center of the space they together take up, have been put in the warmest place, that is, immediately under the middle of her body; those on the contrary which have been ranged towards, or at the circumference, are most exposed of any to be cooled by the neighbouring external air: If you observe at different times the hen that sits on them all, you will not see her always motionless and unemployed; you will see her sometimes make use of her bill to change the order of the eggs, to push towards the circumference of the nest, those that were before nearest to the center, and bring towards the center those that were near the circumference.

It

It is very natural to judge that this is what the hen aims at, if she is allowed to be capable of having any aim at all, when she stoops her head low enough to convey her bill under her belly, and when we see her busy about pecking her eggs without breaking them, and without having any intention so to do. 'Tis true, that what passes under her body at some distance from the brink of the nest is hidden from our eyes; there is however a very plain method, which I have had recourse to, to bring within their reach the effects that have been produced by this repeated pecking. I have written a different number upon each of the thirteen eggs which a hen was sitting on. The egg marked 1, was at first, at the center, and surrounded with the eggs numbered from fig. 2. to fig. 6. inclusive, those that were marked with one of the seven numbers remaining to compleat the number 13, stood at the circumference. The next day, when I went to see the eggs, I found the order of the foregoing day intirely altered: the central egg had been conveyed to the circumference, and the center was filled with one of those which had before been at the circumference: there was but one or two which had kept their first place, and which they did not keep quite till the next day. That day and those of the rest of the time of the incubation, made me sensible that the hen caused daily the eggs in the worse places to change them for a better.

I have procured a hen an opportunity of making the displacing of her eggs still fitter to shew the intention she had had of doing it, a displacing which could not be supposed to have been done by any accident, or by any motion that should have caused them to roll and tumble without any settled intention on the part of the hen, a displacing, in fine, much more difficult to be effected than that I have just mentioned.

mentioned. There was in the nest aforesaid only a stratum of thirteen eggs; I put in another nest two and twenty eggs that were disposed in three strata one upon the other. The hen was very willing to do her office, she took upon her to sit on them and did it to a nicety, for out of these two and twenty eggs, I had afterwards nineteen chickens hatched. I had numbered each of these eggs, and had put the eggs marked with the figures 1, 2, 3, 4, at the bottom of the nest, the eggs numbered by the following figures were at top. After a couple of days were expired there remained not the least footstep of the order in which I had ranged them, the eggs marked with the figures of the smallest numbers were brought to the top of the nest, and the others were conveyed down to the bottom. Such a change could not have been effected without much trouble and difficulty, the hen had been obliged as it were to fetch eggs from the bottom of a hole to convey them to the top of all the others, but this toil had not disheartened her, because she had judged it necessary.

As a hen remains so many hours together upon her nest, she has time enough to do all the operations necessary for the good of the eggs: she cannot however notwithstanding all her care, possibly maintain them in that equality of heat which those of a well managed oven may be kept in. She is obliged, in order to live, to take at least one meal a day; many a farmer's wife will even force those she causes to sit to feed twice every day: whilst the hen is a pecking in all haste the corn that is given her, when she is out of her nest, her eggs are uncovered and consequently exposed to the impression of the air which cools them; the meal of our fond brooders is short, but it lasts however seven or eight minutes at least, and sometimes
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above a quarter of an hour, for after eating comes drinking and evacuation: besides this, she stands in no less need to stretch her legs, than to eat and drink. The duration of the time for which the hen is obliged to leave her eggs, is long enough to cause them to lose a considerable part of their acquired heat, this is more or less however, as the air is either colder or more temperate: this last consideration ought to engage the people of the country, never to rouse their brood-hens that make but one meal a day out of their nests but at the hour at which families dine, that is about two o'clock; the air being generally much warmer, at that time than about seven or eight o'clock in the morning, which is the time most commonly chosen to make them eat.

I have had a duck of the common sort, which seemed to be much more uneasy about the cooling her eggs were going to be exposed to whilst she should take the food which she could not possibly do without, than hens seem to be for their eggs on the same occasion: she left her nest but once a day, this was about eight or nine in the morning; she indeed knew not that it would have been better for her eggs if she had not left them sooner than two in the afternoon; but she seemed to know that the eggs would be less in danger of growing cool, whilst they should be less exposed to the impressions of the air. Before she left them, she covered them with a bed of straw, which she fetched out of the body of the nest. This bed of straw above one inch thick, hid the eggs so very well, that the first time I saw the nest out of which the mother was gone, I thought they had all been eaten by some animal; I was afterwards informed of the precaution she used to take before she left them, and if I had not been told of it, I never should have looked for the eggs under the
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straw, nothing could have made me suspect they were there. She, in process of time however neglected to take that precaution, that is, after having sat on the eggs above seventeen or eighteen days together. She behaved in this again as if she had known that the nearer the chicken inclosed in the egg is to the time of its being hatched, the more difficult the egg is to be cooled : it has then within itself a greater principle of heat, a stronger vital spark.

All the ducks of the same kind that have sat on eggs at my house, have not given me instances of so great a foresight and precaution for the preservation of the heat of their eggs as that I have just mentioned. If this foresight is not common to all the birds of this kind, it is so at least to birds which are still more of the water-fowl-kind than ducks, I mean to the little dabchicks. I have heard and been assured from several places which are in the neighbourhood of ponds, where their nests are found swimming on the water, that their eggs are never seen uncovered, that they are hidden when the bird goes from them under a cover made with the same herbs which the nest is composed of. Had I had the opportunities of observing it myself, I could not be more persuaded than I am now of this precaution the dabchick has of covering her eggs, the fact having been certified to me by Mr. *Salerne*, a physician at *Orleans*, and a correspondent of the academy, as capable of a strict observation, as incapable of saying any thing more than what he has seen. Having been in a boat on a pond among reeds to find out nests of these dabchicks and procure me some, he found one with five eggs in it, on which a very thick bed of water-herbs was laid ; he sent me the nest, the eggs, and the very herbs under which they had been hidden. This care which the dabchicks take to
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cover their eggs when they go from them, is known to all those who have many opportunities to see them, and to the peasants who frequent the pond of *Beauce*, where Mr. *Salerne* had gone to seek for some nests for me. The Chevalier *de Bélabre*, whose kind disposition to contribute to the increase of my knowledge on this subject, has been augmented by the recommendation of Mr. *Dodart* intendant of *Berry*, has been pleased to cause collections of the several nests of the water-fowls, that lay and sit on their eggs in his ponds to be made for me; nor did he omit to give me an account how the little dabchick never leaves her eggs uncovered; and he joined to the nests of these birds, which I am indebted to him for, some of those water-weeds which the creature had spread over the eggs. It is commonly thought that this is a piece of cunning which that bird has recourse to, to hinder her nest from being discovered, by rendering it more like a shapeless heap of green weeds; and this supposed intention may very well agree with that of preventing the cooling of the eggs, which is the most important point.

When a hen causes her eggs to exchange their places, she also changes the position which the several parts of every egg had before with regard to each other: I mean the part of the egg which was under, is afterwards at top, or on the side: it is almost impossible it should not be so, as the form of the egg does not cause it to affect any but a reclined position: the eggs are then turned up, sometimes more, sometimes less, when they pass from the center to the circumference, and from the circumference to the center of the nest; but it will be asked, ought not this turning up of the eggs, which is a necessary consequence of their being displaced, to be procured likewise to the eggs that are warmed by art? It is not needless in the eggs sat on by the

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hen, the part of each egg which is immediately applied to her belly being more favourably situated to reap the benefit of the heat than that which is diametrically opposite to it. The eggs warmed in an oven are not so much exposed to this kind of inequality of heat ; and my experiments have seemed to me to prove likewise that there was no necessity to turn them at any time, I never observed that a less number of chickens was hatched out of the eggs that have remained in the same position during the whole time of the warming them, than out of those whose situation had been altered from time to time. However, I am of opinion that it will be still better to turn the eggs now and then, as for instance every three or four days, than to leave them invariably in their first position ; because it is hardly possible that the bottom of the basket should have exactly the same degree of heat, that there is all round the more elevated portion of each egg.

Some reflexions on the several coolings, which eggs are exposed to in the order of nature, dissipated the apprehensions, I might have had on account of the variations which can never fail to happen in the heat of our chicken-ovens : a man, who should never leave them day nor night, but should be fixed to the spot where they were placed, ought not for all his care to flatter himself with an opinion of his being able to hinder the heat from increasing or decreasing sometimes to a degree considerably greater than he would have it do ; the only business is here to imitate nature. If we examine her closely, we shall find that she has the utmost degree of exactness in the choice of the means she uses to compleat her operations ; it is by degrees of heat very unequally distributed in different years, that she causes plants to vegetate, and affords us our crops of corn and fruits. The negligence of
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the manager of a chicken-oven would be excessive, if he suffered the eggs to grow cool there to the degree to which those fat on by hens are cooled once or twice every day. However, there are periods of the operation he is about, at which he might happen not to think for several hours together of renewing the warmth of the eggs, and even leave them for above half a day with no other heat but what they can receive from the outward air in temperate weather, and yet the embryos of each egg might not be destroyed: the loss of these embryos however is the only thing to be apprehended; for it would be no great harm if they should only become chickens one day later than usual: I have had eggs abandoned by hens which had sat on them four or five days together, which have remained above ten hours exposed to the impression of the air; and they have been afterwards warmed again by another hen, and the chickens hatched out of them.

Our brood hens do not afford us instances as fit to free us from our fears concerning the increase of the heat beyond the requisite degree, as concerning its diminution under that degree: the heat of the hen that sits being nearly the same all the while; the eggs will never contract under her a heat of more than 32 Degrees; but it will happen sometimes, notwithstanding all our care, that the heat of an oven will rise higher; it may however increase as far as to 35 degrees without being fatal to the chickens to be hatched: I have had some that have lived thro' a very considerable heat in the egg; nay, that have resisted a heat of 37 and 38 degrees; I have even had some which a heat of 40 degrees and something more has not destroyed. Excessive heat that is instantaneous, or of a very short duration, will not exert its activity on the chicken long enough to kill it. But what I must not by any

means forget mentioning, and what many repeated experiments have taught me, is, that some chickens are killed by a too intense heat that has been of a pretty long duration, whilst others which have been exposed to the very same have resisted it: this difference depends upon the constitution of the chicken, and on its being nearer to, or more remote from the time of its hatching, the excess of the heat is more to be dreaded for those which are nearer that time than for the rest. I have often introduced new eggs into the ovens for twenty days running, each whereof bore the date of its introduction; when the manager of the oven was not as yet sufficiently skilled, or when he had not been sufficiently attentive, he has happened to let the heat rise to 38 or 40 degrees, on the day before that at which the chickens of the first eggs were to be hatched. the consequences of this accident have not always been so fatal as I had expected they would be: during two or three or four days, sometimes more sometimes less, not one chicken has been hatched: I found those which ought to have been hatched on those days, dead in their shells: but to these unlucky days there succeeded others which I had more reason to be pleased with; every thing has been put to rights again, and there have been afterwards nearly as many chickens hatched every day, as there would have been if the heat of the oven had been kept within the requisite bounds.

What can be the reason why the chicken is less able to resist the heat when it is nearer the term of his perfection and seems to be stronger, than when it is tenderer and weaker, and its limbs have a less degree of strength? This is a question which we never could be sure of solving, although we should engage ourselves in all the discussions necessary for the clearing of it. We may see very well upon the whole that the egg which contains a chicken nearer
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its time, will be warmed quicker and more considerably by the same heat than the egg that contains but an embryo: the chicken has its own heat, and the sum of that heat is always by so much less as it is smaller: that of the egg that contains the large chicken, is in the same proportion to that of the egg that contains a very small one, with regard to the stock of natural heat, as a great flambeau is to a small wax-candle; therefore the circulation of the fluids of the bird accelerated in the one and the other egg by an increase of the external heat, will produce in the egg that contains the largest chicken a greater augmentation of heat. Besides, it is likewise evident that when the members of the chicken are more pliant they may give way with greater facility, and be less altered by excessive dilatations, than at a time when they have acquired a consistency that gives them a greater stiffness. The chicken already hatched would not bear without dying the same degree of heat that makes him dye in the shell, when he is but little remote from the moment of his hatching or of the state of a perfect chicken: the impressions that would be fatal to him when hatched are always so when he is ready to be hatched. However, it would be very indifferent to the greater part of those that shall cause eggs to be warmed with hot-beds, to know in a more exact manner why the heat that takes away the life of the chicken that is to be hatched in a few days, does not kill the chicken which is more remote from the time of its birth; they only need be acquainted with the matter of fact; were they ignorant of this they might look upon all the eggs of a brood as lost, and fling them all out of the oven under that notion, although there were many of them very good and worthy to be preserved.

There is then a latitude of degrees of heat above and under the 32d degree, which is not fatal to

the chickens: It were to be wished it might be determined in a less vague manner than we can do it at present, (as by a long series of experiments that should teach us at what time the chicken (reckoning his age from the day on which the egg began to be warmed) may keep alive, although the circumambient air has a degree of heat either above or under the 32d;) what are the lowest of the inferior and the highest of the superior degrees it can possibly bear, and for what time it can resist each of these, according as they shall differ from their medium.

I shall, till such time as we may be sufficiently informed of these things, by a complete series of experiments, give in this place an account of some which have been made against my consent. Eggs which began to be warmed on the 19th of *May*, were exposed for some hours on the 21st, to a heat of 40 degrees, and on the 22d, to a heat of 37: on the 23d, I broke one of these eggs wherein I saw the beginnings of the unfolding of the chicken: the heart already very distinct, never ceased beating for half a quarter of an hour together. The embryos which have been heated but two or three days only, may then resist a heat of 37 and of 40 degrees. In the night of the 23d, to the 24th of *August*, the heat of one of my ovens was raised to above forty degrees, and this killed every one of the chickens that had compleated their time, some of which had already begun to break the shell: those which were to be hatched two or three days after did not stand it better; but I saw a chicken hatched on the first of *September*, and on the second, I saw three others hatched, which had weathered that violent storm: Their eggs had begun to be warmed on the 13th of *August*; when but ten days old in the eggs, they had resisted a heat which had been fatal to those that were from seventeen to eighteen,

eighten, to twenty and twenty one days old; their hatching had even been premature, but the cause of that is not to be attributed to that forementioned excessive heat.

In the same month, eggs which had been put into another oven, seemed to prove that a heat stronger than that of $37\frac{1}{2}$ degrees, may be born for some hours by the embryos, from the first to the 16th day of heating. I saw on the 19th of *August*, seven chickens hatched out of eggs which had been set on the 8th of *August*, and which in the night of the 11th to the 12th, and in that of the 23d, to the 24th, were exposed to an air, in temper above $37\frac{1}{2}$ degrees; chickens were also hatched on the 30th, out of eggs which had been put in with the foregoing, on the 9th of *August*.

Another of my observations will serve to shew at once, that the chicken when very young in the egg, is able to resist a great heat and a no inconsiderable cooling. I broke an egg, because I was uneasy concerning the fate of the chickens of many other eggs which had been put into the oven on the same day. That egg had been warmed for six days together: the first two days, it was heated properly; during the two following days, the air of the oven never had above 30 degrees of heat, and during the whole fifth day the heat hardly exceeded the 25th degree. On the sixth, the same egg had a heat of 37 degrees during the night and a great part of the morning; and yet the chicken inclosed in that egg was alive.

I had been uneasy about a couple of eggs which were put the same day into a chicken-oven warmed by a baking one, as they had at several times been exposed for some hours together to a heat of 37 degrees and upwards, and, what was worse, on the very day before the chickens were to be hatched. They nevertheless were both of them hatched

in their proper time. Many other chickens were likewise hatched out of eggs kept in an oven warmed with dung, which I had hardly any hopes of ever seeing come to light. The several renewals of the heat of the oven had been too long deferred, because the provision of hot dung was exhausted: The heat had been weak, that is, not more than 30 or 31 degrees for five or six days together, and for three other days preceding that of their hatching, it was under 30, under 29, and even under 28 degrees. I have been inclined not to mention these facts, for fear the readers should think themselves too much authorized by them, to slacken their attention in keeping up in both kinds of chicken-ovens a heat of 32 degrees, which is the fittest of any.

Mr. *John Stevenson* says, in a Memoir written on the cause of animal heat, and inserted in the Medical essays and observations of the society of physicians at *Edinburgh*, that it has been observed, that towards the end of the incubation, a hen may leave her eggs in a cold season for a longer time than the chickens inclosed in the same eggs could bear without danger, if the heat depended intirely on the parent; that she may even leave them till they would be reduced to the temperature of the air about them, if they had no principle of heat within them; nevertheless, when one of the said eggs has been opened after this, the chicken has been found neither dead, nor so cold as the egg itself. This observation agrees very well with my remarks.

Altho' there is in reality a latitude of the degrees which have a successful influence over the eggs as to the warming of them, yet one must always aim at managing the oven so as that the temperature of its air may, if possible, never to vary from the 32d degree: it seldom happens that one hits this with a critical exactness, but we may always
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be pretty certain by endeavouring carefully to attain it. I have had ill success by having too much depended on experiments that I apprehended would shew that one was not obliged to keep in a servile manner the eggs of one's ovens to the degree of heat the sitting hen communicates to them. I had seen chickens hatched, which had been for several days of the incubation in an air of not less than 35 and 36 degrees of warmth. These days of extream heat were not indeed consecutive, they had been intermixed with others more temperate: They nevertheless induced me to imagine that I might be allowed to take 35 degrees for a term of heat, at which the eggs might remain during the whole time of the artificial incubation, without any dangerous consequence. This, at least, was an experiment which appeared to me very worthy to be made. I took care for twenty days together, to hinder the heat of an oven from varying much from 35 degrees, that so it might not descend lower than the 34th, or rise above the 36th degree. The chickens which I expected at the expiration of these twenty days, did not break their shells: not one of them was hatched. A day or two after the time at which they should have been hatched, I broke all the eggs of that brood one after another; each of them had a well conditioned chicken in it, in the state of those that break their shell for their deliverance: most of them indeed were dead, some however were still alive; there were even a few which I saw stir through a very small aperture I made in the shell. This aperture was immediately close stopt with a little bit of paper which I pasted over it, and which did the office of the bit of shell which had been taken off: In this manner I stopt six or seven eggs which had each of them a chicken in it which I was certain was alive. I put them into the oven again in hopes of seeing chickens

hatched out of them: but they had the fate of those of the other eggs, and died all of them in their shells.

An observation which I could not possibly overlook concerning the state of the inside of all the eggs I have just mentioned, has taught me, as far as I am able to judge, the reason why that heat which had brought the chickens to the size of those that were at their full time, had not been able to cause or rather had hindered their hatching. The space left empty at the biggest end of these eggs, was far more considerable than it is in those from which the chicken has strength to extricate itself: the chicken with all its membranes, did not fill half the cavity of some of the shells, and perhaps hardly one third part of that of others, whence it followed that the chicken was not surrounded with as much liquid matter as it stands in need of, nor with a matter so fluid as is necessary to facilitate the motions by means of which it gets the power of breaking its prison. The continuation of a strong heat had produced in those eggs a much greater evacuation than that which is occasioned in the eggs not exposed to more than a gentle heat; the quantity of the fluids surrounding the chicken had been diminished too much and rendered a great deal too thick; and the creature had lost too much of its own substance.

When the constant heat that has been kept up in the oven without reaching the 35th or 36th degree, has been stronger than that of the 32d, as for instance when it has been of 33 or of $33\frac{1}{2}$ degrees; far from doing any harm, it has, in that case, given me the pleasure of seeing the chickens hatched, one and even sometimes above two days sooner than I expected. A heat which has been under 32 degrees, and has been often only 31, or even less during a great part of the days of the incubation, has
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nevertheless brought the chickens to a happy issue, only sometimes they came one day later than they would have been hatched under the hen.

I have had chickens that did not come out of their shell till two days after the usual time, *viz.* on the twenty-third day; and what renders this singularity more remarkable, is, that I could not possibly attribute the retarding of their birth to any too great remission of the heat the eggs had been warmed with; I judged it on the contrary, to be the effect of a too intense but not a lasting heat. When the chicken which is to stay but two or three days more in the shell, receives what I shall call a flash of heat; that is, when the heat happens to surprise the manager of the oven, as when it suddenly rises to 38 or 40 degrees, and is not suffered to remain above three quarters of an hour or so in such excess, there happens probably to the chicken not yet hatched, what I have seen happen to others newly brought forth: out of many of these, which had been put into an oven excessively warm, I have seen some killed by the heat, others shewed me by their frequent gaping that they were in a state of suffering, they drooped and were weak to such a degree that some of them died two or three hours after, and some more; however, some of them got over it and resumed their vigour by degrees. The sudden excessive heat has the same variety of influence over the chickens in the shell: there are some that cannot bear it at all, and are killed by it immediately; others resist it but remain in a drooping condition, and must recover, as it were, of a fit of illness before they can resume the strength they stand in need of to break their shell; and are not capable of coming out of it till a day or two later than they otherwise would have done.

I have had an instance of the hatching a chicken still much more retarded, which probably but for me

would never have been hatched at all: I found it full of life in its shell, which I broke six days after the term at which it ought to have been hatched: The cause of this long delay ought not perhaps to have been solely attributed to a sudden flash of heat: since the moisture which had stuck to the shell during some part of the incubation, had possibly contributed to the same effect.

When the eggs have had nearly an equal heat of 32 degrees, during the whole time of the artificial incubation, it is common enough to see chickens hatched from them on the twentieth day, that is, a day sooner than they come out of eggs sat on by a hen in this country. The reason of this difference is no riddle: The eggs in the oven are not exposed to a daily cooling as are those under the hen: we must not only allow for the time the progress of these latter eggs is stopped, when the hen is in feeding, but we must also reckon the time spent in restoring her eggs at each period to the efficacious degree of heat, and the sum of all these individual times may be very moderately rated at one day: the chickens of the oven, by being hatched one day sooner, shew us that this valuation is just. It has been observed that oftentimes the chickens are also hatched under the hens one day sooner in summer-time than in the spring: when the weather is very warm, they are not so much cooled during the refreshments of the hen, as they are in cold seasons: besides it is then much easier for the sitting hen to keep the eggs at the circumference of the nest in a degree of heat near to that of those in the center, the eggs of the circumference being much less exposed to the impression of cold air at that time of year.

There are likewise among the chickens of one and the same brood, whether warmed under the hen or in the oven, some whose birth happens before the usual time, and others whose birth is retarded

tarded beyond the same term, frequently enough above a day. This fact is in every respect agreeable to what happens in the other productions of nature. As all the grains of the same kind of seed sowed at the same instant, do not spring out of the earth on the same day; or the stem of every one of them does not grow equally fast; There are in the same manner among the germs of birds, some that are better disposed for their unfolding and more vigorous than the rest, if they may be supposed to have any native vigour in them; and some happen to be provided with matters better conditioned and better prepared to nourish them, than others.

But the differences of both the thickness and the contexture of the shells of the several eggs laid by the very same hens, are most probably the principal reason why among those which have been continually exposed to the activity of the same heat, the chickens of some come sooner, and those of others later to the point of being hatched. No kind of unfolding of the germ can be operated in an egg, from the inside of which nothing can transpire, no alteration happens in that case: I gave a sufficient proof of this when I gave the method for preserving eggs perfectly fresh for whole years together. I mentioned at that time experiments that demonstrate that when the shell of an egg has been smear'd over with a varnish that stops all the pores of it exactly, it may be kept under a hen for thirty or forty days without becoming addle, and without the least unfolding of the embryo. *Cæteris paribus*, the thickest shells have not so many pores easily pervadable as those which are extremely thin; and among the shells that are of an equal thickness, some may be of an opener contexture than that of others; therefore the perspiration cannot be effected with equal facility in all the eggs of the same brood.

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I have the more particularly insisted upon shewing the inequality that may happen in the perspiration of different eggs; as it will give naturalists the explanation of many matters of fact to be mentioned in the following Memoir: I shall there shew, that the death of many chickens in their shell ought to be attributed to a perspiration excessively diminished: an over abundant perspiration may also be equally fatal to them. This I think to be evidently proved by one of the uses of the shell of the egg, which has not, for ought I know, been as yet taken notice of. Those who look upon the shell of an egg only as a box designed to contain the white, the yolk, and the embryo, or to hinder the egg from being crushed when a hen sits on it with her whole weight, do not know all the purposes it was intended for. It serves (which is no less important) to prevent a too quick and too abundant perspiration in the egg; it is no rarity to find hen eggs without a shell; they are called rear-eggs. Their fluids have no other covering to contain them but the thick membrane which the inside of the shell of the other eggs is lined with; and this cover yields to the finger in every part. Rear-eggs, or eggs without a shell, being put in an oven, would be in no danger of bursting there: however, you would in vain attempt to have a chicken hatched from an egg of this kind, the perspiration being therein produced with too much facility: the membrane which is the only cover of the egg, yields, wrinkles, and is irregularly rumpled in a short time in several places: the egg loses its form intirely and is reduced above two thirds or three quarters of its bulk in a very few days; it no longer contains any thing but matters that have been so far thickened as to become solid and hard. I knew beforehand what would become of eggs without shells, which I have kept in

an oven with better conditioned eggs; I had seen some of them grow quite shapeless, and shrink into a very small, rugged, unformed mass after I had left them for five or six days together upon the shelf of the chimney of my study. It would nevertheless perhaps not be impossible to cause the chicken of a rear-egg to be unfolded; but art in that case ought to give it an equivalent of what nature refused it, one should replace by some sort of plaistering or other the shell it is destitute of, making it one of plaister of paris, or of some porous mortar or cement: this experiment which would be barely curious, would not succeed perhaps till after having been tried over and over, and would not teach us any thing more than what we already know of the necessity of adequate perspiration.

I did not judge it altogether so needless, and thought it rather more easy and more curious to know within a trifle what the quantity of the perspiration which has been forced in the substances inclosed in the shell of the egg from the moment it began to be warmed, quite to the instant at which the chicken is ready to be hatched might be; and what the proportion of the weight of that matter which has been dissipated in the air, with the primitive and total weight of the yolk and the white is. The experiments that may teach us this, consist only in weighing eggs before they begin to be warmed, and a second time when the chicken is quite ready to appear. I have weighed at these times many eggs of a middling size; but it is observable that the diminution found in the total weight is only that which has been operated in the weight of the substances inclosed in the shell; for the latter being solid and hard, must supply no part, or hardly any part of the evaporation: the heat which the shell has been exposed to, cannot be suspected
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to have increased the degree of its natural ficcidity; it has never ceased to have its inward surface moistened by the fluids contained in its cavity, and it has been moistened in its thickness by the vapours to which it has never ceased to yield a passage. In order, therefore, to know exactly what the soft or fluid substances of the egg have lost, we must have their first weight; and this we shall have, by subtracting that of the shell from the total weight of the egg. However, I did not weigh separately the shell of every one of the eggs on which I made these observations: I did not think myself obliged to aim at a greater degree of precision than that which is necessary here: Besides, a shell could never have been weighed till after the chicken was hatched, and I never should have been able to weigh it intirely but by using a world of precautions to prevent the loss of the small fragments the chicken flings off with its bill whilst it is struggling to break through its prison. What I judged to be most commodious and sufficiently exact with regard to this point, was, to content myself with making use of what other experiments had taught me of the proportion which the weight of the shell most commonly has to the total weight of the egg, which I found to be about a ninth. Although there are shells of eggs some visibly thinner than others, we may very well fix upon this ratio, without apprehension of any palpable mistake in the use we intend to make of it: for the loss made during the time of the artificial incubation ought never to be estimated from eggs whose shells should be evidently and sensibly thinner than usual: I am going to give a few instances, how far this loss was carried during that time in different eggs, which will help us to an estimation sufficiently exact of the degrees to which it generally goes to.

Having

Having weighed an egg which I intended to put into the oven, I found its weight to be 2 ounces and 22 grains, or 1174 grains, out of which subtracting its ninth part, or very little less, that is, 130 grains instead of $130\frac{4}{9}$, I had for the weight of its white and yolk nearly 1044 grains. The same egg was weighed the instant the chicken was ready to be hatched, after it had pecked a small aperture in the shell: its total weight was at that time no more than 990, out of which having again subtracted the weight of the shell, or 130 grains, I had for that of the two substances contained in the shell 860 grains: this last weight being subtracted out of the first, that is, out of 1044 grains, there remains 184 grains for the weight of what had been lost of the substances within the egg by insensible perspiration: this weight is $\frac{1}{5}$ and $\frac{3}{4}\frac{1}{6}$ of that of the whole fluid or soft substance of the egg before it began to be warmed: they, then loose in the time of the operation between a fifth and a sixth of their weight.

Every one must judge that the quantity of matter of which the substances contained in the shell are diminished by the perspiration, is not always critically equal in all the eggs, of which the chickens are hatched to that which was here found; but one may venture to conclude on the other hand, that, for the generality, it is not very different from it. Three other instances I am going to mention, seem to be sufficient in conjunction with the foregoing to prove, that the limits of this loss lye between one sixth and one fifth of the first weight, or within very near that.

An egg the first weight of which was 1140 grains, weighed but 990 when the chicken was ready to come from it; therefore the diminution of the weight by perspiration was 150 grains, whence it is easy to find by a like calculation, that the substances

stances contained in the shell have lost a small matter above one sixth part of their first weight, and not quite a fifth part of it.

The substances inclosed in the shell of another egg lost by the perspiration one fifth, and a small matter more of their first weight: the first total weight of that egg was 1155 grains, of which it lost 207 grains during the time of heating: this loss is a trifle more than one fifth of the first total weight of the soft substances of the egg, which was 1027 grains, because it must have been equal to the remainder of the weight 1155 grains, less a ninth part.

In a third egg, the first total weight whereof was 1002 grains, the diminution caused by the insensible perspiration from the first moment of the warming of the egg, quite to the instant in which it began to be broken by the chicken, was found to be 144 grains; whence it is easily calculated, that the soft substances had lost something less than one sixth part of their first weight.

After having suffered a diminution of about one fifth or sixth part of their first weight, it is then that the substances which composed the white and the yolk of the egg, appear before our eyes under the form of bones, of flesh, of vessels, of blood, of feathers, of horn, that, in short, they are for our use a chicken. We must however, again allow for another diminution, not made by perspiration: one part of the white which has not been dissipated like the rest, and is grown thick instead of becoming fluid, generally remains in the shell at the coming out of the chicken: the chicken indeed carries it sometimes away with him, because it sticks about him; but the weight of that portion of the white is never more than a few grains.

It were to be wished, that our observations on the gradual diminutions of the weight of the egg during the process, had been carried farther than they have been: Naturalists will not think it a matter of indifference to know that a portion of the sum total of the matter which has been carried off by insensible perspiration during the whole time of the incubation, went daily out of the egg through its shell; to know the progress of the insensible perspiration, to know whether it increases or diminishes every day, to know if, when the egg only begins to be warmed, it perspires more or less than when the chicken is ready to appear, and more or less than in the intermediate times. Several obstacles not necessary to be mentioned here, have prevented my making in all these points the results which I expected from the trials I had begun; I shall resume them perhaps another time; I was invited to make them at first on a surmise that they would supply me with a method of finding out by a pair of scales with what success eggs were warmed, by comparing the several diminutions of weight produced in some of those of the same brood during a number of successive days: However, when I reflected that the perspiration might be retarded by the very operation by which the quantity of it was inquired into, I did not judge it worthy of any farther notice. By taking the egg out of the oven to weigh it, you will cool it, unless you take towards the preserving of its heat precautions which are not absolutely simple; besides, the cooling may be hurtful and even fatal to the chicken on some occasions.

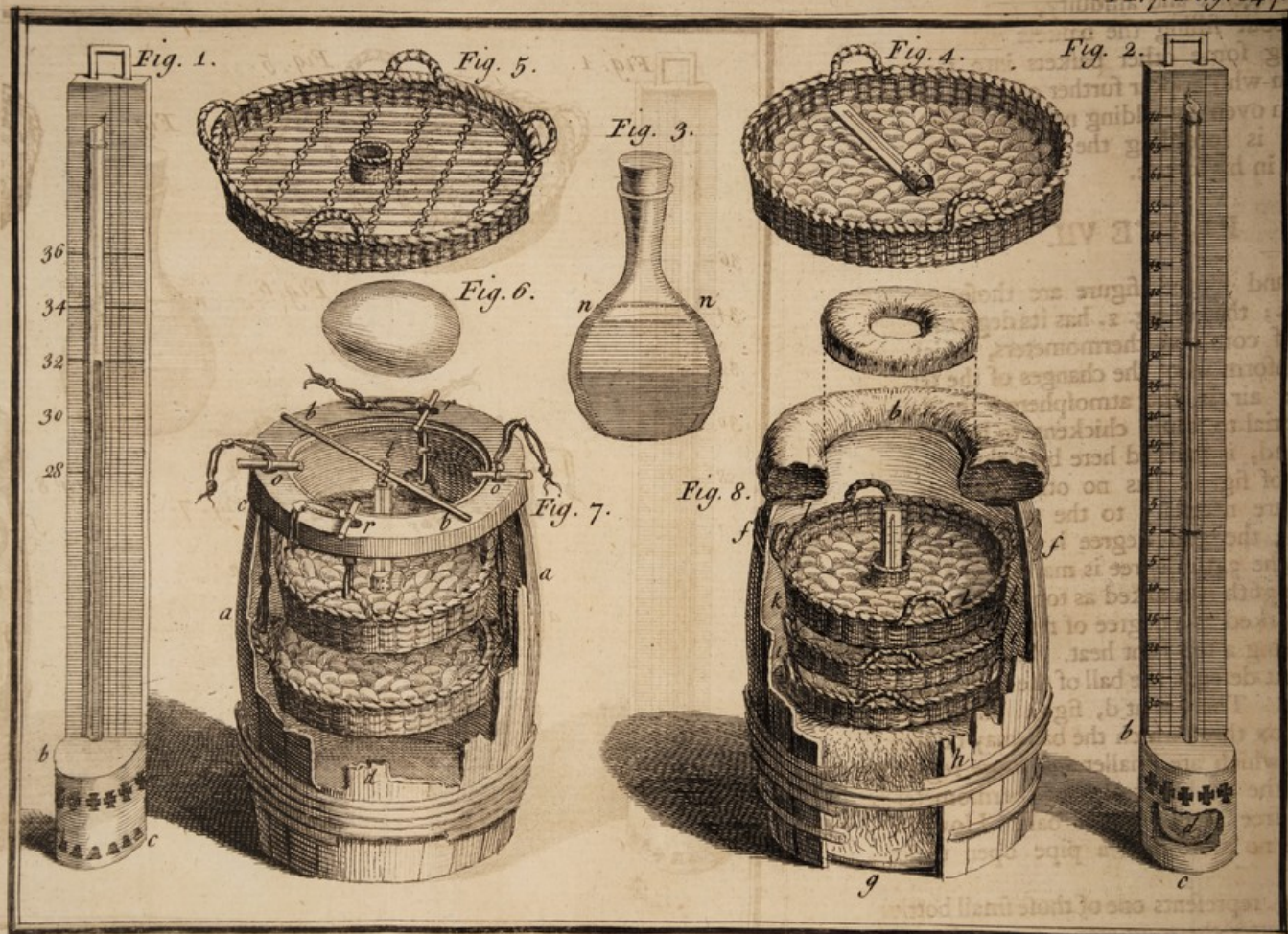
But, it will be enough for those who cause chickens to be hatched meerly because it is well to have them, to have informed themselves in this Memoir of the shape of the baskets, of the manner of placing them in the oven, of the filling them with eggs, and of placing within them thermometers

which are to be consulted several times a day, in order to know the degree of the heat which is actually in the oven; to have seen how these thermometers ought to be constructed, and how they may be certain that they have been well regulated; to have convinced themselves that they ought as much as possible to keep the heat of the oven to 32 degrees; that they would commit a great mistake by giving constantly to the oven a heat two or three degrees superior to that; that great inconveniences may result from too much rather than from too little heat; that, however, a heat of 38 and even 40 degrees would not be fatal to chickens as yet remote from the time of their hatching; that the duration of too faint a heat is less dangerous; that when one is obliged to keep almost all the registers shut up in order to preserve a heat of 32 degrees, it is time to renew the heat of the oven by the bare addition of a few wisps of hot dung; but that the inspector of the oven must redouble his vigilance after this last operation, and pay more frequent visits to it, the to avoid being surpris'd un-awares by a too sudden and too considerable an increase of the heat: We have seen, in short, in this Memoir, that by means of cautions that will take up no greater time, eggs may be warmed with as much success in a chicken-oven made with dung, as they would be under a hen.

An Explanation of the figures of the fourth Memoir.

The Head-piece.

The head-piece of this Memoir represents part of the barn of the society of *l'Enfant Jesus*, in which several chicken-ovens have been constructed, which have had all the success that could possibly be



J. Mynde sc.

be wished, during the year 1748. Some of the sisters of that society who have managed the ovens with equal diligence and assiduity, are represented here busy about filling the baskets with eggs, or about putting some other baskets into the casks. The two men who appear further off, are renewing the heat of an oven by adding new hot dung to it; one of them is spreading the dung the other has brought him in his scuttle.

PLATE VII.

The first and second figure are those of two thermometers; that of fig. 2. has its degrees marked as those of common thermometers, which are designed to inform us of the changes of the temperature of the air in the atmosphere; the degree which is essential to cause chickens to be hatched, that is, the 32d, is marked here by a thread. The thermometer of fig. 1. has no other degrees but those which are necessary to the manager of the chicken-oven; the 32d degree is that of the heat of the hen; the 34th degree is marked as a strong heat, and the 36th is marked as too strong a heat; the 30th is marked as a degree of remiss heat, and the 28th as being a too faint heat. b. c. point out the tin-box that defends the ball of the thermometer from breaking. There is at d, fig. 2. an aperture made in that box thro' which the ball may be seen: The apertures which are smaller and more regularly disposed on the tin-boxes of both thermometers, afford the air free access to the ball. However, the box b. c. is no more than a pipe open underneath.

The third fig. represents one of those small bottles fit to make a butter thermometer. n n, a line up to which the bottle is filled with butter.

The fourth fig. represents a two-handled basket full of eggs. A thermometer *t* lyes reclined on the eggs.

The fifth fig. exhibits a basket with four handles; this has no eggs in it. There is at *e* a kind of wicker-pipe that rises above the bottom of the basket, and serves as a very high ledge to the hole which is at the center of that basket: This hole is designed to let the thermometer pass through it in and out of the oven.

The sixth fig. is that of the egg of a hen, on which is written about its smallest end, the day of the week and month it was put into the oven.

The seventh fig. exhibits one of the manners in which two two-handled baskets may be put one over the other and supported by strings. The fore-part of the cask has been taken off at *a d a*, that the disposal of the baskets in the oven might be exposed to view. *p p*, the inferior basket supported by the strings *p o*, *p o*, which the small sticks *o o*, keep from descending lower. *q q*. The upper-basket, hanging by the strings *q r*. *q r*. The stick *b b*, serves likewise to suspend a thermometer *t*, which comes down as far as the basket *p p*. The string on which the thermometer *t* hangs, ought to be longer; but if it had been made so, the upper-part of the thermometer, which is the only one seen here, would not have been visible.

The eighth fig. represents another chicken-oven, the fore-part whereof *f h g f* has been taken away to shew how three baskets full of eggs are disposed one over the other within it. There is at *h* and above it some straw by which the inferior basket *i i* is supported. That basket and the two others have each of them four handles. *k k*, the middle-basket which rests on the four handles of the basket *i i*. *l l*, the upper-basket which is supported by the four handles of the basket *k k*. There appears

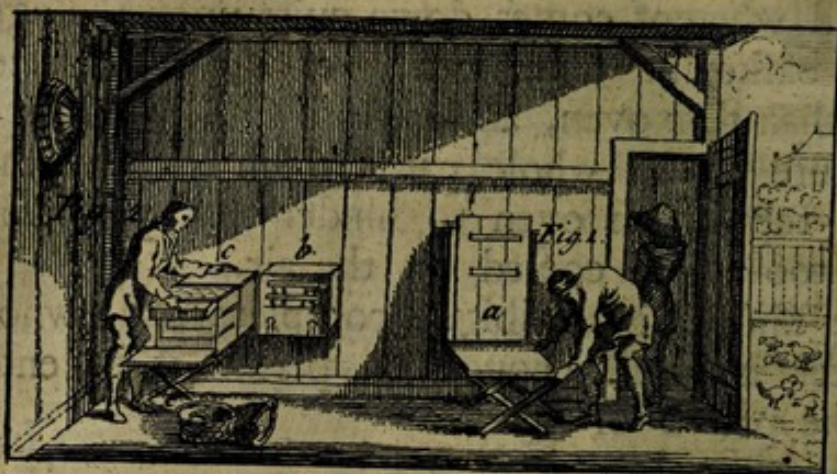
at t the upper-part of a thermometer the box of the ball whereof comes down quite upon the eggs of the basket ii. The half b of a pad is placed lower than that oven, and gives a sufficient idea of the figure of the whole pad, which is sometimes put at top of an oven to hinder that part from being too much cooled by the air.

The ninth fig. exhibits a compleat pad, whose diameter is small enough to permit it to enter into the pad b of fig. 8.



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MEMOIR



M E M O I R V.

Of the effects produced by imperceptible vapours, which are fatal to the chickens inclosed in the shell: Of the remedies which prevent them, and of the construction of an oven altogether inaccessible to the vapours of the dung.



LL that remained to be found out towards causing eggs to be as successfully warmed in hot-beds as they are under the hens, seemed to have been discovered at last, after it had been proved that there were infallible means to keep them in a proper heat, and that when they had been put in an oven from the sides of which a great quantity of vapours did not continually proceed, as from the first ovens whose sides were entirely made of dung, the chickens were hatched from fruitful eggs on the twentieth or the twenty-first day. The success of the artificial incubations made in my first ovens lined with plaister, had left me no room to think that any thing more could be desired, or that I could want any further instructions to continue to cause other broods of chickens

chickens to be hatched with equal success as the first: These had been warmed in very happy circumstances, as I may say; the ovens had been heated by a kind of dung that was not very moist, and in a time of year also that was very fit to dry it. I was not then informed how important these circumstances were, till I began again to cause eggs to be warmed after the vacation, about the end of *November*. These last experiments shewed me what I yet wanted to be sufficiently informed of; viz. that the eggs might very possibly be surrounded with a hurtful vapour, altho' the sides of the oven could not possibly produce it: and that whenever the air of the place where the oven stood was full of that vapour, the registers of the oven, some of which it was impossible not to keep open, left it too easy a passage into the cavity of the cask. I was at first ignorant, but this experiment acquainted me at last, that there might be in the ovens degrees of moisture which, though not perceptible to the eye of the managers, were nevertheless fatal to the chickens, made them die in their shells, some very soon, and a yet greater number when they were just upon the point of being hatched.

I cannot better acquaint the reader with these dangerous circumstances, which must be avoided with the utmost care, than by giving an account of the experiments in which they have been fatal to the chickens which I had tried to hatch with success. About the end of *November*, I broke up my old hot-bed, which was then grown too cool after it had lasted above ten months. I had another made in the same place; and four casks were buried in it, because I wanted to have spare ovens to shift into. This new hot-bed was made with very wet dung: the place where it was laid was low, it was a stable for horses; a tall man at top of the hot-bed would have reached the cieling with his head; there was

but one small window in the place, and this was situated on the same side with the door, so that the room was soon filled with a very sensible vapour, which was very thick at some times. The ovens which had acquired in a few days a heat above 32 degrees, did nevertheless not appear to me fit to receive any eggs: I knew at least enough of the matter, not to introduce any into them, so long as there should remain a sensible moisture there. I found that the whole underside of their covers was wet, and that to such a degree that the water dropt from them now and then; it gathered under the cover the more easily as it was lined with plates of tin, and consequently with a matter it could not penetrate as it would have done thro' wood. However the under part of the covers appeared less and less wet every day, it was only dampish after that, and in time it seemed to be perfectly dry every where, in some of the ovens sooner, and in others later: there past however a whole fortnight before the top of some appeared thoroughly dry.

As soon as I had one of my ovens dry enough to let no remains of moisture be perceived, I thought I might trust it with some eggs: I introduced some into it constantly every day, that is, those which my hens had laid the day before, which were not very numerous, the season being not then over-favourable for laying: so that a new brood was begun every day which was often very small, being but a couple of eggs on some days, and even of one single egg on others. Before I come to give an account of the manner in which these broods succeeded, I must mention here all the precautions I had taken to make myself able to compare their respective products; because it will be proper that the same should be taken by all such as shall make it their business, or amusement, to warm eggs and hatch chickens from them, and that shall have a
mind

mind to know with exactness the number of chickens, their industry may have procured them; to the end that whenever they find it does not answer their well grounded expectation, they may try to find out what the cause of their disappointment may have been. I never failed to write upon the small end of each egg the day of both the week and the month it was ready for warming. I have mentioned heretofore the several conveniences resulting from these marks; but I must here add that I kept an exact journal of them ruled with three columns, the first contained the days of each week, the other two the days of the month, and the number of the eggs put into the oven on each of those days: in the second, where nothing was to be written till about twenty or one and twenty days after the first day of the first column, the number of the chickens proceeding from each brood was recorded; I wrote there the chickens that were hatched, and the day, over against the day on which the eggs began to be warmed; and I marked in the third column and over-against the same day, the number of the eggs of that brood which had proved addle or unfruitful. A fourth column would have been needless for the number of the chickens which had died in the other eggs, that number being easily found out by adding the addle-eggs to those which had yielded chickens, and by subtracting their sum from that of the eggs of the whole brood.

A glance of the eye on the first column of this register, taught me every day the number of the chickens that might be expected, and the second shewed which brood had better and which had worse answered what ought be expected from it. I shall not exhibit here at length this journal, which could never be so instructive to others as it was to me: they would meet with many odd circumstances

cumstances there, without finding the particulars which had occasioned them: It will be enough to give the results that have taught me, there are degrees not only of sensible, but also of insensible moisture as to our eyes, and that there are vapours exhaling from dung which we have not the least perception of, although they are much to be dreaded, on account of the chickens inclosed in the eggs. It is these results that first put me upon seeking after means to hinder vapours from hanging round the eggs in the quantity that might prove hurtful to them.

I had all the reason in the world to be satisfied with the manner in which the heat was regulated during the twenty or twenty one days, which were to bring the chickens of the first brood to the time of their being hatched; nor was it any worse regulated as to the incubation of the following days. The first brood was much more considerable than those which came after, it consisted of above sixty eggs which had been collected beforehand; this is not mentioned on my journal which I had not as yet begun: But notwithstanding all I had hoped from it, on account of my having always found the eggs in the proper degree of warmth, and to appearance perfectly dry, I had nevertheless but three or four chickens from the whole number. I attributed this bad success to some remainder of moisture in the plaister of the oven, which I had not taken notice of; I had better hopes of the following broods, as the oven must have grown every day more and more dry. In short, the dampness of the air itself of the place where the ovens stood, which I had begun to dread, had been diminished by the care I had taken to keep both the door and window open: then indeed the product of chickens began to come nearer to the number of the eggs; one day it proved a quarter,

ter, another day it proved a third, and another day one half of them.

The broods, after having appeared to succeed better and better for four days together, and when I had reasons to hope to see daily a number of chickens more proportionable to that of the eggs; ceased all of a sudden to afford me any: not one chicken came out of its shell for twelve days together. I had myself occasioned this new disorder, and that at a time when every thing began to mend: I took it into my head to have an operation made, without reflecting how dangerous it might be to the ovens: this was to construct one of a much greater capacity than any I had hitherto made use of, that is, with a sugar-cask. The large hole we were obliged to make in the hot-bed to bury such a cask in, and the quantity of new dung I thought necessary to surround it with in order to warm it, filled the place with a much greater quantity of vapours than there had been in it hitherto: the plaister of the wall and that which was between the joists of the cieling imbibed so much water after this, that what was scraped off those places might be kneaded like dough; the walls and cieling charged with this prodigious quantity of water, contributed therefore with the hot-bed made of dung that was too moist, to fill the air with dampness. How should this fail to have crept into the ovens, since the air must needs convey it into them? I saw sometimes large portions of the under part of the covers stand full of drops of water, and the very eggs themselves were now and then sensibly moist: in vain did I convey them from the oven where the dampness was so visible into another where it did not shew itself, which commonly was one next the door; in that very oven where the eggs seemed to be dry, they could not fail being influenced by a vapour so universally diffused

diffused all over the place. For a month and a half, that is, during the last days of *December*, the whole month of *January* and part of *February*, two or three days often passed without one single chicken being hatched: out of five or six eggs and sometimes out of eight or ten, there came but one chicken. One brood of seventy five eggs (all of them fruitful) which I had not from my own hens, afforded me in all but ten chickens. Whenever I broke the eggs which had been warmed during more days than was necessary to cause the chickens to be hatched, I found a dead one in each egg: the chickens of some of them had perished in the first days of the incubation, those of others had died later, and the majority of them had lived till they had been quite ready to come forth.

I was exposed here to a number of events, almost as disagreeable as those of my first trials; with this only difference, that the cause of the evil was now sufficiently known to me, and I was no less acquainted with the remedies which ought to have been applied to it: but it was at that time utterly impossible for me to have recourse to those so very necessary means. The business was to renew incessantly the air of the place where the hot-bed was, and never to permit any air introduced into it, to remain there, not even for a small time. The disposition of the place did not allow me to open any new windows, nor to contrive any very large apertures in the cieling: All I could do was to open a few vents that were in one of the walls, small enough to draw the air from a passage that parted the stable where the ovens stood from another: These apertures being but very small, did not however increase the circulation of the air sufficiently; so that I lost all hopes of causing eggs to be warmed with any tolerable success in these ovens; and I judged that, if I had a mind to stay till summer for the

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hatching

hatching of chickens, I must needs remove the ovens then to a more airy place, and there surround them with dung of not so damp a nature.

But why, some will ask, does the moisture, which did not hinder the germ from unfolding itself and from growing, and which had not hindered the chicken from being formed, yet make it die afterwards, sometimes sooner and sometimes later? and why is it more commonly fatal to it, when it has almost attained to his full growth, than at any other time? Can a mere watery dampness be capable of producing such dismal effects? Does not the moisture which kills the chicken, poison it with the sulphurs and volatile salts it is impregnated with, and which have exhaled from the dung? Why, in short, are there chickens that resist this vapour, and are hatched at last whilst a much greater number of them are destroyed in their shells, although the eggs of them all have been warmed in the same basket, and one as much like the other as possible?

The principle which we have made use of to assign the reason why among the eggs warmed by the same degree of heat, there are some whose chickens are hatched sooner, and some from which they come out later, is also the principle that will answer these new questions: the principle is, that when the pores of an egg are intirely stopped, no alteration can be made in its cavity: let it grow ever so old, it remains as fresh as a new laid egg, when it has been done over with varnish immediately after it was laid: in short, let it be fat on ever so long, its germ can never be unfolded: this is an experiment I have made many years ago, by keeping eggs varnished over under hens, and which I have repeated of late by putting eggs so coated over into chicken ovens. As soon as you are informed that the chicken cannot unfold itself in the egg when the perspiration
which

which ought to proceed through the shell is thus intirely obstructed, you will soon conclude from it that all which would have passed within the cavity of the egg if the perspiration had been perfectly free, will not take place if that perspiration is any way diminished ; that it may be so to such a degree that the germ will not unfold itself but with the greatest difficulty, and perish very soon after ; that a perspiration not altogether so much diminished, may possibly permit the chicken to grow, but that so faintly as it were, that its weakness will make it die in a very few days ; that, in short, if the perspiration is freer, though not quite so abundant as it ought to be, the chicken will live a greater number of days in the shell, and perhaps arrive at its full growth, but it will still be destitute of that vigour which is necessary to enable it to break the walls of its prison : after many fruitless efforts on its own part, it will die at last without ever seeing the light.

Doubtless the diminution of the perspiration is proportioned to the difficulty which the particles driven towards the shell of the egg by the heat, find in making their escape ; the water that sticks to the shell and fills the pores of it, does not oppose an invincible obstacle to the venting of these particles, but it retards, and if it does not intirely obstruct the perspiration, it at least diminishes it. The people who sell new laid eggs all of them know, more indeed than it were to be wished, that the eggs which are kept in water are preserved there for a few days with the appearance of new laid ones ; that by this means the empty space which had been made in them if they had been kept in the open air, is avoided, and that they will boil milky.

In order to make myself sure by a more decisive experiment, that water alone is capable of hindering eggs from being fat on with success ; about the middle of *July*, I put six in a pot of water
which

which I had made luke-warm, the pot was put into an oven, which soon caused the water, and consequently the eggs, to assume the heat of 32 degrees, which they were carefully kept in. Several successive broods had succeeded very well in this very oven, and had I put into it a basket full of eggs at the same time, the chickens would infallibly have been hatched. Three days after I broke one of the eggs which I had just taken out of the water; but I could not perceive in it the least appearance of a germ that had unfolded itself: I waited a longer time to examine what would have been done in the others: on the ninth day I was invited to break a couple of them; as they were then become lighter than the water and swam at the surface of it; one of the two yielded an insupportably foetid smell, it was rotten: the other had its yolk still in a ball, but its white was become as limpid as water; I found in these no vestiges of a germ that had perished after having been unfolded, nor even of any unfolding at all. On the tenth day, I broke a fourth egg, one of the three which had remained at the bottom of the pot; its yolk was in a ball, and the white was become very fluid, nor had the germ made any greater progress in this than in the others. In short I waited till the seventeenth day before I broke the other two eggs, which had not stirred from the bottom of the pot; one of them was a rotten egg, which, when broken, yielded a most offensive smell; the other had its yolk in a ball and the white quite melted, and its smell, though not quite so strong that of the other, was nevertheless very disagreeable.

We shall then in vain attempt to bring chickens within the time they are to be hatched in, by keeping the eggs in the purest water, that shall have constantly the most favourable degree of heat for the unfolding and the growing of the germ, if this
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should happen to unfold itself, it woul perish in a very short time: most probably it had unfolded itself in the two eggs of the foregoing experiment, which were decay'd, and it was destroyed soon after. A great many experiments which I shall mention hereafter, have shewed me, that when eggs have no germ within them, they are not subject to be addled: these experiments seem to shew very clearly that the chief principle of corruption is in the germ, which perishes after it hath begun to increase: and if the four eggs above mentioned, the yolk of which was not dissolved, had a germ within them, 'tis probable this had perished before it had unfolded itself in a sensible manner.

A perspiration rendered much less difficult than it is in an egg surrounded with water on all parts, a perspiration, in short, that would be sufficient to let the chicken grow, may nevertheless be fatal to it by the nature of the cause of it; I mean that a chicken might be hatched from an egg that should perspire a little less than another, merely because a few of its pores were obstructed by varnish, whilst another chicken could not arrive at that point from another egg that should have but just the very same quantity of pores obstructed, with this only difference, that they were stopt with water. There is one observation that will cast a greater light upon this last proposition, and give us the compleat theory of what may be fatal to the chicken in the egg; *viz.* that if the egg perspires, it breathes and takes in air of course. We have the measure of the quantity of the matter that has perspired from the different substances of the egg, in the vacuum which is found at its biggest end, and which increases from day to day. This vacuum, already mentioned in another place, which is between the membrane that covers the inside of the shell, and the membrane which followed the substances

stances of the egg to prevent any space therein that might not be filled with the said substances ; this space, I say, which is certainly not an absolute vacuum, is also the measure of the quantity of the matter perspired.

Whilst matters of the utmost subtilty pass out through the pores of the whole shell, there comes air also into it through those of its biggest end. This may be thought to supply the chief part of the matter taken in ; it is air which must needs pervade the shell ; it is to air that the shell must leave a passage open ; but air is not the only thing which its pores are capable of admitting through them : the experiments made with the air-pump have taught us long since, that the very fluids of the egg many transude through its shell. The same matter of fact has been demonstrated to us without the assistance of the air-pump, by those eggs of our first trials, through the shells of which a most foetid liquor did transude. Some other observations have shewn me, that particles of matter which must needs be incomparably grosser than those of the air, may penetrate into the cavity of eggs ; I have found a mouldiness in eggs which I had broken long after the time the chicken ought to have been hatched in ; nor could I perceive any cracks in those eggs ; naturalists have ennobled mouldinesses, and raised them to the rank of plants : many have shewn, and Micheli among the rest, that they come from seeds ; therefore, the seeds of those minute plants had pervaded the shell of the above-mentioned eggs, and the membrane with which the cavity of them was covered.

The united force of so many experiments was not necessary to prove, that the air enters the egg through its biggest end, and that it may at entering into it be charged with matters capable of causing in the substances of it alterations that may

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prove

prove hurtful to the chicken. Alterations very sensible to the taste may be produced in those substances by mere aqueous vapours: the abovementioned eggs which are kept in water to be preserved in the state of new-laid-eggs, cannot deceive by this appearance those that have a nice palate in eggs; I and a great many other people, can distinguish an egg which is really new laid from one which has been kept four and twenty hours in water; this last has an unpleasant taste to a connoisseur. The air charged with vapours proceeding from a hot-bed, may be charged with particles still much more capable of causing fatal alterations in the egg, than an air which is charged only with pure water; 'tis probable from this, that the membrane which contains the substances of the egg, is not impenetrable by these vapours of the dung.

It is for these reasons doubtless, that foetid smells kill the chickens in their shells, and cause them to corrupt there; and when an ill smelling egg happens to be among a brood, as it sometimes is, one cannot take it away too soon; it becomes contagious to the rest. Having left a rotten-egg under a common hen for four and twenty hours, and another under a turkey-hen, I saw all the eggs of these two broods fall off and turn one after another: I found one or two rotten every day: and although the straw of each nest had been put fresh, in order to leave no vestiges of the bad smell, all the eggs continued to rot to the very last; the deadly impression having been already made within them. One of the great motives of the visits which the Bermeans pay to their *Mamals*, is the necessity of removing all the rotten eggs.

Under the hens, as well as in our ill-situated ovens, the chickens do not die sometimes in the eggs till they are ready to be hatched; in which case the egg is free from all ill smell. Country people are not at a loss how

how to account for their premature death, when it has thundered ; they dread that kind of weather for the broods under their hens ; those in the time of *Pliny* had the same apprehensions, and he has taught them a preservative against the ill-effects of thunder, of which still a good opinion is maintained in our villages, *viz.* a piece of iron put in the nest. If thunder occasion the death of the chickens in the eggs, I cannot think it does it in a special manner by the sulphureous vapour it spreads in the air. Birds are susceptible of fear : may not the frightened hen perhaps perspire too much ; and may not the matter of too abundant a perspiration joined to a warm air already charged with moist vapours, be mortal perhaps to the chickens, the shells of which it can penetrate ? But, before we look for an explanation of this fact, we ought, notwithstanding its having been given for truth a great while ago, previously to begin by ascertaining it. My ovens have taught me at least, that iron is not at all a preservative against vapours either barely moist or impregnated with the many other matters which exhale from dung. I have hit upon it by mere chance, having lined the inward surface of the major part of the covers of my ovens with iron. *Pliny* was not contented with giving one single receipt for the preserving of eggs against thunder ; he gave two at once, the second of which has not had the same success as the first : it is absolutely unknown to our country people, and consists of a clod of earth taken off a plough. *Si incubatu tonuerit*, says he, Lib. 10. cap. 54, *ova pereunt, &c. remedium contra tonitrum clavus ferreus sub stramine ovorum positus, aut terra ex aratro.*

We mentioned it but slightly before, but it is to be observed here, that among the eggs wherein the chicken is dead, some of them spread the most intolerable smell, even before they are, or at least

when they are broken, and the others have no ill smell even after they have been broken. In my first trials made in ovens warmed with dung, all the eggs rotted, and were horridly infectious: Of the six eggs kept and warmed in water, there were but two that grew rotten and stinking: which shews that a merely aqueous moisture does not cause the substances of the egg to rot, unless it is excessive, and that even these substances are often preserved, notwithstanding the most abundant moisture: but a more inconsiderable humidity charged with those particles of dung which are capable of affecting our smell very strongly, produces a corruption in the eggs, which occasions the dissolution of the chicken, and reduces it to a perfect putridity. However we must conclude, that when the air which enters our ovens made of casks lined with plaister, carries too much moisture into the cask along with it, it conveys thither none or very few of those volatile particles of dung which are so apt to corrupt the eggs; for among a very great number of eggs wherein the chicken in these ovens has perished, I very seldom met with any that happened to have an offensive smell.

There is even something still more singular, *viz.* that a chicken, especially when it has died in his shell a very few days before it might have been hatched, is preserved there without contracting any corruption. I have left in the oven, out of negligence at first, and afterwards on purpose, some of those eggs which had a dead chicken in them, seven or eight, and sometimes above fifteen days beyond the term when they ought to have been taken out. The chicken inclosed in his shell had no manner of ill-smell, nor any tokens of corruption: a large full grown chicken with or without feathers, that should have been put in the same oven, the first

four and twenty hours after it had been killed, would have come foetid out of it. Why then is the dead chicken preserved in the egg without decay in a degree of heat so apt to bring on corruption? One may easily conceive that when the chicken has lost its life, there is in the egg a circulation of air nothing so considerable as that which was there before; but something more must be conceived; it would not even be enough to imagine, as I at first did, that obstructions multiplied in the pores of the shell take away almost all manner of communication of the external air with the air within, and that the latter is in a degree of compression capable of hindering all fermentation. We are obliged to quit that notion when we consider that the more days pass without taking the chicken out of his shell, the less room he takes within it; there has then perspired, notwithstanding his death, a matter which the pores of the shell have suffered to escape through them. Therefore, being not satisfied with my first explanation of the phænomenon, I suspected another cause of the preservation of the chicken, which it is owing to in reality. The chicken dead in the egg, happens to be embalmed there in a manner much superior to those which have been used hitherto, not even excepting the methods used by the *Egyptians*, to hinder the bodies of animals and those of men from being destroyed by putrefaction: The chicken the moment he loses his life, is covered on all parts with a kind of balsam, which has indeed no aromatick smell, but which is nevertheless fitter to preserve it from corruption than the most odoriferous balsams, and the most fragrant perfumes; the balsam spoken of, is the white of the egg with which the whole chicken is smeared over: thick that white which was become fluid, is now grown again, and coagulates more and more every day

upon the body of the dead chicken: it suffers itself to be penetrated a while by both the aqueous and the volatile particles which are inclined to escape out of the flesh of the chicken; but it stops all the avenues to the external air that should be necessary to bring on the fermentation; so that the flesh and the varnish it is done over with, are gradually dried up, the chicken loses part of its bulk and substance without rotting; and at length arrives at a state in which it is evidently unalterable for ever.

The explication I have just given, was no longer to me a bare probability, after I had made the experiments that seemed the fittest to demonstrate the truth of it. I have broken off one half or thereabouts of the shell in which chickens had perished just as they were going to be hatched. If it had been impossible for them to be preserved from corruption any other ways, than by the opposition of the shell to an introduction of the external air sufficiently free, being put again half naked into the oven as they were immediately after the breaking away of almost half the shell, they would have been corrupted very soon there, whereas they were preserved in it sound and whole, without contracting the least ill smell: the fluid with which they were moistened, and which was sometimes considerably liquid, grew thick by degrees, and was afterwards perfectly dried up; the chicken was covered over with a kind of varnish, that sheltered all its parts from any sensible alterations occasioned by fermentation. However, the heat of the oven is not at all necessary to render the white of the egg a fit preservative from corruption: I have assured myself of this by keeping in my study several of the said chickens, having broken off a considerable part of their shell; they dried up there without contracting any ill smell, and they are ready to be shewn

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to such as are fond of seeing what the disposition of the outward parts of the chicken is, whilst it remains in the egg.

I shall not make any apologies for the digression into which this fact and my inquiries into the cause of it have thrown me; the knowledge of this cause may be many ways useful to us: it informs us that we may make use of the white of eggs with more success in preserving the tenderest kinds of flesh, and other bodies inclinable to corruption than of the best of balsams, and the varnishes most esteemed for their hardness. Though none of them will adhere to bodies that are wet, or they do it at least with great difficulty; and have, before they come to be dry, a corrosive quality which the white of eggs have not. I shall defer to another time enlarging on the several uses I have applied it to, but I am very glad of this opportunity to inform my readers, especially those who love to make experiments of a useful kind, that they may use it to secure the duration of several organised bodies which it is of consequence to keep from corruption, and which they are very soon apt to fall into.

However, the smell of dung which never fails to become sensible where there is a bed of it, is never dangerous to eggs, but when the air that conveys it is charged with a certain quantity of moisture: a hen happened once to chuse a nest so as to inform me of this particular. She laid her eggs upon some straw which was at the end of the manger, nearest to the window of the stable where my first chicken-ovens were, and that at a time when I had reason to be pleased at the success of the broods: she shewed an inclination to set, which I took great care not to oppose; not taking any eggs from her, I added a few to those she had already; and there were as many chickens hatched out of them,

as there comes generally from successful incubations.

I had a mind to make a second experiment to see whether eggs exposed to the smell of dung, stronger than what had acted upon the eggs of the foregoing brood, would not be a detriment. I relied upon the good will of the hen just mentioned, I took from her her chickens as they were ready to be hatched; before she had had time to know and take an affection for them, I gave her in the room of them six new eggs to sit on; but before I made this exchange, I prepared every thing so that they might be surrounded with a vapour or smell of dung much stronger than that which had acted upon the others. I put in the same manger a common basket in the form of a truncated cone, such as gardeners usually gather herbs in: it was fifteen or sixteen inches high, ten or twelve in diameter at top, and about six or seven at bottom: I had it filled above half with litter pretty moist, which contained a good quantity of dung; the bed of straw of which the nest for the eggs was made, was laid upon that dung; I next caused the outside of this basket to be surrounded and even buried, and that quite to the top, with dung not very dry: there was no space which was not well supplied with dung in any two places diametrically opposite, but that which was between the opposite sides of the manger and the basket, the layer of dung was but of a moderate thickness in those two places, but I had caused it to be made above a foot and a half thicker in the direction of the length of the manger. The hen was put in that nest thus surrounded on every side with dung: she liked the place very well and sat with great affection on the six eggs that had been given to her. The germ of every one of them prospered better in that nest than in a common one, as the dung helped
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the hen to keep them warmer than they would have been in any other; two of the chickens were hatched two days before the usual time, that is, in the morning of the nineteenth day: two others got out of their shells only on the twentieth, the fifth was not hatched sooner than the twenty first, and the sixth proved an addle-egg. This experiment, which shews that the vapour of dung is not dangerous to the germs when it is not over and above moist, affords us an instance of the differences that happen between the times of the hatching of the chickens of one and the same brood, and confirms its being forwarded by a stronger or at least a more continual degree of heat; the above mentioned eggs were cooled but little whilst the hen went off to take her food.

The dung that surrounded the nest just spoken of, had lost the greatest part of its moisture in a very few days; such a small heap in comparison to a large bed, and surrounded almost on all parts with the free air, could not supply for any long time a moisture capable of hurting the embryos in the eggs. I saw, on the contrary, all, or almost all, the embryos perish in the eggs of three nests unskilfully situated, and chosen by the hens immediately upon a too moist earth, whose dampness had continued pretty nearly the same during the whole time of the incubation.

But how happens it (as we have already asked) that when the vapour of dung proves fatal to the major part of the chickens of a brood, there are however some of them that are spared, and that come to be hatched? What we had said of the difference in the texture of the shells of different eggs, will supply us with a sufficient solution of this question. The shells whose texture shall be more porous, and shall be perforated with a greater number of holes, or rather with larger holes, shall not be so easily obstructed

structed by the vapours as those whose texture is more compact ; the intensity of moist vapours which renders the perspiration too difficult in the latter, will leave it free enough in the former : and it is not even improbable that the same vapour which occasioned the death of some chickens has facilitated the hatching of some others ; if a perspiration that would have been too abundant had not been considerably diminished, the degree of fluidity which is necessary, would not have remained in the liquors of the egg, they would have grown too thick before the chicken had attained to his full growth ; they would no longer have contributed to its daily increase ; nor even to its life : these so much favoured chickens, are at least some of those that would have been hatched one or two days before the rest in an oven where no excessive dampness was.

If there is a difference in the texture of the shells of eggs of birds of the same species, and even in the texture of eggs laid by the self-same bird, it is to be presumed that this difference is still greater between the eggs of birds of different kinds ; that the eggs of certain species are more affected by moisture than those of hens, and that the eggs of other species of birds are less so : this I have been convinced by experiments often repeated. In a great many incubations where the intensity of the vapours had not been strong enough to hurt the chickens, it has killed the ducklings in their shells some earlier some later. A common eye may judge likewise that the shells of the eggs of tame ducks, are less spongy than those of hens ; they are visibly smoother, they seem to come nearer to the nature of horn, they have something fat and unctuous in them, ink will not stick to them without difficulty, in short, they are evidently more compact. Our eyes would not in the same manner

manner inform us that the shells of turkey-eggs are of a more compact nature than those of hen-eggs; but I have also been taught by experiments, that they are much more affected by the action of the vapour than hen-eggs are, and much less still, than duck-eggs: I have nevertheless caused ducklings to be hatched, but, it was in ovens where there was very little or no vapour at all. It is very probable, that eggs that are sat on in the middle of water by their mothers, such as the eggs of dabchicks, of sea-divers, of moor-hens, &c. are so framed as not to have any thing to fear from moisture; but I have not had any opportunity to try whether these eggs might be warmed with success in our ovens when they are as damp as possible.

As soon as the perspiration of an egg is diminished to an excess, the growth of the chicken inclosed in it is retarded; this I was convinced of by a variety of observations. Certain eggs had been put into an oven wherein there had always been an excessive moist air, I deferred breaking them eight or nine days after the term at which the chickens ought to have been hatched; I found them dead almost all, but I happened to find a few alive, and in the state of chickens within three or four days of their being hatched.

I suppose that the time when a free perspiration is most necessary to the chicken, is that wherein he is to begin to breathe; for it is then that above three quarters of the chickens which die in their shells do perish; the regret you have to take them dead out of the egg, is much increased when you see that the major part of them are large, well conditioned and strong, and that nothing seems to be wanting but bare life. The chicken, about the end of its time, stands in greater need of a renewal of air in his shell: and it is very probable that that air reaches his lungs, for it seems demonstrable, that
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it begins to breathe before it can have thrust any part of his bill out of the shell: I have a hundred times heard the chicken squeak within the egg before it had made any aperture in the shell, before it was pecked, before it had the least crack made in it, even any perceiveable by help of a deep lenticular glass; while the shell, in short, was perfectly sound and whole. What we know of the time at which the human foetus begins to breathe, has made many an anatomist to deny the possibility that a chicken as yet imprisoned in its shell and covered with all his membranes, could squeak there in an audible manner; this matter of fact, which they never had any opportunity to verify, is nevertheless very certain.

The pores of the shells of the eggs which happen to be surrounded with vapours, must needs become more and more obstructed from day to day; there are always among the corpuscles that pervade the pores of the shell, some of them that stick and fix there; the perspiration is then so much the less free as the chicken is nearer to the time of its birth; it is the duration of the influence of the air charged with vapours that causes the evil; what the said vapours could not have done in eight or ten days, they effect in twenty; an experiment which I have repeated a great many times will demonstrate this. After having taken from under a hen eggs which she had sat on for ten or twelve or fifteen days together, I introduced them directly into one of my ovens; and when the number of the days which they wanted to have been sufficiently sat on was over, the chickens were as perfectly hatched from them as they would have been under the hen; but those which ought to have been hatched at the very same time from eggs which had remained above twenty days together in the oven, did not break their shells, they were found dead in
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them, though full grown, and in appearance as well conditioned as they possibly could be: what the vapour had not been able to effect in the eggs it had exerted its power on for five, eight or ten days only, it had effected on those it had acted upon for twenty days together.

Some reflections on the manner in which this vapour acts, and on the time when that action becomes fatal, gave me an idea of the means to prevent its effects, which I used at first with tolerable good success, and which might be used still, were it not yet better to think of hindering that vapour from getting into the ovens in a quantity, that may prove detrimental to the eggs. I thought myself obliged to try whether a large aperture made in the shell of the egg, would not make amends for the small ones it wanted: it may be made in the bigger end, without danger of touching the substances which are considerably remote from that end in an egg that has been sat on for seventeen or eighteen days: It even seems that the free circulation of the air is more important at the biggest end than any where else. This, then, was the place where I thought proper to make an aperture, which though small yet deserves the name of a large aperture as I called it, if compared with those which are imperceptible. It is such an aperture as may be made with the print of a sharp penknife, or with the point of a pair of common scissors thrust about one line deep into the shell. Holding either of these two instruments between the thumb and the fore-finger of my right hand, I let no more of its point appear but so much as I had a mind to thrust into the egg: a bold and quick, but gentle blow will pierce the shell without breaking or cracking it. As the major part of the chickens died only two or three days before the time they should have come to light, I began with piercing
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or pricking the shells of such eggs as had been already sat on for seventeen or eighteen days together. The two first eggs on which this trial was made, gave me each of them a chicken in the right time: I afterwards pricked three other eggs, these were taken out of a brood of seventy, which I have before spoken of, and out of which I had but ten chickens: two of these were hatched from two of the pricked eggs, that of the third egg could not be saved by the operation: in another brood consisting of eight eggs only, there was but one egg pricked, and the chicken of that egg was the only one that was hatched.

This little operation being repeated, and the consequences of it nearly the same; I was thereby invited to try whether it would not likewise save the chickens of the eggs in which it should be done sooner: but the trials informed me, that far from being advantageous, it rather proved hurtful to them when the eggs had been sat on less than fifteen or sixteen days together: the membrane which appears in the inside of an egg that has been sat on after the biggest end of it has been opened, was intirely covered in those which had been pricked early, with a very pretty kind of mouldiness generally of a greenish blew: the seeds of very minute plants of that kind, which had been carried by the air to that membrane, had had time to vegetate there: now, mouldiness placed so very near the chicken, cannot but be very unwholesome to it. I have even had eggs which had been pricked but two or three days before the time of the natural birth of the chicken from which it never was hatched: it was perhaps already dead or dying, when the remedy was applied. But were that remedy surer than it is, and the time at which it ought to be made use of for every egg better known; yet would it be still better to have recourse

course to the means by which we are able to keep the eggs in an air so dry as to save us the trouble of recurring to the above mentioned experiment.

Country people have in a great many places a custom which they think of consequence to procure the chickens a greater facility of coming out of their shell, and hinder a great many of them from dying in it. They fancy that the hardness of the shell is often an obstacle above their strength, and that a great number of them are unable to break it: These people think therefore that they do them a great piece of service by dipping the eggs into warm water, and by keeping them in it for some minutes on the day before that of the birth of the chickens, because they think it a means of making the shell more tender. Were the shell rendered something less hard whilst it remains in the water (which is not at all proved) it would, when taken out of it, soon resume its former hardness: The eggs we eat in the shell may convince us of this. If this operation is of any real utility, methinks it can be only by unstopping the pores which may have been obstructed during the incubation by a solid matter dissolvable in water; the water, in that case, will do a real good to the chicken, and cannot have time enough to hurt him, because the water that might have remained on the shell will evaporate, before it has penetrated into the egg in a sufficient quantity to cause any hurtful alteration in it. Altho' I had no great opinion of this trifling practice, I nevertheless thought myself obliged to try whether it would produce any good effect; I have washed and even kept in warm water, some eggs one, some two, and others three, four, or even five or six days before the hatching of the chickens; the chickens of the eggs kept in warm water died in the shell one or two days before the time of their being hatched, and sometimes on the very day of their
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natural birth, as they did in the eggs which had not been bathed after this manner.

Another kind of experiment whereby I tried to shelter the chickens against these mortal vapours, aimed at rendering the eggs less accessible to them: I have kept some of them in deep sand, and others in bran I had filled a box with. The chickens of the eggs surrounded on all parts with bran or sand, had no better fate than those of the eggs that were uncovered in a basket. I put others each of them in a little flannel bag, to try whether the moist vapours could not be stopt by the closeness of these sorts of textures; but the contrary of what I desired happened: two eggs were put naked in a basket, and two others were put next these, each in a flannel-bag. When I went to visit my four eggs three hours after, the two naked ones were very dry in the basket, and the shell of the two others which I took out of their bags was covered with drops of water.

The right method to preserve the life of the chickens in the eggs, being to keep the air that fills the cavity of the ovens from being charged with vapours, and I having lost all hopes of causing the excessive moisture of the place where I had put mine to vanish in a short time, and to go off from the eggs, I took the resolution to remove my ovens. The only place I could dispose of to put them in was a coach-house open before, closed at the end and on one side by a wall, and on the other side by a partition of boards: it was hither my ovens were transported and my hot-bed here made a-new.

Altho' one of the ends of this place was quite open, as it generally is in our common coach-houses, this wanted nevertheless two things I could have wished it had, and which were necessary to shelter my ovens intirely against the vapours, *viz.* a greater elevation, and one window at least opposite to the
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the open side, to procure a current of air in that direction: for, I could not well expect to see the air renewed there at pleasure, on the days when there should be no great wind stirring, or when its direction should drive it against the end enclosed by a wall, or against the sides, one of which was shut by a second wall, and the other by a partition. However, I found I had done wisely in taking a resolution to remove my ovens; but that change was not quite so advantageous to them as it would have been, if their new place had had all the accommodations I could have wished.

The first broods were warmed in that place before the air was unloaded as it were of all its moisture: they yielded me little more than one half of the chickens I should have had; the number of those I found dead in their shells when ready to be hatched, was almost equal to the number of those that were produced: the air became daily less impregnated with vapours, which the dung sent out less and less from day to day: the number of the chickens that died in the shell continued to diminish, and there were in fine as many hatched out of the eggs of some of my ovens as I could possibly expect.

Nevertheless, every day did not afford me constantly an equal produce: there still happened in many of them, some of those events which we are apt to call very odd, because we are not able to find out the causes that produced them. After I had seen chickens hatched from above three quarters of the eggs of a brood, not so much as one quarter part was hatched in the same oven out of the eggs of another brood; and it even happened sometimes, that not so much as one would be hatched for two or three days running, they had perished in their shells every one; an increase of vapours which had not been observed, had overpowered the chickens ready for birth: The increase might have

been produced either by the diminution of the circulation of the air, or sometimes by the additional supply which had been made by the dung employed to renew the decayed heat of some of the ovens. When the air of the place where the ovens are, receives an increase of vapour, it soon communicates it to the air that fills their cavity; this last becomes moister, and what is still worse, it becomes so in an imperceptible manner. Its dampness may increase so as to be capable of making mortal impressions within the eggs, without the least warning given of it by any outward symptom. every thing seems to be perfectly dry in the cavity of the oven: its sides, the under-part of its cover, and the shells of the eggs give not the least sign of a damp, altho' the air that surrounds them continually be highly saturated with moist vapours. We never try, or we do it too late, to apply a remedy to an evil not known: It seems then, that in order to manage a chicken-oven well, we ought to have besides the instrument which informs us continually of the degree of the heat of the air, another instrument that might acquaint us with the degree of its moistness: I mean, that it would be proper to have besides the thermometer, an hygrometer in every chicken-oven.

The naturalists know not as yet of any instrument of this kind that they are satisfied with; altho' many sorts of it have been contrived and made, yet nobody has as yet been able to procure us an instrument whose degrees may be compared like those of the thermometers made upon the principles we have given; no man can make hygrometers by means of which observers in different places may be able to give each other an exact account of the daily variations that happen in the moisture of the air in which they live. However, it may be with the imperfections of our known hygrometers, after
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I had lost all hopes of ever using them to any great purpose for our ovens, my observations made me think of a way to be sure of the actual state of the air of chicken-ovens in point of moisture, and which is very suitable to the capacity of those who are to use it, as it is of the utmost simplicity, and even so very plain that I dare not style it an hygrometer; for how could I venture to give that name to an egg?

You may, with an egg, at any hour of the day, know whether you ought to be easy as to the state of the air of your oven, with regard to the degree of its moisture, or whether there is any thing to fear from what it is impregnated with, and if a remedy ought to be applied: You need only put into the oven an egg either over or at the side of the others, that has not near the same degree of heat as the rest of them: the colder it is, the better it will perform the functions of a very plain hygrometer. A few minutes or half a quarter of an hour after at most, you must go and examine if the shell is grown sensibly moist, nay, if it is not even covered with a multitude of drops of water: then quarter after quarter of an hour, and lastly every half hour, you must go again and see if the shell remains wet, or if it is become dry. When the shell of your fresh egg does not become sensibly moist in the oven, the air it is filled with may be looked upon as free from moist vapours, as may be desired, and you may be sure that if it remains thus pure during the whole time of the incubation, the brood will prove very successful; but if the egg wets and does not become dry till several hours after, you may conclude from thence that the air is charged with too great quantity of vapours. There have been times when I was too easily pleased, and did not sufficiently mistrust the state of the air within the oven when I saw the eggs

cease to be wet in an hour's time. I became more and more difficult on that head, as my experiments became more numerous. 'Tis true, I have had broods that gave me a reasonable number of chickens, altho' the trial-egg put cold into the oven had often remained wet there for half an hour together; but if you will have compleat success, the egg put into the oven must contract no perceptible moisture in it.

However, this examination of the state of the air in the oven in point of moisture, is not so troublesome as what I have just said might make you imagine: when 'tis once done, it needs never be repeated; but when you have any room to suspect that the air of the place where the ovens are, has been rendered more moist, by the addition of new dung, or from some other cause; it suffices to do it once a day; nor is it even necessary to do it every day; such an examination cannot however take a great deal of time, as it requires no more than is necessary to put an egg into the oven, and to come a few minutes after and see if it has contracted any moisture; if it gives no sign of it, all is well.

The water which covers presently all parts of the shell of the egg which was introduced quite cold into the oven, was dispersed in the air the said shell was surrounded with: I would not insist upon so trivial an observation, if I was not afraid that others should entertain as to the origin of that water a notion quite different, and perfectly like what I framed to myself at first, and which I kept to constantly, till necessity compelled me to examine into the nature of it. The first time I took notice that eggs which had been kept but a very short time in the oven were become wet, I imagined they were so on account of their liquor which had transuded through them; I admired the abundance

of the perspiration brought about during the first hours of the incubation. I should have been much sooner out of conceit with this pretended wonder, had I made the egg as warm as those that were in the oven before I introduced it among them; I then should have seen that egg remain perfectly dry in my hands, altho' the degree of heat it had contracted must have occasioned a perspiration more considerable than that which would have been raised, had it been put quite cold into the oven. If, as soon as an egg appears covered with drops of water, you should take it out of the oven, wipe it dry and let it cool again, and then put it again into the oven, it would grow wet a second time there, and obtain another covering of water a quarter of an hour after. The person that should repeat the same operation again and again for several hours together, would soon be convinced that the many coverings of water taken off the egg could not have transuded from within it, and that the quantity of water that might thus be supplied in four and twenty hours, could never be afforded by its contents, altho' they should almost all of them have perspired through the shell of the egg.

It is not then from within, but in truth from without the egg put cold into the oven, that it receives all the water which appears on its shell; the very explanation of the matter of fact serves to prove this, because it teaches us that there happens here what happens in analogous cases. When you fill a glass with water, wine, or any other liquor that has been rendered extremely cold with ice, the outward surface of the glass is soon covered over by a moist vapour that spreads upon it; the layer of aqueous particles in the circumjacent air falling one upon and by each other, becomes perceptible, it wets the finger that wipes the glass and which restores its transparency by that wiping. If a man

is at all versed in physicks, he knows that the vapour which wets the glass did not pervade its pores, that it was in the air, and that the glass collected it from the atmosphere. The glass by cooling the air and the vapours that are buoyed up in it, has condensed them, it has deprived them of both the bulk and the motion to which they owed their floating condition: these particles at present condensed and come to contact have joined together and reassumed their watery state; the small guttulæ that have met with the glass have stuck to it as any water would do; a flat piece of glass, that should have been rendered as cold as this by ice without being wet, and then have been brought into the common air, would soon have had both its surfaces covered with minute drops of water, like those on the outward surface of the glass filled with a liquor rendered cold the same way.

What happens to the glass rendered cold by ice and then surrounded with a temperate air, happens to the egg which, though not quite so cold, has been brought into a much warmer air. Altho' the manner in which water is turned into vapours is not yet very clear, altho' we are not sufficiently informed under what form it subsists in the air at that time, nor how it is buoyed up there, a hundred experiments which it would be equally tedious and needless to mention here, have taught us, that when an air loaded with vapours is cooled, and loses a certain number of degrees of its heat, it can no longer buoy up the same quantity of vapours it did before, and that these vapours being left to themselves and drawn nearer each other than they were, come to make minute drops of water: the air whose temperature was seven or eight degrees above congelation, deposits on the side of the glass, some of those minute drops of water, which have for instance but a degree or less above congelation: the

the egg, which has but 12, 15, or 20 degrees of heat above congelation when set into the oven, and which is then in an air that has 32 degrees of heat, does also occasion there the reunion of the vapours of the air which touches it forthwith into minute drops of water which adhere directly to its shell.

The egg becomes a more sensible and more perfect hygrometer, in proportion as there is a greater difference between its temperature and that of the air in the oven: Of two eggs that shall be put into the oven at the same time, that which proves the colder shall be sooner covered with water, and remain longer wet than the other; and the water that shall have stuck to both, shall not be taken away and turned into vapour again, till they shall have re-assumed a degree of heat that comes nearer to that of the oven. If an egg was made to assume the degree of cold productive of congelation, it might contract a damp in an oven where an egg put in with 20 degrees of heat would have remained dry: but, there is no necessity of having recourse to so nice an hygrometer, the eggs being perfectly secured in an oven when its air is not moist enough to be divested of its vapours by an egg whose temperature is of about 20 degrees.

What we have just said leads us to an observation concerning the care with which we ought to keep the degree of heat in the oven up to 32, altho' one might let it fall below it without occasioning any hurt to the chicken; but it might well have the more to suffer from the vapours at that time; for the more the air they swim in is warm, the more the matter they are formed of is rarefied: whence it follows, that, *cæteris paribus*, the quantity of water diffused in the air of the cavity of an oven shall be so much the less as that air shall have a greater degree of heat.

All the substances which moisture easily adheres to, and which it will not readily penetrate, might make an hygrometer for a chicken-oven as well as the egg: chalk, wood, &c. would not be proper for it, because they might imbibe the water, and one could not see what quantity of it they had imbibed. Those matters which have that singular property in them not to suffer any dew to stick to them, such as silver and other metals, would neither be fit for that use: But nothing can be more convenient than an egg for those who are causing them to be artificially fat on and are handling them every day and even at different hours of the day: It does not cost them even an egg to make an hygrometer, for they may warm with the rest the egg that has performed the functions of it; but if they chuse to use always the same, they need but empty it, and fill its shell with wax, tallow, or any other solid matter: the empty shell would not be so good an instrument; because it would grow warm too soon.

There are many advantages resulting from the knowledge of the state of the air of the oven procured by the hygrometer: when this informs you, that the air of it is excessively impregnated with vapours, you must forbear trusting it with any eggs if it has none in it, or letting in any new ones, if it has any already: This instrument will acquaint you when it is time to use all the means you are master of towards diminishing the dampness of the place where your ovens are; in which case you must open all your doors and windows, in order to increase the current of air as much as possible, and carry off that which is overcharged with moisture. But, there are places, and by misfortune I never had any but of that kind at my disposal, in which you cannot have the windows necessary for a sufficient renewal of the air; this
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may be helped in part by many expedients: one which I have not as yet made use of, but which cannot but be good, is to have the air renewed by means of any ventilator whatsoever; you might make a pretty good one of a fan many feet long, and as wide as the height of the cieling it should hang to would allow. There are a thousand ways of disposing such a fan so as that one might make it move quickly enough; it may be made of thin boards or with past-board; and it will sweep away the air that has stagnated too long in the place, and will force new air into the place of it.

Another expedient which I have used, seemed very fit to hinder the air of a chicken-oven from being too much loaded with vapours when the air of the place it is in may supply them in too great abundance. I thought of a method for continually conveying into the oven new air perfectly free from all the vapours which exhale from the dung. Every one knows the canals through which the wind is distributed by the bellows of the furnaces of our silver-smiths and of organs, *viz.* that they are wooden pipes of a square or a parallellipedal form: I once introduced the end of one of these pipes into the bottom of an oven which had been bored purposely to let it in *; the end of the pipe † was raised three or four inches, and covered with a tin plate bored full of holes like the rose of a watering-pot: I have even sometimes caused five tin pipes, all of them issuing from the same basis ‖, and diverging from their common origin, to be fastened on that end: each of these five pipes was likewise bored as above like the watering-pot. The first wooden pipe was set vertical, its lower-end was joined with an horizontal § pipe prolonged beyond the place where the ovens stood: in order to convey it out of the place, I only caused a square hole of a diameter proportionable to its own, to

* Plat.
VIII. Fig.

† b a.

‖ Fig. 2.
a, a, a, c, c.

§ Fig. 1.
d c.

to be bored in a partition of boards that separated the coach-house which had been appropriated to the ovens from another that was used still for a coach : It would not have been very difficult to have conveyed it thro' a plaistered partition or a common wall. The end of the wooden air pipe was jointed in a wooden funnel * of a pyramidal form with its basis rectangular ; each side of its aperture was ten inches long, and the funnel itself was fifteen or sixteen inches deep, having its aperture turned towards the yard. The air driven into this funnel could not fail of being directed towards the oven, into which it was conveyed warm : its position, which is a small matter lower than the bottom of the oven, shews that it was covered in part by the hot-bed of dung. I had, in order to secure the duration of this wooden wind pipe-and to hinder the dung from rotting it too soon, taken care to cause that of one of my ovens to be done over with tar over which dry rubbish had been thrown, and to cover with a coat of plaister that of another for I used these wooden pipes for two different ovens. The use I made of them answered my expectation : however, the air was not always conveyed into the oven through the wooden pipe in so great a quantity as I could have wished : but when my hygrometer informed me that the air of the oven contained too many vapours ; in order to drive that air quickly out, and mix it with a considerable quantity of pure air, I needed only to cause the air-pipe to be blowed into, with a double pair of bellows, that is, with one of those bellows whose blast is continual.

Besides the vapours exhaling from the hot-bed, there are some that have their source in the very oven : a matter perspires continually from the eggs, which is not to enter again into their cavity : The quantity of that matter is greater in proportion as the

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the oven contains a greater number of eggs: experiments which we have already mentioned, teach us that the weight of the matter that has been dispersed in the oven for twenty days together and a small matter more, is nearly equal to the fifth or sixth part of the weight of the yolk and the white of all the eggs that have been warmed; but these experiments cannot teach us what space such a quantity of matter, whether fluid or solid, will fill when it is changed into vapour. If the vapours which exhale from the eggs every day were accumulated in the oven, the air within it would be overcharged with them, and probably be rendered very impure; but when all the registers of the cover are not stopped, there is always a circulation of air, which carries off at every instant a sufficient quantity of these vapours, so that there is nothing to fear from what remains of them. The necessity the hen is under to rise every day from her nest in order to feed, is perhaps very useful to the eggs she sits on, because the air that stagnated under her, and which had been impregnated with vapours supplied by the perspiration of the eggs and even by that of the hen herself, is carried off and replaced by a purer air during the time she does not sit upon them. I have recalled to my mind since I made these reflections, that almost all the eggs of several successive broods had been spoiled under a turkey-hen, which had a mighty inclination to sit, a thing that is not very rare in those birds; she had no disgust for three months together for a function in appearance so very tiresome; she remained sometimes whole days together upon her eggs without ever leaving them a single instant, and was very well pleased to see that one spared her the trouble of getting up, by giving her her meat and drink upon the nest: but it is very probable that her constancy in keeping her eggs warm caused them to decay, because
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she hindered the air about them from being renewed.

The Abbe *Nollet*, who is so great a master in the art of following nature in all her proceedings, whose great facility of contriving ingenious experiments is no less known than his skill in the execution of them, having heard me talk of the manner of hatching chickens by means of hot-beds of dung, would make the trial of it himself: in his first experiment which was made at *La Meute*, he saw but about one third part of the chickens hatched; the other two thirds which ought to have come to light with the rest, died in the shells; he did not fail consulting me upon what might have killed these last chickens so very near the time of their birth: a very few words were sufficient to convince him of what has been said so much at length in this Memoir: he was presently persuaded that the cause of it was not to be looked for any where, but in the vapours mixt in too great a quantity with the air of the oven. He proposed to add to the methods I had given him to prevent the accumulating of these vapours another of his own contrivance, towards a more compleat imitation of what passes among the broods sat on by hens: he told me he thought it would be proper to take every day the baskets full of eggs once or twice out of the oven, and to fan them: I applauded his notion, which he put in practice in a second brood; this was indeed warmed with a sort of dung which must have exhaled less vapours than it had done during the first incubation. This new brood consisted of sixty eggs, thirty whereof proved to be addle-ones; it was then reduced to thirty eggs capable of affording chickens, and there were eight and twenty chickens hatched out of them. Drawing the baskets out of the oven and fanning them, is a method which I have tried myself:

myself: I judge it to be very fit to prevent the stagnation of the vapour proceeding from the perspiration of the eggs, and to renew the air of the oven which is to be fan'd likewise after the baskets have been taken out of it; but if the air driven away by this fanning is replaced by one too moist from the top of the hot-bed, the chickens will not be saved by this operation; besides it seemed to me to be perfectly needless as to the eggs warmed in ovens that have no other heat but what is borrowed from baking-ovens: there are no other vapours to be carried off from around these eggs but those supplied by their own perspiration, which are easily carried off by the ordinary circulation of the air, and by the additional circulation which is procured whenever the door of the oven is opened to examine the state of the eggs and of the heat.

But, will not the many precautions which we have given our readers to cause chickens to be hatched with success in hot-beds of dung, give them a disgust for the trying that method? Will not the multitude of the accidents we have mentioned, and which we have endeavoured to remedy, cause this work to be looked upon as excessively difficult? If a man had heard an account of the many accidents that might hinder a crop from succeeding, he would not perhaps dare to plough his land, and venture the sowing of a considerable quantity of corn and grain of all kinds year by year, before he had been encouraged again to do it by repeated experiments. I may then encourage my reader, by the consideration of the vast success of experiments that have procured me as many chickens as I could possibly expect; and by the consideration of others, which though tried by some other persons whom I thought not as yet sufficiently informed, have nevertheless succeeded in the completest manner. What has succeeded

ceeded once in the point of physicks, will always meet with the same success, under the same combination of circumstances. The circumstances that are necessary here, are known, and the combination of them is easy to be brought about. The whole purport of this Memoir may be reduced to something very plain and easy to be practised: we have shewed of what importance it is not to suffer an air too much impregnated with vapours to stagnate in the oven: an egg is a very easy means to know whether the air is as free from them as it ought to be: one needs not even have recourse to that, when special care has been taken to make the hot-bed with dung not excessively moist, or full of water, and when the said hot-bed or the chicken-oven have been established in a barn that has a high roof and a good many apertures, or, for want of a barn, in a place opened on all sides, and having always a free current of air through it, in which case all the precautions I have mentioned are perfectly needless: there is no longer any necessity of an air-pipe, nor of a vast fan; nor of taking the egg-baskets out of the oven; as the broods will succeed as well as can be desired without any such care.

But what is the success that may be reasonably expected? What proportion will the number of the hatched chickens generally bear to that of the eggs that are warmed? Will the same number of them be hatched in proportion in the ovens as under the hens? these are questions that will naturally be asked by those who do not cause chickens to be hatched out of meer curiosity. The undertakers of the *Egyptian* ovens will afford us an answer to these queries: they are contented, as we have already said, with hatching two thirds of the eggs they have warmed: however, the right term of comparison

comparifon which we ought to take for our rule here, would be the medium of the quantity of the chickens hatched from eggs fat on by hens ; and that term or medium is not yet eſtabliſhed : thoſe who ſet eggs under hens are not a claſs of people able or willing to make the obſervations on which calculations of this kind ought to be grounded : thoſe I have made for two years ſucceſſively, do not ſeem ſufficient to determine this medium : however, I have kept for that time an exact account of the eggs I have given my hens, and of the chickens hatched out of them : but I think I have had more unfortunate broods than it is cuſtomy to have, and that the accidents againſt the experiment have been more frequent and in greater number with me than they generally are. The product of chickens for each of theſe years has been leſs than a third part of the number of the eggs : But I think in general, that it will not be under-rated, if it is allowed to be equal, to one half of the quantity of the eggs fat on ; it is well proved at leaſt, that it ought to be rated under the two thirds of the number of the eggs, ſuppoſing that the products of the *Egyptian* ovens have not been under-rated. Eggs are not expoſed to ſo many accidents in theſe ovens as they are under the hens : too commonly they break ſome of the eggs they are fitting on ; there are even aukward breeders that conſiderably diminifh the number of thoſe given them : I have had hens which have broke four or five eggs out of thirteen, either by fitting too heavily upon them, or by making them change places by a too rough way of pecking.

There are ſome that give us ſtill greater reaſon to complain, by their eating one of their eggs every day : there are others which after having fat on their eggs for ſome days together, take a ſudden diſlike to a kind of life that ſeems enough to tire them,

them, and intirely give them over to resume their old way of living. I have seen other hens do worse ; still ; I have seen some which having at last lost all patience a few days before the chickens would have been hatched, have unmercifully broke the eggs one after another with their bill, and consequently killed a number of chickens by thus causing them to see the light too soon. Three such mischances have happened to me in such circumstances that I could not but observe them. I had collected a series of eggs of hens, which had been matched with cocks of different species, I was curious to observe what odd productions would result from them : as I knew not at that time how to warm chickens in ovens, I gave part of those I valued, (it was about *Lady-day*,) to the very first of my hens that shewed an inclination to sit : she began her mischief on the 15th of *April*, by breaking one of those eggs with her bill, she broke two more the next night, and all the rest the next day : the chickens were all of them as forward as they ought to be. It would have been plainer had the hen barely quitted the nest, that the fatigue of remaining too long in the same place was her only motive for using with so much cruelty the little ones she was to give birth to ; but she remained on the nest after she had broken the first eggs ; does it not seem rather then, that she was prompted by the uneasiness and impatience she had, not to see the chickens come to light so soon as she expected it, and that she fancied she did them a good office by doing with her bill, what they ought to have done with theirs ? Let the motive for her behaving in this manner be what it will, the eggs of two other broods had just the same fate ; the second was sat on by a different hen, and the third by the very same creature, who after having roved about as usual for some days, shewed again a very earnest desire
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to sit: having no other hen ready, I trusted her with new eggs, which she used as she had done the first; and it was once more but a very few days before the time of the birth of the chickens that the eggs of both hens were broken in this manner.

There are no fowls so perseveringly willing to sit as the turkey-hens: I have tried to turn this inclination, which is so very fit to multiply chickens, ducklings and young turkeys, to more account than is generally done in the country: I have made several turkey-hens sit at a time, from all which I took the little ones as they were hatched; I replaced these constantly with new eggs; some of those turkey-hens had the patience to remain upon the eggs (which I took care not to let them want) for above five and six months together: and after this long incubation they still continued with obstinacy to remain in the posture of sitting hens, although they had no longer any eggs under them, nor did I supply them with any. One of these stubborn sitters has nevertheless made me lose eggs, not only by crushing them, which is more common with the turkey, than with common hens, but in a more singular manner. She had built her nest in a place raised a foot and a half from the ground, between a wall and a dog-kennel under shelter. As I generally never caused eggs to be sat on by turkey or by common hens for any other purpose but to make observations, there were always or most commonly something written upon those which I put under brood-hens, though it were only the date of the day when they began to be sat on: I thought it odd enough one morning to find in the middle of the yard, two of the said superscribed eggs, that were of the number of those I had trusted to the above-mentioned turkey-hen. I knew neither by what animal, nor how they had been carried to the distance of more than fifteen or

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sixteen yards from the nest: I had afterwards an opportunity of being convinced, that this had been done by the turkey-hen herself: I surpris'd her off her nest, holding in her bill one of the eggs, which she went and laid very gently on the ground, which done she returned to her nest and sat again on the others. I have catch'd her several other times at the same trick during the course of two years, in each whereof she kept sitting continually on eggs four or five months at least. The circumstances in which she did it deserve the more to be known, as they seem to point out to us the motive that prompted her to do it. The perseverance turkey-hens have above common hens in sitting on eggs, is not the only thing that makes us have recourse to them for this use; we are moreover invited to it on account of the quantity of eggs they sit on at a time; which is sometimes nearly double the quantity that can be put under a hen: I say sometimes; and the turkey-hen will teach us the reason of this restrictive expression. She having completed a brood, most of the chickens of which had been happily hatched, I left under her a couple of eggs that were good for nothing; they remained there till the next day, when I had her taken out of her nest in order to have twenty seven fresh eggs ranged in it: this being done she was left again at liberty to return to her usual place. As soon as she was in it and had squatted on them, she seem'd to be frightened with the new task given her, and with the number of the eggs she was now commission'd to sit on: she fell a pecking of them harder than she ought to have done, had she had no other intention than that of barely ranging them: she broke in my view one of the biggest which had been lay'd by a large hen. As I was afraid she should do more mischief, I had her taken from her nest, out of which I caus'd

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ed nine eggs to be taken: she was then left at liberty to return to it, which she did. But instead of thinking of doing any new mischief with her bill, she now used it only to range gently and to her liking the eggs which had been left her, and seemed to sit on them with great pleasure.

In order to use the time of that turkey-hen to most advantage, I caused the nine eggs which had been taken from her to be returned to her at several times, and that within the three succeeding days; they seemed to be very wellcome to her at first, but she afterwards seemed to be uneasy at seeing the number of those she was to sit on too much increased; she took a resolution to lessen it by carrying out of her nest in her bill those she judged to be supernumerary. The first two eggs I had found in the yard, and which I have just mentioned, were of those she had thought to be thus supernumerary. She in some days freed herself of five of those that had been given her; and the more the time of her sitting was prolonged afterwards, the fewer eggs she would suffer under her: after she had remained constantly in the same place for above three months together, she never failed, whenever the number of the eggs put under her, went beyond fourteen or fifteen, to break or carry away some of them, till she had reduced them to that number.

The next year she was in the same disposition: she even shewed us much sooner that she would not be charged with more than a certain number of eggs. Out of seven and twenty eggs that composed her first brood, she would not keep above twenty one or twenty two. She in the space of the two first days, carried five or six of them out of the nest: nevertheless, she in time consented to sit on the twenty seven, which had appeared an excessive number to her at first.

Notwithstanding the motionless state of a sitting hen, a slight examination of her attitude will soon convince you, that it gives her a sort of fatigue, and that the more as she is more fond of sitting on a brood of eggs that fill up a larger surface: she, in that case, does not keep her wings quite close to her body: the fond brood-hens, which have a mind to warm at once as many-eggs as possible, keep their wings at some distance from their body, and so much the more as they have a greater number of eggs to sit on. 'Tis probable that my turkey-hen was fatigued with keeping her wings spread to a certain degree for several months together: she afterwards would not keep any other number of eggs but that which permitted her to keep her wings close to her body: when she began to sit the second year, the attitude she was obliged to be in to sit on twenty seven eggs, seemed too great a confinement to her at first, but after she had sat on them a few days she acquired a greater facility of spreading her wings without being incommoded by it.

Besides the losses of eggs occasioned by the misbehaviour of the brood-hens, they often occasion the loss of the very chickens they have just brought to the light: nor do they do it out of ill-will: it is very often from an excess of fondness and satisfaction that a mother claps her body too roughly upon that of the chick, which is but just come out of the shell, or which is not even quite disengaged from it: she presses it too hard, and smothers it. It is common enough to find in each brood, and more commonly in those of turkey-hens than in those of other hens, chickens that have been pressed to death by their mothers, the very instant they were hatched: for which reason a brood is reckoned to have succeeded very well, when a dozen of chickens are hatched out of fifteen eggs; for it happens sometimes, that you have

have but three or four, or even but one or two out of that number of eggs. The country dame is very well pleased when her brood-hen which had fifteen eggs given her, is followed by a train of eight or nine chickens after she has left the nest. We shall have proofs enough of what we say without setting any hens, if we do but take notice in the country of the hens that are followed by some very small chickens: the attendance of those whose chickens are but just hatched, consists of but seven or eight, and sometimes of but two or three; those which have a greater number have it frequently at the expence of some other hens from whom their own chickens have been taken and put under tuition of the former.

The causes just mentioned that diminish so considerably the product from eggs sat on by hens, are not to be apprehended in eggs kept in ovens, as they run no risk there of being either broken or abandoned: the chickens are hatched in them with the greatest ease and conveniency, nothing hurts them there, as they are in no danger of being crushed by the weight of a common hen or a turkey. However, when about two thirds or three fourths of the fruitful eggs warmed in ovens, afford each of them a chicken, we should be contented with the product, which generally must not be expected to be much greater. I have often had a number of chickens equal to that of the eggs of very small broods, which consisted for instance of but seven or eight eggs or even of less: but I never had any large brood without being at the loss of some of the eggs: it will be extremely rare to have any so successful as was one of those broods under the care of a lady of the society of *L'enfant Jesus*. She had two hundred and ninety six chickens out of three hundred eggs put into one cask: she lost but four of them, which came even so for-

ward as to be able to peck their shell ; and which died on no other account, as she thinks, but because their eggs had been too much confined by the others. One must not expect that such vast products as this should always be the reward of the cares taken to keep the eggs constantly in the properest degree of warmth, and to keep all hurtful vapours from them : doubtless there are among the germs that are unfolded, some less perfect than the rest ; the chickens that proceed from them are puny ; they grow indeed, but it is sometimes to end their life before they come to light ; they die on that account, some sooner, some later. Chickens die most naturally when very young on account of an indifferent constitution ; why then should not others die on the same account in the shell ? We have already seen that independent of the cause of death, which may be owing to the ill-condition of the germs, the contexture of the shell may occasion the death of some of the chickens, either by rendering the perspiration too easy, or by doing the contrary. The chickens lodged in shells that are too porous, must needs die there, after the manner of those of rear-eggs, that have no shell at all : and those whose shell is too compact, are by nature lodged like those whose shells have been obstructed by vapours. It is a great wonder that the shells of eggs should most commonly be framed as they ought to be not to permit the perspiration to be wrong either from excess or want. But, we are now to speak of another kind of ovens, wherein eggs will be less exposed to a dangerous vapour than in those which are made of an empty cask.

It is probable that we have succeeded better in causing the vapours which exhale from the hot-bed, to be dreaded while the chickens are yet inclosed in their shells, than in removing the uneasiness
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which we have raised in the mind of the reader concerning the hurt these vapours may do the said chickens. Another means, which I have not mentioned hitherto, has been also made use of to hinder vapours from being accumulated in the places where the ovens stand. I caused the hot-bed to be covered in good part with planks; some of which were flanted circularly, and surrounded each oven on all sides: this kind of floor opposed the rising of the vapours; and therefore the air which was above that floor was much purer than it would otherwise have been. Another good effect of this floor was, that it preserved the heat of the dung, and rendered it more lasting, as it sheltered its surface from the impressions of the cold air: besides, it preserved the moisture without which that dung could never ferment or heat, which is one and the same thing. The boards were not joined because I thought the necessity of renewing now and then the heat with fresh dung would not well permit it. There were then many empty spaces in the floor formed of these planks; they were even very considerable: they made use of old boards at the society of *L'enfant Jesus*, to cover the hot-bed with a floor of this kind. I have wished more than once that I was able to procure for my hot-beds a floor as closely joined as those of our apartments are; that might enclose all the casks exactly, and above which the orifices of these casks might be raised a few inches only: by means of this there would have been no room left to fear an air impregnated with vapours exhaling from the dung ever entering the ovens.

But what method could be contrived to warm ovens having their bodies under this desirable floor? I have not as yet been able to find any satisfactory solution to this difficulty. However, a folding-floor might have been contrived, I mean

one whose several pieces about the oven, might be taken off one by one and disjoined at any time when a renewal of the heat was necessary to be procured with fresh dung, and might be put together again immediately after. There would be no vapours dispersed in the air in that case, except during the short interval for transporting and disposing of the new dung: which would be no small point gained: but all these supposed preparations and expences, did not square with the plan I had proposed to myself, of procuring the hatching of chickens by the plainest and cheapest proceedings intended for the narrowest capacities: and besides those inconveniencies, a floor of that kind would never have lasted in proportion to what it must have cost.

It was on account of their cheapness and simplicity, that I was pleased with the ovens made only of a cask, and I still value them on the same account: the prepossession I have had, and with good reason too, for these casks, has hindered me from timely perceiving, that it was possible to construct chicken-ovens as inaccessible to the vapours of dung, as those of whose orifice I would have to be separated from the hot-bed by a well jointed floor, although they were cheap, and very easy to be warmed. The ovens warmed with a wood fire, like baking ovens, offered every day to my eye a model of construction, which I had not taken notice of, and which deserved to be imitated, towards procuring ovens to be warmed with dung, which might answer all my views.

The ovens made with a plain cask may be called vertical ovens, having their orifice or mouth horizontal, and baking-ovens are horizontal-ovens whose mouth is vertical: this vertical mouth is commonly contrived in a wall beyond which the body of the oven is; the body stands in a room or covered place
different

different from that where the mouth appears. Let us imitate this model, and lay the cask on its side, or rather, as it would not be so long as might be desired, let us substitute in the room of it a long box opened at one end only, and closely shut every where else: let the aperture be placed in a room separated by a wall from the room where the rest of the box stands; let all the chinks that may have been left in the hole made in the wall to let the box through, be well filled up and stopt with plaister or some such matter; the opening * of the end of the box, will * *See the head-piece of this Memoir.* become the mouth of a long chicken-oven, which it will be easy to warm, even with moist dung, very capable of saturating and overcharging the outward air with vapours, without affecting in the least the internal air of the oven, this being never renewed but by the air of a place that has no manner of communication with the room where the dung is.

This so very natural idea, which ought, one would think, to have offered itself at first, though it came but very late into my mind, seemed to make good every condition towards warming eggs with the utmost security: and indeed it answered my expectation in the completest manner, although the first trial I made of our new oven was not attended with the most favourable circumstances; I had then at my command but two coach-houses separated from each other, by a partition of boards not over well joined; the body of the oven was placed in one of them †, † *See the head-piece of this Memoir.* and its aperture jetted out into the other but a few inches beyond the partition, which had been sawed to let the open-end come through. And plaister had been used to fix close the out-jutting part into that partition, and to stop the holes not filled up by the box.

The

The description of this new oven will not take up much of our time : it consisted of a box seven feet long ; two of its opposite sides were each of them five and twenty inches high, and the other two, that is the upper and the under-part, were each of them twenty one inches wide. Its inside was lined with a coat of plaister, like the inside of the casks turned into ovens ; besides this, I caused its whole outward surface to be done over with tar, which served still better than the plaister to stop all avenues to the moisture, and was moreover designed to secure the duration of the box : it was layed on a bed of dung eighteen inches thick or thereabouts, surrounded on each side and covered at top with a layer of dung almost two feet thick : The short portion of it, which was in the other coach-house, was the only part not surrounded with dung : great care had been taken to put none round the mouth of the oven, into which no access was to be left to any vapours. The reader will easily guess that the mouth was not to remain wide open, and that it was to have a door. It had one that moved up and down at pleasure *, as it slid freely between the grooves that served to keep it in a vertical position. This door had also several apertures, that were stopt by small boards which moved likewise within grooves : We have already spoken so many times of registers appointed to regulate the degree of the heat of the oven, that we need not now say that these apertures contrived in the door were designed for the same purpose.

* Plate
VIII. a.

There remained no moisture in this oven after the water imbibed by the plaister was evaporated : I fancied that the plaister was become sufficiently dry two or three days before it was so in reality : I forgot to consult the hygrometer when I put the first eggs into the oven : very few of these gave me chickens ; but there were seven chickens hatched

from

from seven eggs, the only ones that began to be warmed three days later than the rest. The number of the chickens was not afterwards always equal to that of the eggs of each brood, and the reader knows it could not be; but it was as nearly equal as could reasonably be desired; therefore, you need but to regulate the heat of this new oven in a proper manner, to be certain of having your eggs warmed in it with much better success than under hens.

Being pleased with this new oven, I caused a second to be made that resembled it as to its essential parts, but with different proportions; I had it made much of the same length, but almost twice as broad, and one third part less in height. What determined me to increase its width and diminish its height was, that I had been taught by experience, that one must not think of ranging egg-baskets or boxes in it one over the other: if the eggs of an upper-box are well warmed, those of the inferior one cannot be sufficiently so, because the heat proceeds chiefly from the upper-part of the oven. It is therefore in the highest part of it that the fittest degree of warmth lasts longest: Instead of having the upper-part of this second oven done over with tar, I caused its outward surface to be several times painted in oil; this paint is not liable, like the tar which I had used for the first oven, to be softened by the heat so as to run, which happened to the tar with which the first oven was done over. But, my experiments have taught me that the paint did not always secure the long wooden box which is the body of the oven, against all danger of being penetrated by moisture; and that tar is still preferable; especially if you mix it with brick-dust, or with something equivalent, so as to make with it a cement that may never be rendered liquid but by a degree of heat
more

more considerable than what can be given it by the warmest dung possible.

It is not in order barely to secure the duration of the oven, and to hinder its wood from decaying, that one ought to do its outward surface over with something that may hinder the moisture from penetrating through it; the chief intention of this operation is to hinder the moisture from reaching thro' to the inside of the oven, that is, from impregnating the plaister after having made its way through the wood. The upper part of the ovens of this last kind is more exposed to the water that may trickle from a too moist kind of dung, than the outside of an oven made with a cask can be. The sides of this being vertical, the water dwells less upon them because the drops are precipitated towards the bottom of the hot-bed by their own weight, whereas they stick and are accumulated upon the upward surface of the horizontal oven. The water has time to insinuate itself into the wood, to pervade the plaister, and then to spread into vapours in the cavity of the oven. However, this effect can never be produced but by a too wet kind of dung laid upon the oven. I have once experienced that dung excessively moist may have that inconvenience. Having a mind to restore the heat of one of my new ovens, and to revive the fermentation that began to slacken, I ordered several pailfuls of water to be thrown on it: the dung was warmer for this the next day, but my hygrometers, I mean, some cold eggs put into the oven, and examined five or six minutes after they had been in it, informed me that the air within was impregnated with vapours, as these eggs came out of it wet. In order to shelter the inside of the oven from moisture in cases like these, which are but rare and will never happen when the dung is not soaked to an excess, I caused paper to be pasted
over

over the plaister of the oven, and when the paste was dry, I ordered that paper to be oiled. One would be surer still of stopping all avenues to moisture into the cavity of these ovens, if one was not afraid of making the expence too considerable, tho' never to be repeated again, by lining their inside with milled lead soldered together: this might be clapt immediately against the wood or against the plaister, as one pleased. By good luck, the precautions I have just mentioned, need never be used but in cases which every body may avoid; they are even rendered perfectly needless, when the outward surface of the oven has been done over with a thick lay of the above-mentioned kind of cement, or with any other cement that has the same quality.

The form of the round baskets does not suit the oblong square ovens as it does the cylindrical ones; nay, I even do not put in baskets the eggs to be warmed therein; I range them in boxes supported upon a machine that runs on casters, like that I spoke of in describing the chicken-ovens warmed by the heat of baking-ovens. There was in the latter a wooden frame on which the carriage rolled, that the motion of it might be easier, and the plaister of the inferior floor not damaged. Here, it is proper that the carriage should be so constructed as that the box may be placed on it higher or lower, according as the degree of the heat of the oven requires it.

These ovens must from time to time be warmed again as well as the others, and their heat must be renewed in another manner, because their position is not the same. If new dung was laid every time upon that which is grown cool, this would indeed give a new degree of heat to the oven; but that degree would be so much less as the operation of warming the oven again should have been oftener repeated:

repeated: for each renewal of the heat is an addition of dung to the thickness of the hot-bed that rests upon the upper-surface of the oven; whence it would happen in time, that this surface would be separated from the new hot-dung just added by a too thick bed of that matter not sufficiently warm: the new dung must warm that thick substance before it could reach to warm the oven, consequently one part of the heat would be spent without any necessity or benefit, and the little portion of it that could reach the oven would come to it only at the long run, and frequently much too late. In order, then, to be able to renew the heat of these ovens with greater speed and with better success, it is proper to begin by taking away the old layer of dung which is on the upper-surface of the oven, and to put in its stead a layer of new and very warm dung, by which means the oven is warmed again immediately.

Nevertheless, instead of uncovering the whole upper-surface of the oven at once, it is better to take away the dung that covers only one third or one half of its length, that is, to warm again but one portion of it at a time, and to warm the rest the following days. It is even proper to procure more frequent renewals of the heat to the fore than to the back-part of the oven, as the former is nearer the door than the latter: The portion of the inside of the oven that stands next to the door, is more liable to be cooled by the external air: therefore, you can never succeed in maintaining a nearly even heat within a large portion of the length of the oven, but by warming more than the rest the portion of its upper-surface that communicates its heat to the portion of the inside which first grows cool, and which is always colder than the rest.

I have not mentioned the warming of the sides, which cannot but be very proper, but this may be
dispensed

dispensed with, if the width of the new ovens is made much more considerable than their height, as I have already said I had done with regard to that which was built last. But, I must forewarn the reader that if the oven is built twice as wide as my first oven of that kind was, it will be necessary, in that case, to divide its inside into two parts nearly equal, either by a partition that runs from one end of it to the other, or by a row of four or five wooden pillars, that shall strengthen the upper-part of the oven so as to resist the weight of the hot-bed : As I had not taken this precaution for the oven that was twice as wide as the first, its upper-part gave way some time after, and became somewhat convex within the oven. There might be another means of easing the upper surface of the oven of one part of the weight of the dung, *viz.* to put cross-pieces two feet distant from each other or thereabouts, each whereof might be supported by props, at the distance of some inches from the upper-part of the oven ; In short, the upper-side of the oven may, though ever so wide, be strengthened and sufficiently inabled to resist the weight of the dung, by cross pieces parallel to its extremities, fastened against its sides, and clapt either upon the upper or the under side of its top.

Each renewal of the heat of these horizontal ovens, consumes a quantity of dung much more considerable than that which is used to renew the heat of a vertical oven made of a plain cask ; but in return the horizontal ovens need not be warmed anew so often ; in winter time, one is obliged to change the old dung for new but about once a fortnight ; and in milder seasons, the same new dung, if it is of the best and the warmest kind, will administer a proper heat to the oven sometimes three or four, and even during five weeks together ; which gives me room to think, that if any such
ovens

ovens were constructed in those dung-hills which I have mentioned at the end of the third Memoir, to which some new dung is daily added during the whole course of the year up to the month of *October*, and which are made of rotting plants mixt with straw, that the heat necessary to cause chickens to be hatched in ovens built under the very middle of these masses of dung, would be maintained seven or eight months together, without the least necessity of attempting a renewal of the heat, or without any necessity of visiting the eggs above once or twice a day; as the variations of the degrees of heat would be very inconsiderable and slow, in so large a mass as this. As these sorts of ovens would stand in the open air, it would be proper to cover their door with straw; a small hut might even be built before the door, such a hut, I mean, as country-people know how to build with hurdles, faggots, or furz; and which would be no more than a day's work for one man.

When the heat diminishes in a horizontal oven that is not covered with such a thick hot-bed, nor with so compact a dung as those we have just mentioned, I mean in such an horizontal oven as those I have caused to be constructed at my house, and when you have not directly at hand dung as hot as you could wish, nor a quantity of it sufficient for a thorough renewal of the heat, there is a means to increase and keep up that heat, which is the same we have already proposed for the ovens made of a cask; it consists in introducing pans full of hot wood ashes, or of small coal-duft well lighted; the whole, in that case, is at once a chicken-oven warmed with dung, and on urgent occasions by means of a shift, which costs scarcely any thing, it is always easy to hinder the eggs from being cooled to excess.

We have sufficiently explained why the heat is not equal, at the same height, the whole length of any one of these horizontal ovens, and why it is always weaker in the part which is nearest to the door or the mouth of the oven than any where else: hence it ought to be inferred, that the eggs would be warmed too unequally in a box that should be almost as long as the whole inside of this oven; it is then fit to make it only half as long or a little more: the vacancy it leaves has its peculiar use: the carriage, or the box on it (for it is all one) is pushed further into the oven, or drawn nearer the door according as the degree of heat is weaker or stronger. This box is nevertheless still large enough to contain above three hundred eggs at once: a greater number might be put into it, if you are inclined to put more than double rows of them, and the thing is feasible, provided you put the eggs at different days; those which are piled above are always those in which the chicken is farthest from being hatched. You may treble, or even quadruplicate the rows without any risk in two thirds of the box by means of two transverse partitions that shall divide it into three equal parts; you will always have two of these third parts wherein the eggs may be heaped up without any inconvenience; those that have already been warmed during a greater number of days, must be kept in the other division, where there ought to be but two rows of them at most, the uppermost of which must not be so numerous as the inferior, that the eggs of the latter may not be intirely hidden by those of the former. This disposition is essential, and will enable you to find the egg whose chicken informs you by his squeaking that he is actually striving to break through his shell, and to give him a greater facility of doing it, by putting that egg in the upper-stratum, where he shall not be incumbered and

loaded with the weight of any others. As the division wherein the chickens are hatched is gradually exhausted of its eggs, those of the other divisions whose chickens are left remote from the time of their birth are successively introduced into it.

By heaping up after the above-mentioned manner the eggs in the two thirds of a box, the number of those that may be warmed in it will be considerably increased; that number will even be doubled, if the oven made like the second we have proposed, is twice as wide as the first; you must put into it two carriages by the side of each other, being each of them charged with its box: you will in short have as great a quantity of eggs warmed at once as you please, by either multiplying the number of these ovens, or by making them wider.

The carriage is a very convenient support of the egg-box, as it renders it very easy to be brought towards the mouth, or pushed towards the farther end of the oven; I have also made use of another kind of support, which is but little less commodious, and much more simple; It is a kind of floor contrived and fixed in the oven at the height at which the box is judged to be placed most suitably: this is laid upon the said floor, on which it is made to go freely backwards and forwards; as you push backwards and forwards the drawer of a bureau, or of a chest of drawers. The motion of the box is rendered still freer, by putting casters under it.

You have several times a day an opportunity, especially when the chickens are hatching, to convince yourself how important it is, that the egg-box may be moved with ease, whenever you have a mind, either out of prudence or out of curiosity, to see what passes in it: you ought not to neglect the taking it, once a day at least, quite out of the oven,

oven, not indeed to leave it a long time out, for it must be put into it again, after having turned its remotest end forward. It is easy to judge that the aim of this turning is, that the eggs which were in a less warm air may be removed into a warmer, and the reverse: They are all of them much better for such a change of place, and they will be better still if they are made to change their places twice a day; this must be done even more frequently, when the heat of the bottom of the oven rises too much in proportion to that of the other parts of it.

When the box which is to be turned is very full of eggs, it is a no inconsiderable burden: to the end, therefore, that a man may not be obliged to load his arms with the whole weight of it, and that he may manage it with greater ease, a table * * Plat. is put without and quite close to the oven, whose VIII. Fig. upper-part is at the exact height of the under-part 3. Q. of the carriage, or of the floor that bears the egg-box: thus it becomes easy to make it slide out upon that table, and to turn it when it is upon it. I have had a door made to one of my ovens which is fastened at its lowest end †, and folding in its † T T. middle §; this folding part will save the expence § V V. of a table as it stands in lieu of it; one half of the door may be put in an horizontal position, and be fixt and kept in that position by one single prop ||, || X. which being put upright under its middle part, becomes a sufficient support for it.

An *Explanation* of the figures of the fifth Memoir.

The Head-piece.

The head-piece represents a coach-house wherein there are the apertures or mouths of two horizontal ovens to be warmed with dung, that is, of two

of those which are made of a wooden box six or seven feet long. The bodies of both these ovens are in another room, separated by a partition of boards from that where the two mouths are.

a, the door of one of the ovens. To open this door, they make it move upwards in grooves which receive the edges of both its sides.

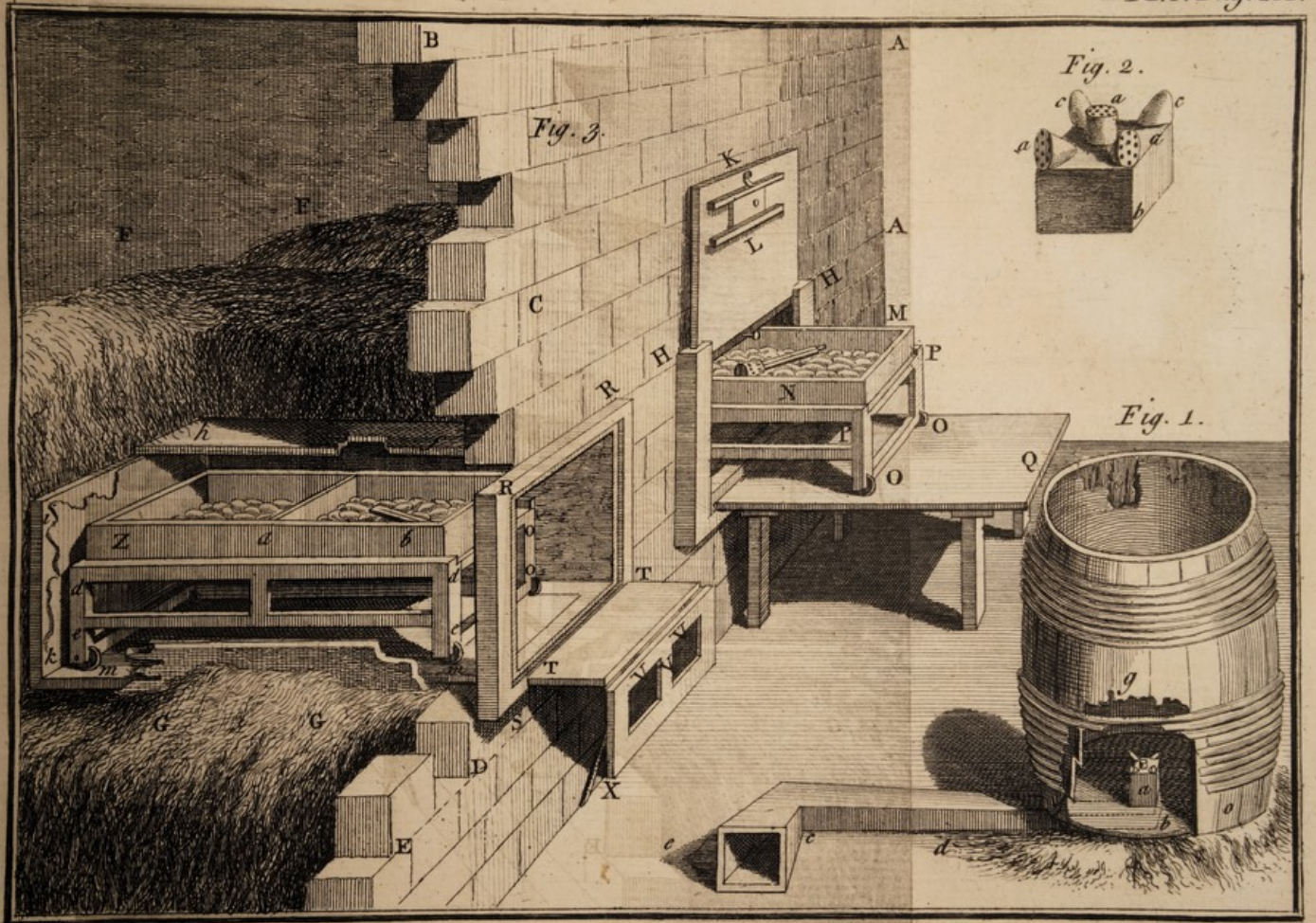
The first figure is disposing a table before the mouth or door of the oven: the table will serve to receive the carriage which is loaded with the box full of eggs, when it is drawn either intirely or partly out of the oven.

b, and c, mark out but one single oven, divided into two in its whole length, this oven, which is almost twice as wide as the oven a, is one third lower. The door of part b is shut; it is a door folding in the middle, and is opened by letting down: when it is open, and supported in a position parallel to the horizon by the stick e, it performs the office of a table to receive the carriage on. The second fig. has already got one part of the carriage upon that table.

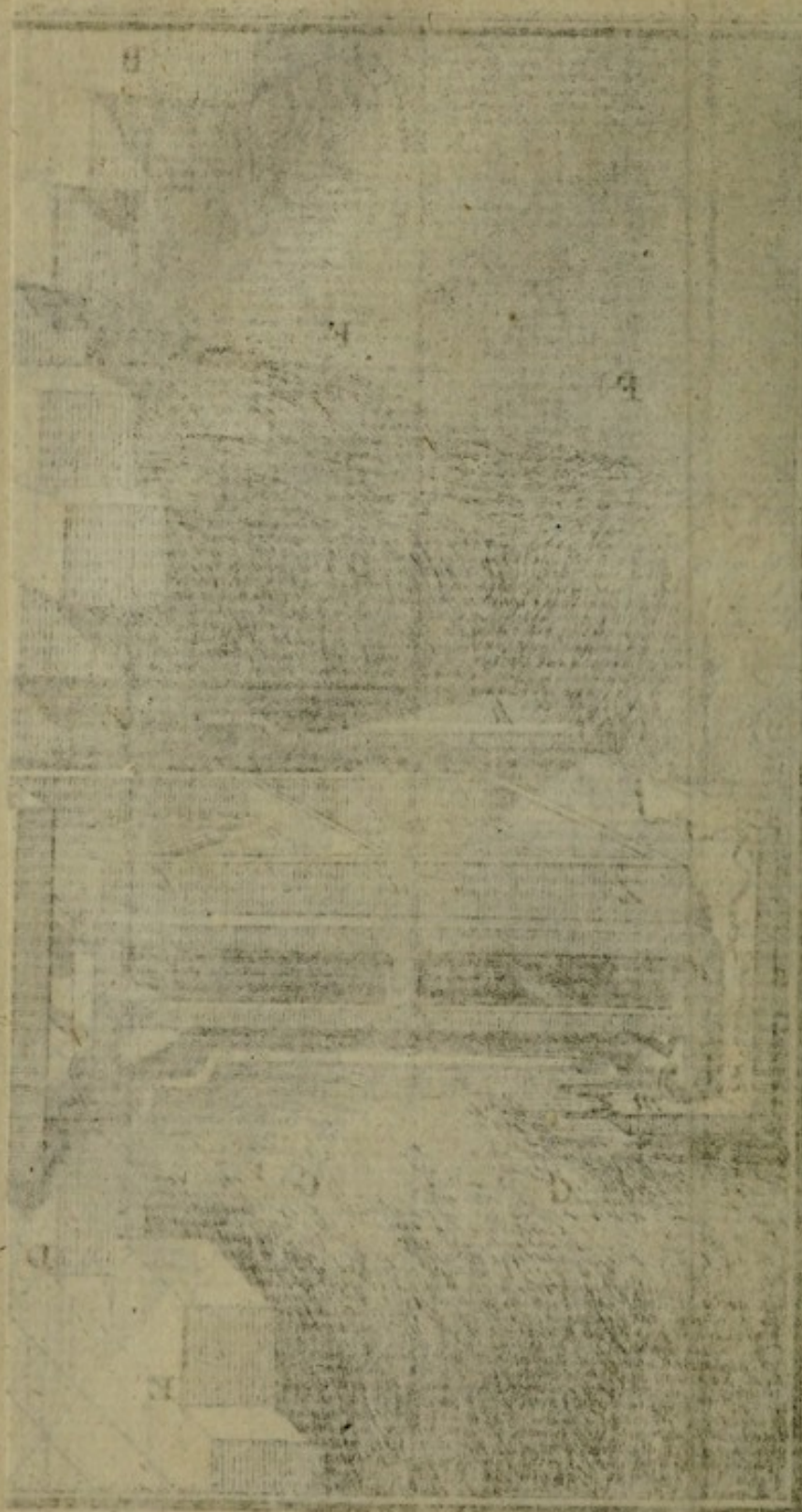
PLATE VIII.

The first figure is that of one of the casks designed to be made an oven: it has been broken at f g o, to shew how the extremity of an air-pipe which is to serve to introduce fresh air into the oven is conveyed into it. e, the funnel of the air-pipe. c d, its principal conduit, which lies under the cask. b, the place at which the short pipe joined to the foregoing conduit, enters into the cask. a, the extremity of the pipe b, garnished with several smaller tin-pipes bored like a water-pot.

The second figure exhibits the extremity a of the pipe a b, fig. I. drawn larger. b, a part of that
I pipe.



J. Mynde sc.



pipe. a, a, a, c, c, are all of them tin-pipes bored like a water-pot: the position of the two c, c, hinders one from seeing their holes, but those of the pipes a, a, a, are seen.

The third figure is intended to give a just idea of the position and figure of the horizontal ovens, that is, of those whose aperture is vertical, and which are made of a box six or seven feet long, more or less, as you please. Two of these ovens are represented here: nothing but the aperture H H I of the first can be seen; but the parts of the wall and even of the box and dung that have been taken away, expose the inside of the second to open view.

A A B C D E, a wall that has been partly pulled down at B C D E. That wall separates the room in which the body of the oven stands, and wherein it is covered with a hot-bed of dung, from the room where the mouth of the oven is: this separation might be effected by a partition of plaister or of planks: It was of planks in the place where I have constructed ovens of this kind. F F, a hot-bed of dung that covers one of the ovens. G G, the dung under the oven set in an open view.

H I, H, a couple of props which are at the mouth of the first oven, and within the grooves whereof the door K with which the mouth is shut, may freely slide up and down. L, one of the two wooden ledges within which there slides horizontally a small board or shutter, by means of which the heat of the oven may be moderated at pleasure: that shutter is a register.

M N, a box full of eggs drawn in part out of the oven, as it is drawn whenever one has a mind to examine the state of the eggs and the degree of heat of the thermometer, which lies on the eggs

within the box, and to see whether there are any chickens come or ready to be hatched.

P O, P O, the two feet of the fore-part of the carriage that bears the egg box; they have each of them a cafter O.

Q, a table which ferves to fupport the carriage when it is drawn: either in part or intirely out of the oven.

R R S, the mouth of the fecond oven; the other oven has a door that is lifted up, and the door of this is let down.

T T, V V, the door of the oven, which is a folding door made of two pieces put together with turning-joints at V V: the part T T is faftened to the box with double hinges: that part ftands in lieu of the table Q of the foregoing oven, when it is placed and fixed horizontally with the ftick X, that ferves as a foot to it, and is vertical here, although people not ufed to perspective may think it to be inclined. Y, marks out two registers which are on that door. When the two halves V V and T T of that door are lifted up and put again in the frame that furround the mouth of the oven, this mouth is well clofed.

Z a b, a box full of eggs which is within the oven, the upper-part of that oven has been removed, to put that box into full view. a, a fmall partition that divides the box into two parts. It is ftill more convenient, for a reason which has been explained in the fifth Memoir, to put in it two partitions to divide it into three parts. The thermometer is put in this box upon the eggs of the foremoft divifion.

d d e e, one of the fides of the carriage which is loaded with the egg-box; e e, its cafters.

f h, the upper brink of one of the fides of the box that makes the oven, to which the upper-part now taken off was faftened.

h i,

hi, the back of the oven. The wood appears at hi, but it is covered with plaister below that place: the plaister is supposed to have been shook by the hammering that has taken off the upper-part of the box.

m, m, some remains of wooden rulers that run from one end of the oven to the other, and which the casters of the chariot rest on; because they roll more freely there than they would upon the plaister with which the bottom of the oven is covered.

o, o, a part of the carriage that may be seen through the mouth of the oven.





M E M O I R VI.

Of the hatching of the chickens.

T
 HE most interesting instant in this process is that of the birth of the chickens ; we have scarce spoke of it till now, and it requires to be treated more at large. The instant which rewards all the manager's care, requires he should give himself some farther trouble about it ; he may save the life of some of his chickens, who would die if he did not help them to get out of their shell ; he may do more than the hen can do for those she has brought to the time of hatching : she does them at that time no very essential services, tho' many people imagine it : those who fancy it to be the office of the hen to pierce the shell and break it with her bill, will find in the foregoing Memoirs, more facts than they want to put themselves out of conceit with that notion. The hen, 'tis true, gives tokens of satisfaction, when she hears the chicks squeak in their shells, she shews at that time a greater affection for her eggs, she is less willing to suffer them to be touched,

touched, at that time, than she ever was before ; but she does not strive to break open their prison with her bill ; nor has she been taught how to do it : if some of them happen to yield to the impression of an impatient love, and to strike an egg with the point of their bill, the little one is in danger of being hurt by it. Hens in general use their bill at that time only to turn up the eggs to make them change places, and sometimes to throw out of the nest the broken pieces of the shell which the chicken has at last struggled out of : it is on the same occasion an offensive weapon also for most hens against the hand which offers to introduce itself under their belly.

The chicken inclosed in the egg is alone charged with the whole work before he can set himself at liberty : one would be apt to think that work much above his strength, did not daily experience teach us what a share of vigour he has, and how well he applies it when the state of it makes him feel how much he wants to come into the world, in order to begin to enjoy an active kind of life, vastly different from that he hath passed in the most perfect ease and tranquillity. The manner in which the outward parts of his body are situated, would not make us think him able to overcome the obstacles which oppose his coming out of an habitation now a prison to him : he is at that instant roll'd up almost like a ball *, his neck comes sloping * Plat. XI. towards his belly, about the middle whereof his Fig. 1. head is placed : his bill lies under one of the wings like that of a sleeping bird ; and that wing is constantly the right : the feet are gathered up under the belly, as those of the chickens and pigeons ready trussed for the spit sometimes are : and the claws bending backwards, touch almost the head with their convexity. The forepart of the chicken is generally towards the biggest end of the egg, where there

there is always a vacancy : a thick strong membrane furrounds him, and keeps him in that attitude, which seems to be so unfavourable to the motions he is in appearance obliged to give himself : it is nevertheless without changing this attitude that he performs the most difficult part of his task, breaks his shell, and tears the solid membrane in which he is wrapt up, and which resists his struggling as much as a hard but friable shell can do.

The shell is a kind of wall which must be broken through and pulled down : the bill is the instrument which is to be used to break it : it is with the point of this, the chicken strikes many repeated blows ; they are frequently strong enough to be heard, and if you know how to watch the critical moments, you will see him strike them ; nor is the head the less constantly under the wing for this : we said too little when we compared it to that of a sleeping bird ; it reaches further under the wing, and the bill comes out from under it towards the back * ; the head, by moving alternately backward and forward, and the reverse, or more exactly from the belly towards the back, and from the back towards the belly, reaches and strikes the shell more or less roughly, according to the quickness of its motion : whilst in action, it is in some degree guided by the wing and the body, that contain and hinder it from leaving its place : the head is very heavy : for the bigness of the head of the chicken ready to be hatched, is very considerable with regard to the bulk of his body : it makes together with the neck a weight so very heavy for the chicken, that he is incapable to carry it for some time after his birth ; but the manner in which all his parts are disposed whilst he is in the egg, and whilst they form a kind of ball by their disposition, renders that weight of the neck and head then easy for him

* Plat.
IX. Fig.
1 and 2.

him to bear : let the egg be in what position soever it may, the head is supported either by the body, or by the wing, or by both together : in fine the more considerable the bulk of the head is, the stronger the blows the chicken strikes with it are.

One need only consult the figures that have been ingraved from the excellent observers, who from day to day have followed the several progressions of the increase of the chicken during the whole time of the incubation, and who have made it their study to set them before our eyes, to be informed that the outward parts of the chicken are otherwise disposed during the fifteen or sixteen first days than during the four or five last : we shall not then undertake to describe the differences which the said outward parts exhibit at those different times ; we shall content ourselves with saying, that among the parts which were straight, stretched out, and extended from the body during the first days, some are during the last bent at the places of their articulations, others curved, and all of them drawn much nearer the body : but what I would observe here to the reader above all, is, that the disposition of the outward parts does not give the whole bulk of the chicken the form of a ball, and that the bill is not conveyed under the wing, but as the time when that disposition will be necessary approaches : it is a fact that when that time draws near, the legs and the neck are grown so very long, that the chicken is obliged to gather them up in order to procure sufficient room for them in the cavity it is lodged in : and what is still a wonder here as well as in all the operations of nature, is, that what seems to be done out of necessity, is the best that could possibly have been done out of choice.

The

* Plat.
IX. Fig.
3. f.

The result of the first strokes of the bill of the chicken is a small crack, sometimes simple and sometimes complicated, I mean that it is sometimes but one single crack, and that sometimes it is composed of several cracks of unequal length, and joining in one center*, that is irregularly radiated. This first crack is most commonly situated between the middle and the biggest end of the egg, and is nearer to the latter than the former: the forepart of the chicken is turned towards the biggest end, and the hindpart towards the opposite. However, I have found among the many thousands of chickens which I have had an opportunity to see hatched, a few of them who had broken through their shell nearer the smallest than the biggest end, and I have seen a young turkey who had cracked his shell in the same manner: nevertheless the empty space was made in the bigger end of the eggs broken contrary to the usual order, as in the others: the forepart of these chickens was lodged within a narrower compass than the backpart, whereas it is usually the reverse: but notwithstanding this inversion of their position, they live every whit as well as those which happen to be in a more natural one.

When the crack is sensible, they say that the egg is pecked; it becomes so more and more as the strokes of the bill are more frequent; they sometimes break off some small fragments that leave the white membrane they were lined with quite naked: I have seen some of those shreds pushed so hard, that they were thrown to the distance of three or four inches from the egg. The membrane from which the first fragments of the shell are but just thrown off, is generally whole and sound; nor can any rent be perceived in it with the best glass: this, probably, is what has induced some to think that the eggs were pecked by the hen: the work seeming to have been begun

gun without the egg, people thought that if it had been done by the bill of the chicken, the membrane against which it strikes immediately would have been pierced through before the shell was broke: They have not sufficiently reflected, that the membrane being pliant and clapt against the shell, it might resist such strokes as would crack and split a matter of a more rigid and brittle nature. Strokes applied to a drinking glass covered with paper, would break the glass without tearing the paper. When the strokes of the bill are directed against the membrane which is no longer covered with the shell, they then push it beyond the point of extension it is capable of, in which case they infallibly tear or pierce it.

I am not certain whether all chickens do what I have observed of one which I have seen by night hard at work by the light of a wax-candle, he was pecking with his bill upon the membrane divested of its shell: he did not strike against it, he seemed to be striving to wear it out, and make it thinner by repeated frictions, which must needs have rendered it more easy to be bored or rent when it should be vigorously and smartly struck against by the bill.

However, if there are among chickens any that are better informed than the rest of the method, which is most advantageous to them for the doing of this work, it is certainly those which are in no hurry to break the membrane, who tarry till the fracture of the shell is become more considerable, or till they are able to render it so very soon: we shall see the reason of it hereafter. The continual blows lengthen the first cracks, they fling off new pieces of the shell, which they strike successively in different places, but all of them much at the same height *: the blows must run (as they really * Plat. do) almost round the whole circumference of a IX. Fig. circle which is parallel to both the extremities of 4. f b. the

* Fig. 5. the egg *; the bill does nevertheless remain still under the wing, and always in the same position. It is to be observed here, that as the chicken is to strike the shell successively in almost the whole circumference of a circle, he must needs turn gradually, till he has completed almost an intire revolution. I have not been able to observe this rotative motion, because the shell hides it from our eyes; but, had I even seen it, it could never be better demonstrated by that, than it is by the several places at which the point of the bill appears whilst the head is continued constantly under the same wing: it keeps that position so strictly that it preserves it for a small time after the separation of the shell into two portions leaves the chicken for his exit a door almost as wide as the habitation he is going to quit. The revolution the chicken makes on his own body, is always effected the same way, not even excepting the odd case in which he begins to peck his shell nearer the smaller end; he protracts the fracture from the left to the right, and gradually gives it nearly the length of the whole circumference of a circle described by his bill; he therefore makes a whole revolution from the left to the right on his own body.

It is more easy to convince one's self, that the chicken makes by little and little a whole revolution upon himself, in order to peck his shell successively in its whole circumference, than it is to see how he can give himself the motion that makes him turn: the parts of his body he makes use of for that purpose, are hidden from our eyes by the shell, nor could we succeed better in trying to see them at work by laying them open, because this would deprive them of the point of support without which they never could move to any purpose: It seems however to be certain, that his feet are the only parts he can possibly make use of in that situation

to move circularly. The claws, when they press the shell through the membrane that separates them from it, find in that shell the resistance which is necessary to push the chicken the way he wants to turn. You will easily judge that the feet are capable of a greater effort than is required towards effecting the motion we now suppose, by considering that it is the feet, and those alone, that help the chicken to come out of his shell: the wings and all the other outward parts of the body (the bill excepted, or the neck, for it is all one, the neck being the mover of the bill) are incapable of any action whilst the chicken is imprisoned in the shell. But is it against all probability that the blows which the bill gives to the shell to break it have a re-action upon the whole chicken, which is sufficient to produce any small displacing of the whole mass, and to make it describe a circle by little and little? A very plain experiment seemed to me very fit to determine whether a notion, not destitute of probability, was a real fact. Were it so, the chicken would be incapable of turning himself in case the bill should be in a place where it had not a solid support for it to lean and strike against: it could not, in such a case, produce that re-action which was judged necessary to cause the body of the chicken to turn. Now, it was easy to take from the bill that solid support against which it was supposed necessary to act; all to be done for this purpose was to protract the fracture towards the right, to break off pieces of the shell that way, and also to tear the membrane: the bill could then strike against nothing but the air; so that the chicken would remain stedfastly in one place, and of course be unable to break the part of his shell as yet intire. I, then, protracted considerably the small fracture made in two different eggs, and took off pieces of both shell and membrane as far as I went, purposely to
see

see what would happen to the chicken in each of these eggs ; the consequence was, that each chicken was released from confinement sooner than otherwise it would have been. I had saved him part of the work ; and he very well knew how to change his place so as to be able to break the remaining part of his shell.

However, nothing of constancy is observed in the fracture, not even as to its position ; 'tis true, the circumference of the circle in which it is found is parallel to both ends of the egg, and most commonly is nearer the bigger than the smaller end ; but the fracture which is made in some eggs is more remote from the biggest end than that of some others, which depends chiefly on the depth of the empty space that has been made in the egg while it was sat on ; the depth of that vacuum determines the distance of the biggest end of the egg from the foremost parts of the chicken ; the fracture is broader on some eggs, and narrower on others : nay that of the same egg is of different breadths in different places ; some leave a greater and some a smaller portion of the membrane open : a very few pieces are broken off the shell of some eggs, whilst a great many are broken off the shell of others ; and you see in that case all the fortuitous irregularities of a glass-bottle broken by many repeated gentle blows of a hammer might afford to the eye. All, therefore, of importance to the chicken, and all he endeavours to effect, is, that two parts of his shell may be intirely separated from each other : when they are no longer joined, they are still retained in the same place by the membrane, to which they adhere : the chicken is then furthermore obliged to tear that membrane, and that by pecking it again and again, which he never fails to do as soon as any considerable portion of the shell has been fractured.

Finally,

Finally, all chickens do not employ equal time in doing this important work : some of them are able to come out of their shell in an hour after they have begun it ; others are not hatched till two or three hours after ; and most commonly it proves to be half a day's work : others are not hatched for four and twenty hours after their shell appeared first to be pecked. I have seen chickens remain under that difficult task almost two days together : some do it without any interruption, others take some hours of rest, after which they go to work again. They are not all of equal strength or of vigorous constitution ; there are some that from an excessive impatience of seeing the light begin to peck their shell a good deal too soon. The help which I have now and then tried to give to some of them towards their deliverance, has afforded me an opportunity to observe among them some of those that had broken their shells in too great a hurry. They must, before they are hatched, have a provision of food within them, that may dispense with taking any for above four and twenty hours after they are born ; that provision consists in a considerable portion of the yolk, that has not been consumed, and which enters into the body of the chicken through the navel : the chicken that comes out of his shell before the yolk is totally absorbed by his body, droops and dies a few days after he is hatched. I have opened many eggs much fractured, whose chicken had as yet much of the yolk not taken up.

Besides, some of them have greater obstacles to overcome than others : all the shells are not of an equal thickness nor of an equal consistence ; and I suppose that what we say of the shell must also be said of the membrane which is the immediate envelopment of all the matters that compose the egg. The shells of the eggs of birds of different kinds, are

of different thickness, this has been proportioned to the strength of the little one that is obliged to break his shell into two parts after having had his growth in it. The canary-bird would never be able to break the shell he is inclosed in, if it was as thick as that of the egg of a hen: and the hen would crush all those she should attempt to sit on, if their shell was as thin as the eggs of a canary-bird. A chicken would in vain try to break his shell, were it as thick and hard as that of the egg of an ostridge; though an ostridge ready to be hatched is perhaps thrice as big as a large chicken, we can hardly conceive how the strokes of his bill can be strong enough to break a shell thicker than our common china-cups, and whose smoothness and gloss shews that it is nearly as hard; it is in short a shell of which very large and solid drinking cups are very often made.

Among the bills of birds of different kinds, those which are sharp at their extremity like the bill of a hen, seem to have a form fitter to pierce the shell than those whose extremity is more blunt, like those of ducks. Nevertheless the young ducklings as soon, and it may seem as easily, peck and break their shell as the chickens do theirs: the main point here is not so much the figure of the instrument that strikes, as it is the strength of the blow.

I have spoken in another place of the notion one ought to entertain of the practice of the women in some countries, who dip the eggs for a little time into warm water on the day at which they are to be pecked: they fancy that by this means they do the chicken service in rendering his shell more tender: but the shell of an egg does not come sensibly less hard even out of boiling water; and had it contracted any softness there; it would reassume its first hardness in the air, when it grew dry.

The

The chicken is often contented with having made a continued track of fractures in three quarters, or thereabouts, of the circumference of his shell, and with having divided the membrane in several places, not very distant from each other. He thinks he has, and he has in reality strength enough to separate the fore-part (the biggest end) of the shell from the other at the instant when they no longer adhere to each other, but by a small portion of the circumference; his bill is no longer wanted to compleat that separation: the chicken brings it about more efficaciously and more speedily, by applying the whole mass of his body; he makes an effort by stretching out his feet to push his body a small matter forward; he no sooner succeeds in this, but his body lifts up the portion of the shell it meets in its way, because the diameter of the cavity of that portion is smaller than that of the kind of ball which the outward parts of chickens constitute by their disposition. The chicken, by thus continuing to push his body forward (and he repeats this several times) forces the foremost portion of the shell to rise more and more; he at last tears all the fastenings, or if any of them hold out, if any part of the membrane refuses to break, it becomes as to the portion of the shell what a hinge is to the cover of a pot, it is turned up and supported by it*, neither does it at all incumber the aperture necessary for the chicken to come freely out at.

* Plat. IX.
Fig. 8.

It happens, therefore, that the foremost portion of the shell is sometimes intirely broken off, and even thrown at no inconsiderable distance from it, and sometimes that it is turned up only and remains fastened to it. But, it happens likewise, and that very often, that the portion of the shell is placed in a yet more extraordinary manner: you look for, but cannot find it unless you know

* Fig. 7.
c a c.
† P q P.

where it must be looked for ; it * lies within the hind-part †, as we often put one empty cup within another : when the chicken just born, the fore-part of the shell stands before him , he pushes it back with his feet, and without any intention or need so to do, he shoves it into the other, whose cavity lies ready to receive it.

A young duckling which I observed just as he was striving to separate the two parts of the shell intirely, shewed me that he had recourse, in order to this, to methods that were like those used by the chickens for the same purpose, and those of birds of all kinds are probably the same in the like case : his shell was at most fractured in only two thirds of its circumference : the fracture was wide, and suffered me to see that the bill was placed under the right wing ; whilst the duckling was lifting at the fore-part of the shell on the side where it did not resist, because all its fastnings were broken that way ; by which method he forced the shell to break on the side on which it was as yet intire.

When the chicken has at length been able to turn up, or, at least, to heave sufficiently the fore-part of the shell, he has thereby procured to himself a door, or means to go out of the hind-part, he stretches out his legs as yet weak, their motions are still insufficient to carry him, but their stretching throw him forward : being then either intirely, or almost out of his shell, he draws his head from under that wing where it had kept constantly ; he stretches out his neck, he directs and bears it forwards, but is not as yet strong enough to raise it, and he is often several minutes before he can do this. When we see a chicken for the first time in that condition, we have no opinion of him, we judge that his stock of strength is exhausted by the efforts he has made, and we think him almost ready to expire : some time after, which commonly is
very

very soon, he appears quite another creature; all his parts gather strength; after having dragged himself on his legs for a little while, he becomes able to stand on them, to lift up his neck, and give it a variety of inflexions, and finally to hold his head up streight. The feathers he is covered with are only a fine down, and whilst they remain wet they make him appear almost naked. These sorts of feathers seem by the multitude of their branches, to be so many small shrubs: when those branches are wet and sticking to each other, they take but very little room: but as they dry, they untangle and part from each other. The branches, or rather the beards of each feather, were kept and pressed close to each other by a kind of pipe within which they were lodged: this pipe is made of a membrane which breaks as soon as it dries; and the spring of the beards which inclines them to recede from the stem contributes to this effect. When all these beards are spread as it were, each feather so composed, takes up a good deal of room; and when the feathers are all dry and streight the chicken is covered with a coat which is extremely warm and pretty.

Thus much has been said for the sake of those who love to know the several means employed by the author of nature to perpetuate his manifold productions, especially those that are animated; who love to know how animals that have not as yet been struck with the sight of any outward object, and are besides extremely weak, yet perform operations that shew they have a desire of coming to light, that they are instructed how to execute many operations that seem to require a knowledge, a strength and a skill which one would not be apt to think them capable of, and which they cannot have acquired by repeated acts: all these things required the more to be mentioned concerning the

chicken, as all the effects which are produced at the time of its birth, have not been described by any of the learned observers who have followed the whole course of the incubation of the eggs. We are now to speak for those who are chiefly desirous to multiply the number of their chickens. There is hardly any brood of eggs that will not afford a few chickens more than common, when a helping hand completes the hatching of some whose labour has not been sufficiently efficacious: some of them are weak, others, though not destitute of strength, yet want to be assisted, because they meet with too much resistance, either from the shell or the membrane: but, there are some, which although they are as strong as chickens ready for birth can possibly be, and inclosed in a membrane and a shell of but a common thickness and consistence, yet are altogether unable to open to themselves the aperture necessary for their coming forth, and are even utterly incapable of setting themselves at liberty, although that door should be opened for them: some peculiar circumstances have deprived them of power to revolve upon themselves, and to make that circular motion which we have observed was so necessary, that the repeated strokes of their bill might successively break at least a very great portion of the circumference of the shell: their body is fixt in the same position; it perfectly sticks to the shell. To be sensible how a chicken may be glued to his shell, and how this is brought about, we need only know that between the membrane and his body there remains of a clammy fluid which is the white of the egg; this fluid by drying, becomes a real glue, very apt to cause the feathers to adhere to the membrane they touch: the chicken of an egg in which that fluid has been more thickened by an intense heat, is in greater danger of being thus tied to the shell by his feathers: nevertheless

theless this dismal accident does not generally happen to him till after having made a pretty wide fracture in the place that was first pecked, he has rent the membrane in that very place, and then has remained at rest a good while : the air that was introduced into the cavity of the shell through the fissure, has directly changed into a dry hard glue the liquor that was next the brink of the aperture, and that of some other parts within ; afterwards when the chicken would return to his work, he may use his bill indeed, but he no longer can make his body move : the attempts he makes towards it are painful to him ; they are apt to tear his feathers, and force him to squeak : he has no longer any desire to repeat the same trials, and when he happens to reiterate them, they expose him to new pains, and are as little successful as the first.

We may have tokens sufficiently certain that a chicken is in this condition, in which he needs must die, if not assisted. Whenever you observe that a pretty large fracture * that has been made in * Plat. IX. a shell together with a rending of the membrane, Fig. 4. fb. remains the same for five or six hours, and is not enlarged, you may conclude from it that the chicken adheres to the inside of the egg : if you look with attention on the brink of the hole made in the membrane, you will see it dry, no fluid will appear to moisten it, and it will even sometimes be apparently covered with feathers sticking to it. You must not hesitate in that case to do for the chicken, what he would infallibly do were he not deprived of all liberty of acting : by many gentle strokes of a hard body, as for instance of the end of a key, you will lengthen the said fracture till the whole circumference is completed, and then tear the membrane which is under the fracture : this may be done with a small point, as for instance of a pin or of a pair of scissars, but you

must take the utmost care not to let it penetrate into the cavity of the egg any further than is necessary to effect the intended rent. You may often, without any danger to the chicken, tear the membrane round the whole circumference of the egg with your nails or with your fingers, by making the gentlest efforts to take off the fore-part of the shell, which is already separated from the other by the fracture; the membrane that sticks to it is torn by the efforts made thus against it. But generally one ought not to attempt to break off all at once the whole fore-part of the shell; and the resistance you experience in that case, is a sufficient warning that you cannot do it without causing an excessive pain to the chicken. When the resistance proves to be too great, you must break the said fore-part of the shell into many pieces, which must be separated gently from each other afterwards, that so the chicken may lie quite open; there are among those pieces of shell, some that must be taken off with singular circumspection; I mean those which cannot be pulled without making the chicken squeak, and to which his feathers are glued: when the extent within which the feathers adhere is not very considerable, you may pull them notwithstanding the cries of the little creature: you sometimes tear his feathers off: but most commonly the feathers themselves tear off the shell the part of the membrane to which they adhere. After the chicken has been thus freed from all the parts of the shell, there remain upon his body several flat scales of different width, which are so many pieces of the membrane still adhering to the feathers. This spoils his coat for three or four days only, at the end of which those membranous scales fall of their own accord. It happens sometimes that the chicken adheres not only to several places of the fore-part of the shell, but also

to

to many places of the hind-part from which he must likewise be separated.

This operation, though very painful to the chicken, yet is not mortal to him : he no sooner gets rid of it, but he appears to have as much vigour as any new born chicken : but it is in the power of the person that saves his life to save him the pain also ; he needs but moisten with the corner of a piece of linnen dipped in warm water, the places where the feathers adhere to the membrane the shell is lined with, which done he may unglue them without the hard necessity of tearing them off the body, or of renting fragments of the membrane.

The chickens which have their feathers glued to the inward surface of the membrane, are not the only ones whose life may be saved by our help on their hatching : there are some, as we have already said, that cannot arrive at breaking through their shell for want of strength or the having too powerful obstacles to conquer. This must be judged to be the case of the chicken in any egg that remains pecked for above half a day, or for a whole day together without any further extension of the crack to the right, and without any renting or even any uncovering of the membrane. In that case, you do him a kind piece of service to cause him to be hatched, and you do it too without giving him any pain : After having fractured the shell all round its circumference, and torn the membrane, you will find no difficulty in taking off the fore-part of the shell. If this help does not come too late, the chicken is no sooner exposed to the open air, but he pulls his head from under his wing, stretches out his neck, and most commonly is not long without making the necessary efforts to come out of the portion of the shell which he still is in.

This

This assistance, which is so important to many chickens, might prove fatal to others: for which reason I would advise the readers not to attempt it in too great hurry. My opinion is that the facility of coming out of their shells, ought not to be procured to any but those which have been near four and twenty hours together, without getting forward in their work. There are chickens, as I already observed, which shew too great an impatience to peck their shell, and do it before the yolk is entirely got into their body: it would prove fatal to these, were they inabled to come out of their shell a few hours after they have pecked it. I have, nevertheless, many a time caused chickens to be hatched, which had pecked their shell for the first time but half an hour, or even a quarter of an hour before: nor did I do this for the good of chicken, but barely to satisfy the curiosity of the people who deserved to be indulged, and who having seen how eggs were artificially fat on in my ovens, were desirous of having the pleasure to see a chicken come out of his shell. Those chickens whose birth was thus rendered premature, were never the worse for it afterwards, when there appeared no yolk left out of their body at the instant of their coming out of the shell. However, it is generally better to let the chicken come out of the shell of his own accord; for in that case he is hatched only when his limbs are become sufficiently strong, and when they have assumed in the shell a consistence and vigour which they would not be so sure to acquire if they were exposed to the open air.

I have found both among the chickens that were hatched of their own accord, and those which I have assisted, some that notwithstanding the perfect consolidation of the place through which the yolk had been introduced into their body; had nevertheless still without it portions of intestines some
longer

longer some shorter : one might think that these portions had not been inclosed in the capacity of the belly at the same time when the rest was ; but it is no less probable that all this is the consequence of the efforts the chicken had made towards being hatched, and that they had brought on him a rupture : this is a considerable illness to him, and commonly fatal in a very few days.

An *Explanation* of the figures of the *sixth* Memoir.

The Head-piece.

The head-piece represents a shed on all sides independent, whose roof is supported with four pillars, and under which chicken-ovens made with casks have been constructed. They are not exposed there to any strong vapours of dung, which cannot hang in any hurtful quantity under a shed of this kind. But the wind might happen to blow too fresh on it at certain times, or the rain be driven into it at others, or in short the sun act too powerfully upon the hot-bed : but a curtain r, put on each of its sides, will shelter the hot-bed against the wind, the rain, and the sun : according to the exigency of the weather, one of the curtains must in that case be shut and the other three be left open.

These ovens are supposed to be examined in a moment when chickens are hatched out of them in great number, and when a good many are hatched already. Among the figures which are about and near the ovens, some are busy about drawing out of them the chickens just hatched, and others receive these chickens into baskets, to carry them directly to the chicken-house. The two streight figures which are more distant from the ovens, are busy about taking out of their eggs already pecked chickens

chickens unable to break through them on account of their adhering to the inside. One of these figures is now breaking gently with a key a shell of which he would widen the aperture, in order to be able to separate the feathers of the chicken from the membrane to which they adhere, or to pull off fragments of that membrane.

PLATE IX.

The first and second fig. exhibit each of them a chicken drawn out of his shell at a time when he was very near hatching, and had already begun to peck his shell, that is, to crack it with his bill; his outward parts are disposed in such manner that their whole bulk makes a kind of ball: the chicken of each of these two figures has his bill under his wing; but the wing covers the head of the chicken of fig. 1. much more than it does that of fig. 2. which is conveyed further over the back: there are only a few feathers thrown over the head of the latter, whereas that of the former lies almost intirely hidden under the wing.

The third fig. represents an egg which the chicken has but just begun to peck, there appears at f an irregular crack, from which no piece of the shell is as yet fallen, and which is the work of the first strokes of the bill. When the chicken continues such a fracture, he protracts it towards b.

The fourth fig. exhibits a fracture that fills up nearly half the circumference of the egg. The strokes of the bill have made it wider than they generally are, nor has the chicken been the better for it: the liquor which wetted his feathers being too much exposed to the air, is grown dry, and has glued the said feathers against the membrane, which is the wrapper of all the outward parts of the chicken. This chicken is in the case of those that must die,
if

Fig. 1.



Fig. 2.



Fig. 3.

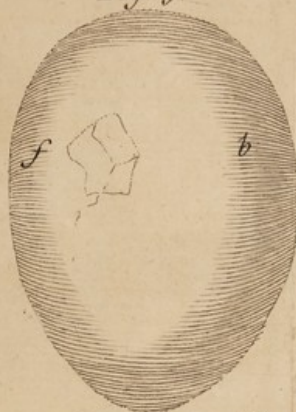


Fig. 4.



Fig. 8.

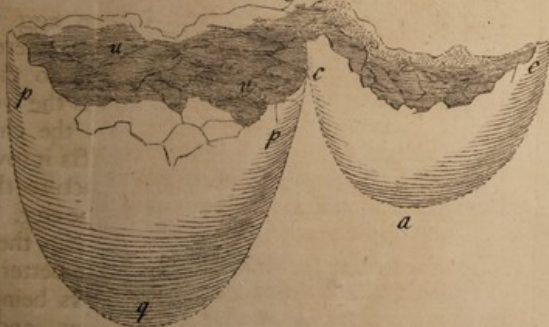


Fig. 7.



Fig. 6.



Fig. 5.



... of the other, by a piece of membrane,
as the corner of a box hangs on the body of it by
means of a hinge. The break itself is not, and on
the other parts of the membrane that covers the
inside of the shell are the blood vessels which are
carried in a wonderful manner, and which we do
not pretend to have imitated here very exactly.

M.E.

if a helpful hand does not extricate them from their shell, by doing for them what they are utterly unable to do for themselves.

The fifth fig. is that of an egg whose shell was pecked all round its circumference, the chicken has nothing more to do but to heave up the piece *c a c*, and make it fall away.

The fifth fig. exhibits a chicken that has thrown off the fore-part of the shell, which lays him quite open: he has been uncovered still more than he naturally would be, by taking off the fore-part of the remainder of the shell. This was done purposely to expose to the eye a part of the thigh that might make one judge that his foot was inclined to stretch out, and push forward the chicken whose bill lies still under his wing.

The seventh fig. exhibits an egg-shell out of which the chicken is come, and whose fore-part after having been broken off has been pushed into the other by the motions of the chicken. *p q p*, the hind-part of the shell. *c a c*, the fore-part got into the other. This case is no rarity, and the portion of the shell. *c a c* is sometimes so nicely ingaged with the other, that you suspect it not to be there.

The eighth fig. represents another egg-shell whose chicken is just come out of it. *p q p*, the hind-part of the shell. *c a c*, its fore-part turned up, and still hanging on the other by a piece of membrane, just as the cover of a box hangs on the body of it by means of a hinge. The streaks seen at *uu*, and on the other parts of the membrane that covers the inside of the shell, are the blood vessels which are ramified in a wonderful manner, and which we do not pretend to have imitated here very exactly.



M E M O I R VII.

Methods for replacing the mothers of which chickens hatched in ovens are deprived.



THE art of hatching chickens in what quantity we please would be perfectly useless to us, if there was no probability of our being able to bring them up. This part of the task has been perhaps looked upon as the hardest; the impossibility men fancied they saw in the execution of it, most likely caused them, as we have already said, to neglect constructing chicken-ovens like unto those of *Egypt* in countries where all arts are cultivated and industry encouraged by rewards. What could we do, say they to themselves, with so many chickens hatched at one and the same time, and deprived of those mothers which are so necessary to warm and shelter them against the injuries of the air? However, this difficulty would never have appeared to them unconquerable, had they taken the trouble of reflecting on it, and sought after proper methods

methods to remove it : It ought not even to have stopped those who know that, instead of a leading mother, a leading father may be given to chickens hatched under hens, and that a capon duly instructed will lead, tend, and warm the chickens trusted to his charge with as much care as the mother under whom they were hatched could do.

Now, it has for many years been a well known fact, that a cock may be made to contract both the inclination and the skill which seem peculiar to the mother-hen alone. *Gesner* says in his *Ornithology*, that this fact was attested by a great many moderns of his own time, and he even quotes *Albert the great*, who asserts that he has seen a cock foster chickens.

Willoughby, in his *Ornithology*, speaks of the same fact as an eye-witness of it ; he says, that he had more than once, and with great pleasure, seen a capon perform very well all the functions of an affectionate mother with chickens entrusted to his care. Almost all the authors who have wrote of rural œconomy, have taught us the manner in which we ought to give a capon an inclination for the leading and tending of new-born chickens : however, country-people are not sufficiently informed that capons may be substituted instead of hens for that kind of business : at least our peasants are not so mindful of giving them that employment as they ought to be. I have had many repeated opportunities of convincing myself with my own eyes, that capons perform this office very well : a lady, a relation of mine, and generally respected by all who know her for her good nature and extraordinary sense, has a vast number of chickens brought up every year, and not one of them taken care of by any but capons : I have seen very frequently at her castle of *Vaujour* by *Livry*, above two hundred chickens that had only three or four capons for
their

their leaders; for one of the advantages to be got by giving them that office is, that a capon may be trusted with two or three times as many chickens as may be given to a hen. Another advantage of this œconomy is, that you may trust a capon with chickens at any time you please, he is always ready to accept of those you think fit to commit to his tuition, he even seems to be prouder in proportion as their number increaseth, whereas hens abuse the young chickens offered them when their age is a little different from that of those they have hatched and tended from the moment of their birth.

Another benefit resulting from the custom of intrusting capons with chickens is, that you lose not the eggs which your hens would have laid during part of the time they would have been busy about tending their brood: but the desire of laying eggs, which is generally suspended by that care, is sometimes too soon renewed in them; in which case they give up to themselves the care of chickens as yet too weak, whereas they are never given over by the capons but when they are no longer pleased to be under tuition.

These are very essential benefits, which cannot be unknown to country-people; why then do we see so seldom in our country villages capons at the head of a brood of chickens, why is it a rarity even in the countries where the ways and means of enabling capons to do it are not absolutely unknown? These methods have been taught a great while ago by *Porta* in his natural magick, *Book 4. Chapt. 26.* He directs us to pluck at night the feathers off the belly of the capon to be taught, and to make that naked part of his skin painful by rubbing it with nettles, and to put chickens under him that very night or the following. Others will have us add to this method, as a surer receipt, to make the capon drunk by giving him wine, and to range the
chickens

chickens under him whilst he is intoxicated : some people have mentioned the effect of that drunkenness as if it gave room to the capon to think, at seeing himself surrounded with chickens when awakened, that he has been transformed into a hen, so as to give him, or cause him to contract all the inclinations of that creature.

These proceedings, which may have been given out as equally sure and plain, must have given a disgust for making this use of capons, to all those who shall have expected so sudden success from them : They must have seen that the capon, as soon as awake, trod upon and crushed the chickens which had been slipped under his belly, and killed some of them by pecking them to death : this was the behaviour of three capons which I successively tried to train up to the tending and leading of chickens. Other people, whose attempts of this instruction of capons shall not have met with better success than mine, will probably have declined repeating them.

What is it then we are to do besides the foregoing things, to cause capons to contract an affection for chickens like what hens have for those they have hatched ? A longer time must be spent upon it ; we must give them an education not the work of one single night or of a day, but which must be continued for several days together. Having at several times attempted in vain to communicate to my three capons by the aforesaid methods the talents I wanted them to acquire, I sent them at last to a mistress of greater skill, *viz.* the woman who had the management of the poultry-yard of the above-mentioned lady ; they came out of her school very well instructed, but not till ten or twelve days after they had been put under her discipline. Her method is neither to pluck the feathers off their belly, nor to rub it with nettles, nor to make them
R drunk ;

drunk ; altho' nothing of all this is contrary to the intended purpose. She keeps a capon alone for a day or two, in a pretty deep but not very wide bucket, which she covers with boards ; she takes him several times a day out of that bucket to put him under a basket where he finds some food : soon after she gives him for his companions two or three of those little chickens who have already some strength, and are fledg'd so far as to have some feathers in their wings, and even an appearance of feathers in their tail ; she leaves them with him, and takes them together out of the bucket to put them under the cage, and makes them eat together there, if he abuses them, she parts them for that time, and the next day puts the same or some other chickens with the capon into the bucket which lets in but very little light. By means of these operations repeated several times a day, and for some days together, the capon will contract a habit of living with two or three chickens : the number of these must be increased by degrees : he accustoms himself to the company of the last as he has done to that of the first ; and when you have at length put seven or eight chickens with him, and he seems to have taken a liking to them, you may afterwards give him a greater number without any risk, he being now brought up to the point of shewing the greater satisfaction as the number of the chickens put under his conduct shall be greater. He may then be set at liberty, and will sit on them as hens do on their chickens, whenever they stand in need of being warmed ; he will lead them to the places where he thinks they can find any food ; he will cluck like the hens, to call back those that may straggle too far from him ; he will redouble his clucking when he finds some dainty bits, to invite them to come and share them with him ; if it is a piece of bread, or a long worm, he will divide it

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into

into many small portions for them, be enchanted to see them eat it greedily, and will deprive himself of it for their sake.

The first days of his education are the most difficult, they seldom pass without the death or laming of some little chicken: these dismal scenes must be expected without being disheartened by them, as they are not to be repeated afterwards; they are the price of the instruction of the capon. By means of the same education you will be equally successful in causing cocks to grow as fond as capons of leading and tending young chickens: I thought I had sent to school three capons, but one of them had no other appearance of a capon but his comb being cut off, he was a perfect cock in every other respect; nor did he for that come home less well instructed than the real capons; he had led and tended very well the chickens he was trusted with: he never happened to neglect them but for a few moments, when he saw a hen go by, whom he judged to be disposed to accept of his favours: this was a very fit object to give him some interruption, he could not resist it, his chickens were forgotten for that instant, he left them abruptly to attack her, and had no sooner obliged her to comply with his desires, but he coolly returned to them.

When capons and cocks have once been taught how to nurse chickens, it is a talent they keep to the end of their life, nor are they ever tired with that occupation; if you leave them unemployed for several months together, as is generally done during the latter end of autumn and all winter, you find them again indowed in the spring with the talent you had given them, or a very few lessons will suffice to make them resume it.

Let then the quantity of the chickens hatched in ovens be supposed to be ever so great, there would be no room to fear any incumbrance from

them, provided you have had the caution to provide yourself with a sufficient number of capons or cocks ready to receive and tend the chickens as soon as they were hatched. It is nevertheless very true that you must decline hatching any during the hard seasons, if you will leave the capons substituted to hens the liberty of roving in yards: they could not be employed with any success to bring up chickens during the winter-season, otherwise than by keeping them in warm places, in a kind of stoves: we must not expect more from them than from the hens, all the care of which cannot save the life of their chickens, when the season is too severe.

I had some hopes, that it would be possible to bring up chickens with success, and at all times of the year, without putting one's self to the charge of supplying so many capons with corn; it seemed to me that one might expect that the same hot-bed of dung which had served them in lieu of a mother to cause them to be hatched, would still be so to them towards preserving their life and making them grow; that one might likewise use to a very good purpose towards bringing them up, those baking-ovens or others by the heat, whereof the eggs they were hatched from had been warmed. The success answered my expectation to the full: I must own indeed that it was not till I had first met with a world of oppositions, nor without paying for the pleasure I had had to see thousands of chickens hatched, by the grief of seeing a great, nay, a very great part of them die; I am obliged to give an account of those adventures which have chagrin'd me so much, and to set forth the causes of them, to hinder others from experiencing the like fate. But the series of my trials towards bringing up chickens, either by means of the heat of dung, or by means of a common fire that costs nothing or but very

very little, have at last taught me methods to do it with success, that were as plain and as sure as I had desired them. They are in so many respects superior to the method hitherto employed, that the reader will be of opinion that there would even be a benefit to be got by taking from the hens the chickens they themselves have hatched, in order to tend them according to some of our new methods. I shall begin with explaining those which require the use of a hot-bed, as they will leave me but very little more to say concerning those that shall have the heat of common fire.

Cold and rain are the two greatest enemies of young chickens: the mothers have much ado to shelter them from either of them, even in the hottest weather: summer is the season wherein they die least of any, and in which they thrive fastest. By bringing them up in a hot-bed, it will be easy to make them enjoy a perpetual summer that will expose them to no cold nights, nor to any rainy weather: the constant summer I mean is never interrupted in the oven where they are born. People who would give themselves that trouble, might bring them up in that very oven or such another, in case they should have one to spare, till they should be a fortnight or three weeks old: they never should be taken out but at the hours appointed for their meals, that is, five or six times a day, when they should be put in an uncovered box wherein they would find something to pick up and fill their little crops with: the meal being finished, which is generally done in a quarter of an hour, they should be put again into the oven, where they should remain all day and all night. This way of bringing them up at that tender age, has nothing that can be alledged against it but its being troublesome: the success of it is infallible. But, although your intention should not be

to keep your chickens in an oven during two or three weeks, they must be left either in the oven where they are hatched, or in another to which they were carried, for about four and twenty hours; they are all that time at least without any need of eating; although there are some that begin to peck ten or twelve hours after they are hatched, they do not however do it out of necessity: their little limbs gather strength in the warm place where they are put: however, I did not think it proper to keep them in the casks where they were hatched, at least when they were come to a size that makes them strong, and that gives them an inclination to much stirring: they never could have there the liberty of walking, which is necessary to exercise their legs and strengthen their bodies: but I judged that walking places of five or six feet long would be spacious enough for new-born chickens, and even for such as are grown almost big enough to be left to themselves. I then thought that nothing could be more proper than to lodge them in a long nar-

* Plat. I. row box *, not wider nor higher than the single board that made the bottom was wide; it had at top a very light hurdle of osier.

I have given this box the name of *chicken-house*, which I shall use hereafter whenever I speak of it; I shall also call it the first chicken-house, to distinguish it from another of which we shall point out the use. I caused this to be buried in the hot-bed, and surrounded with new litter quite full of dung: the dung was high enough at one of its extremities, to be level with it and the sides of the box †, from thence quite to the other extremity §, the surface of the dung was laid gradually lower, and left more of the chicken-house uncovered, so that its other end was not buried in the dung above an inch or two deep.

† Fig. I.

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The result of this disposition of the dung was, that there were different temperatures of air in the chicken-house from one end of it quite to the other: when the chickens wanted to be as warm as if they had been sat on by a hen, they needed but repair to the extremity that was best warmed, that is deepest in the dung; but when the duration of the action of such a warm air began to make them uneasy, they had a choice in the remainder of the box, among the several degrees, as I may say, of the temperature of air they there met with. Although our bodies, and most probably those of the major part of animals, suffer greatly by a too sudden passage from a cold to a warm place; the health of animated bodies would perhaps be impaired in an air that should never be subject to the least vicissitude; and I judged, in short, that our chickens must find themselves the better for not being always kept in an equal degree of heat.

It was in a place of the chicken-house where the temperature of the air was middling, that I caused small vessels to be put, some of which contained the food that was fit for the little chickens, and the others were full of clear water which is the only liquor they drink. A little of their food was spread upon the bottom of the box, so as to make a track that might lead them to the places where they could find a greater quantity of it together: they did not fail coming there to fill their little crops, and when this was done, they went back to the warmest end of the box, and flocked there together in a small platoon crowding close to one another. After a rest sometimes longer, and sometimes shorter, they, without invitation, and of their own accord, ran about in the box, fluttered, and went again to replace what had past from their crop into their gizzard.

By means of such a plain chicken-house as that just described, chickens have been brought up at my house; not however without the death of a good many of them, although the number of these was not perhaps greater in proportion than that of those who die notwithstanding all the care of the hens. My chicken-house did not seem to be sufficiently perfect afterwards; I judged it wanted an addition that might contribute much to the health of the chickens, and of course save the life of many of them: they were kept in a warm air, indeed, but they had not in that box any equivalent for that gentle pressure of the belly of the mother upon the back of the little ones she sits on: their back is more warmed than the rest by the hen's belly, whilst she claps it against the back of her chicks, their belly rests very often upon a cold and moist earth, whereas their feet are better warmed than any other part in the chicken-house. The chickens I kept in it ought to have informed me very soon, that they stood in greater need of having their back warmed, than any other part of their body, when after having repaired all of them to the warm end of the chicken-house, they remained motionless there, instead of sitting squat down upon the tail, which is to them an attitude natural enough at the times when they take their rest: they stood stiff bolt upright on their legs, with their back turned towards the sides or the end of the box, in order to clap their back as close as possible against those sides, which were warmer than the air. The best thing we can possibly do is to copy after the proceedings of nature, whenever we have a mind to produce effects like those she sets before our eyes. I then judged that the little ones in the chicken-house wanted a mother, that might by sitting on them, determine them to take their rest in the same attitude in which they take it
under

under the hen : I contrived to give them an inanimate mother, that might stand them in stead of a live hen. Let the reader form to himself one of those portable desks which are generally put upon a writing-table, all the sides of the cavity of which should be lined with a good warm fur, and he will easily conceive how it may be to the chickens an equivalent for a mother, and even something better still *: this is a lodging which affords them a wide door to come in at, but the roof of it being shelving and not very high, they never can go very far into it, without touching with their back the hair of the fur which the inside of that roof is lined with; as they go further and further into the cavity, their back presses more and more against the fur-lining, and they press it more or less as they please themselves. They soon shewed me how sensible they were of the vast merit of this artificial mother: they loved to remain under it, where they were warmer than any where else, and to press it very close: when they had taken their little meals, they jumped and capered about, and as they began to be tired, or to be no longer warm enough, they repaired under this mother, and went so deep into it that they could not be otherwise than squat upon their belly; and when this artificial mother was taken off and turned up, I saw the impression of the back of several chickens sensibly marked in the fur-lining.

The breadth of this artificial mother is determined by that of the chicken-house, into which it must be introduced with ease: its breadth, or, if you will its depth, is arbitrary, and must be proportioned to the number of chickens you are willing it should contain: I generally make it fifteen inches, which is sufficient for above fifty or sixty very small chicks. The age of those who are to be covered and kept warm there, requires that one should have many of these mothers, some higher, some

* Plat. I.
Fig. 1. 2.
and 3. M.

some lower, at the entrance and at bottom of the chicken-house; for it is proper to have a variety of them for the chickens that differ much from each other in point of shape. The small timber work of this mother consists in a wooden frame

* Plat. II. which is the roof * of it: this frame leaves a plianthess in the fur, now stretched upon the inferior surface of it, which it would not have if that roof was a board; it rests upon four feet, the two hinder ones of which are very short, two inches is a sufficient height for them; the two fore-feet must be but four inches high, if the box is designed for new hatched chickens, and they are made higher, when intended for older ones; in which case the hinder feet are also to be made higher in proportion.

It was with lamb-skins dressed by a skinner, and garnished with good long wool, that I caused the whole inside of the artificial mother † to be lined:

† Fig. II. other skins of a small price, such as hare, rabbit, cat, &c. skins, might be applied to the same use; but the lamb-skin, which is more woolly, deserves perhaps to be preferred on that account: finally, I caused a small curtain § to be put to the fore-

§ Plat. II. part of some of my artificial mothers: this being Fig. 1. let down at night when the heat of the cavity seemed not to be over and above strong, it contributed to make the chickens pass the night with greater warmth and comfort.

You make yourself sure of the degree of heat that reigns in this furred lodge, as you make yourself sure of that of the heat of the ovens, that is, by means of a thermometer. The coarsest of them all appeared to me the fittest for that purpose; even the same which I propose for the use of country-people, a very small bottle full of

|| Vol. I. a mixture of butter and tallow ||: the form and Plate VII. small size of it will allow you to place it so as not Fig. 3. to expose it to risks which thermometers more perfect

fect indeed, but more brittle, and besides more difficult to be lodged and handled, would be exposed to. It is of no importance here, to know the degree of the heat (at least of an excessive heat) with so much exactness as you are to know that of the heat which is to warm the eggs: when the little ones are too warm under the mother, they know very well how to go from it, to spread about in the chicken-house, or to go and flock together at the more temperate end of it. When the butter in the small bottle does not keep sufficiently liquid, but is partly congealed, it then forewarns you to think of warming the chicken-house again, which is done by surrounding it with a bed of warm dung: these renewals of the heat for the chicken-house are no way different from that of the ovens, saving that they require to be made seldomer, and with less dung.

However, there is no natural mother that can do the little chickens so much good, as the artificial one: they are not long without knowing the value of it, and without contracting a kind of fondness for it: instinct is a quick and sure director to the animals who have no other guide, as it teaches them what they ought to love and seek for. Chickens drawn out of the oven twelve or four and twenty hours after their birth, and put into the chicken-house, will almost that instant, and of their own accord begin to pick up and swallow the small grains or crumbs of bread which are laid before them; and after they have eaten and walked about for some time, they generally find of their own accord the fleecy lodge under which they go to warm and rest themselves: they remain there till the want of eating or a desire of stirring puts them in motion again. All in the chicken-house never fail to go under the mother at night; and they leave it exactly at break of day; if you procure them a
seeming

seeming day before the rising of the sun, by bringing a light near the chicken-house, they directly determine to go out, they come and pick up the remainder of the food they have left; they, in that case, want to eat at hours when the hens would not be hungry, and are more easy to be waked and put in motion: hens kept in the same place where the chicken-houses are, remain quiet at the approach of the light that causes all the chickens to move; this I have experienced a hundred times. In order to preserve the better the heat of the artificial mother, one may cover it at top with hay, which is heaped upon it, and raised quite to the upper brink of the chicken-house.

It is an advantage to the little chickens not to live with any but those that are nearly of the same age with them: the new born ones suffer much and run some hazard, when they have for their companions some brisker chickens that have already acquired some vigour: these are never checked by the consideration of the weakness of those they meet with in their way; they often overthrow and tread upon them, and that without any bad intention, only to gain their aims. Lively chickens that follow each other, and continue thus to tread on that which has been thus thrown down, and which is now upon his back with his legs upwards, make it altogether impossible for him to rise again; and he is sometimes killed by this sort of treatment in a very little time. At meal-time, the weakest have nothing but what the strongest are pleased to leave them: these very often possess themselves of the best places under the mother, which the others are the worse for disputing with them. You will provide for the security, ease and conveniency of the weakest by multiplying the houses and artificial mothers: it suffices to have three of different sizes. The first * is appointed for those that want to be more nicely

* Plat. 1.

Fig. 1.

nicely treated, and that are but just hatched : it may be shorter by half than the two others, and be but about three feet or three feet and a half long, when you intend to lodge no more than fifty or sixty chicks in it : it is more easily warmed on that account, and its capacity is better proportioned to the size of its inhabitants. I begin in the first place by putting every one of those I trust it with under the mother, that they may get acquainted with it directly, and know as soon as possible where it is they may find the degree of heat they like.

When the little chickens have dwelt seven or eight days in the first chicken-house, and are grown strong enough not to have any thing to fear from other chickens, which are a small matter older, as for instance, from chickens a fortnight or three weeks old, I lodge them in company with those in the second chicken-house *. If you have an oven wherein you put eggs daily, chickens are daily hatched out of it, and you daily commit new ones to the first chicken-house. It would be too troublesome to keep a register of their age : nor is that caution at all necessary to know afterwards those that are fit to be taken out of the first chicken-house ; the eye may judge of it, and even much better than the dates of their age could decide, because one chicken is often more vigorous at six or seven days old, than another that is already eight or nine ; and the sturdiest must always be removed first.

I leave the chickens in the second chicken-house, till they are about a month old, and then I convey them into the third : this is more spacious, and I distinguish it from the other two by calling it the *weaning-house* *. It is twice as broad as the two other chicken-houses, and its height or depth is also double theirs, that the chickens which begin to use their

Plat. I.

Fig. 3.

Plat. I.

Fig. 4.

* Plat. I.
Fig. 2- C.

their wings may not fly over its sides. It has however a cover as well as the other chicken-houses and these covers do not hinder the air from being renewed in the boxes, nor the chickens from enjoying the light; they are only thin-wrought wicker hurdles* of a size and form proportionable to that of the aperture they are designed to stop. A variety of events have shewed me the necessity of having recourse to these; cats and rats would never miss any of the opportunities they might have to make much havock in the chicken-houses, and a great many murders would be committed there as well as in the weaning-house, if they could have free access. Chickens grown to be hens or cocks will readily return to the place where they were hatched; it is difficult to estrange them from the hot-bed where they have been brought up, they enter into the boxes and chicken-houses whenever they find them uncovered: the greatest mischief they do there, does not consist in eating what was not put there for their use; they never consider when they jump into these boxes, whether they may light upon any chicken or not; they even frequently kill with their bills some of those that offer to eat with them: the above-mentioned hurdles are proper fences against such accidents as these: they are lifted up whenever you have a mind to give the chicken their food and drink, to clean their habitation, or to take any other little care of them, or barely to have the pleasure of looking at them: you can never fail of doing them good whenever you can leave them open without exposing them to the risks above mentioned.

You must multiply the number of the chicken-houses of each kind and the weaning-boxes, if the number of the chickens you hatch requires it; I say you must multiply them, because making them

them larger, especially in point of breadth, would not be an equivalent: for the broader these boxes are, the more difficult it is to preserve a warm air in them; for they are not exactly in the case of the casks, which are seldom the more difficult to be warmed for having a larger diameter; they have a freer communication with the air without, and are buried much shallower in the dung: their breadth may nevertheless be made something bigger than that I have determined for the chicken-houses which serve during winter, and greater still for those that should be used only in summer time.

The summer tuition frees you from using a few other precautions, which the winter-one requires: when the season is cold, you dare not expose to the outward air, chickens that have been brought up tenderly: when these are grown big enough to want a larger room than that they have in the weaning boxes, that is, when they are grown bigger than black-birds, I put them into a spacious cage, well furnished with sticks for them to roost upon, in which they are able to use their wings; it is a lodge or cottage *. The smallness of the ground * *See the head-piece of the third Memoir.* I had at my disposal, obliged me to fix the length of it at eight foot, the breadth at three foot and a half, and the depth at four feet; it has the form of an harbour, and resembles in little the green harbours of our gardens; its grate-work is likewise formed by rods which are so placed, that the square meshes are not wide enough to let the chickens go through them. It is easy to imagine what the little timber work necessary to make the body of that cage, and to support the grate-work of it can consist of, and there will be no need of describing the several pieces of it and their connection. It is also easy to imagine that this grate-work might be made of a wood different from that of which hoops are made; that it would be more agreeable

agreeable and not make the cage so heavy, if it was made of iron wire ; but then it would be dearer in proportion. I must not forget to mention that its bottom is made with a few boards laid upon the dung of the hot-bed that serves for the hatching of chickens, and to bring them up in their tenderest age. It may be warmed again by surrounding it with dung, which is hindered from passing through the grate-work by means of an inclosure of a board on edge. The cage has at one end a door through which a man may enter. The chickens are fed there like all those which are fed in the other cages : a mother is even become needless to them, they have already taken, or are ready to take a liking to the custom of roosting which is common to all the large poultry of their kind.

The chief difference between the winter and the summer education is, that you are not obliged in summer-time to keep the chickens in the place where the hot-bed lies, till they are grown quite as big as those which come to our tables : they may be let into the open air in fine warm days, and they seemed to me to grow much the quicker for it : those that have lived in the weaning-box, and the strongest of the second chicken-house, may be taken out of them a few hours before the sun rises, when it seems to promise a fine day : they must be put one after another into a deep chicken-basket much like those which our gardeners fill with the greens they gather, and then you will carry them under a cage laid on the grass, and in the most favourable exposition you can possibly chuse that they may enjoy the sunshine without being too much exposed to the wind.

The form of the cage in which they are put at that time, is indifferent, its size must be proportioned to the number of the chickens you intend to keep in it : you may make use of those which
basket-

basket-makers make in all countries, and which are well known to every farmer *; their basis is round: ^{* See the head-piece of the third Memoir.} they keep the same diameter in a considerable part of their height, after which they form a kind of dome, in the shape of a truncated cone. At the top of that dome is the aperture through which the chickens are put into the cage, and which shuts with a small door made of wicker work. You may use cages of quite another form, as for instance square or oblong square ones, grated either with wooden-bars, or with hoops like the above-mentioned. When this happens to be of no service upon the hot-bed, it may very easily be carried into a yard by a couple of men. If you love neatness and elegance in that kind of work, and will have a cage still fitter to decorate the yard, you may have one grated with iron-wire. An artificial mother will be a very useful addition to each of these cages; as it shelters the chickens, when at rest, sometimes against the wind and the cold, sometimes against the scorching sun and rain; I mean by this that it is proper that they should always have a shelter at hand in their cage.

These cages must be prisons to the little chickens only during the few first days at most, and at the hours when the weather seems not to be settled. The liberty of going out must be granted them when the weather is fair. One or several doors may be made to them by raising one corner of the cage higher than the rest, with a stone as big as the body of the biggest chickens, or by removing one of the bars, or any otherwise: they will make use of that liberty to run about, flutter, eat grass and hunt after insects; but the remembrance of foods more easy to be found and much to their liking too, which they have left in the cage, will bring them back to it, and make them flock together in it again: The narrow door does not afford to the other poultry

of the yard the liberty of going thither, to rob them of food which has been put there for them alone.

One might be afraid they should disperse for want of a hen to guide them, for the clucking of the mother and that of the capon call back to the main body of the crew those who happen to go from it; but, they are fond of keeping together: and if any one of them chances to be too remote from the rest, his squeaking betrays his uneasiness, and he listens to try whether he cannot hear his companions make a noise, that he may find them again.

You see them flock together under the cage at night, you then stop all the doors of it, take them back, and put them to bed, either in the weaning-box, or in the chicken-house, or at least under shelter in a place shut up, and under one and the same cage. When they are grown strong, and nights are not cold enough to make it necessary for them to be warmed, then at length the time comes when they may be put to roost along with the rest of the poultry, they then will love to roost all night long, and when they may be let out of the hen-house in the morning without concern or uneasiness: but when full grown they still love to live in company, which shews that a mother hen was not necessary to procure a durable sociability among them.

An artificial mother, or a small roof contrived in the cage placed in the open air, serves to shelter the chickens from a heavy shower: and it gives you time to take them in again before they are wet. If the rain is not likely to last long, and the sun is ready to appear very soon again, it is not worth while to carry them so soon back into the boxes of the hot-bed; but, it is proper in cases of heavy rains, to furnish each cage with a cover that may be put upon it in
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an instant, and be laid by at other times. That cover may be made of thin boards, or a plain frame furnished with an oil-cloth. I sometimes erect upon four pillars a small roof, under which the cage is put: then, indeed, the chickens have nothing to fear from the rain, and being at liberty to go out of the cage, they enjoy the sun-shine when they please, and they are allowed to go to the places exposed to its beams.

What we have said of the manner of bringing up chickens, extends to all the birds that may have been hatched in the ovens, provided they are not of those kinds that require their fathers and mothers to give them their food by bill-fulls, but of those who feed themselves very soon after their birth, that is, as soon as they have proper food at their disposal: such are young turkies, pheasant-pouts, young partridges, quails, and so many other birds of different kinds which belong to the class of the hens. That class is not the only one whose chicks know how to hunt after and take their food as soon as they are hatched; the birds of the goose and duck kinds come into the world with the same talent, but the latter are never pleased when they find no water into which they may from time to time go to swim and paddle: therefore the chicken-houses where you shall have a mind to bring up young ducklings and other water-fowl, require besides the things necessary in those where chickens are reared up, that one should place and fasten at the end opposite to that where the artificial mother is, a pan of water *; this will be a small pond in which the ducklings and goslings will not fail to go and bath, provided you take care to contrive a gentle declivity or shelving way through which they may arrive at the said pond: this will be rendered still more pleasing to them, if you surround it with a few clods of green turf. However, they need not

* Plat. I.
Fig. 2. B.

be kept in the chicken-houses so long as young chickens, they are much more hardy, and need not have any weaning-box: those which have been brought up together, may be given over to their own management at the end of twelve days or a fortnight: they will live together, and will never part, but will grow apace, provided you have contrived a place for them, where they can go and paddle whenever they have a fancy for it.

The difference is very great between the condition of the chickens which have a mother to lead them about, and that of those which are brought up in the manner we have just described: the reader will see how considerable the advantage is on the side of the latter to be deprived of a real mother, if he but considers that most commonly the hens, though prodigiously fond of their chickens, occasion the death of some of them, either by being too aukward, or out of inconsideration. The pleasure of having little ones, far from making them clearer sighted, seems rather to blind them, especially at first; they will, out of an excess of uneasiness, keep them too near themselves; whence it happens very frequently that they set their foot upon some of them, whereby they are either crushed or mortally hurt; and they even crush some, by barely sitting on them: very desirous of procuring them a feast, they scrape the ground in order to fetch out of it some worms which are a very nice bit to them: but a hen that is thus scraping does not reflect whether the foot she is pushing backward will not meet and strike one of her chicks, roughly enough to throw him a good way from her. In short, let the affection of the hens, for their broods be ever so great, they cannot hinder the little ones from passing often from great heat to great cold; they neither can nor ought to sit on them constantly, they must let them eat and run about; very rainy days must
needs

needs prove fatal to them notwithstanding all they can do; therefore, nothing is more common, as we already observed, than to see a hen, which has hatched ten or twelve chickens out of a brood of eggs, unable to bring above three or four of them to the age at which she ceases to lead and tend them. So many experiments have taught us that hens cannot, in spite of all their pains, bring up in cold seasons the chickens they have hatched, that no body cares to encourage or indulge the desire which some of them shew of sitting on eggs when the winter is near: in most of our provinces they decline giving eggs to the hens which seem inclined even about the beginning of *September*. The chickens kept in our chicken-houses, enjoy a perpetual summer: but then it has happened, and I have more than once wondered at it, altho' I ought to have expected it, that during the ten or twelve days of a very severe cold we had in the year 1748, I lost none of the chickens which were born a week or two before, nor even any of those which were hatched when the cold was the most piercing: there had not been any sensible change in the temperature of the air as to these.

We have now brought the chickens to that period at which they may be left at liberty in the poultry-yard, as though all of them had reached that term: nevertheless, the major part of my first trials have not, by a considerable deal, procured me the pleasure of seeing even the major part of those who had been put in chicken-houses, live to that desirable time: I have seen some of them die there at all the intermediate ages, and sometimes in so great a quantity, that the number of the dead has been considerably greater than the number of those that have survived them. I have sometimes been so unfortunate, as not to be able to save and secure the life of one or two chickens out of forty: there have been times at

which I saw chickens hatched every day in my house, whilst the number of those I had alive was hardly increased by them; those which were hatched from day to day did hardly any thing else but replace those which had expired that very day. Many different causes have made me lose them; some of those causes were easy to be known, and commonly they were also very easy to be prevented for the future: others were more hidden and of a more mysterious nature; I was not able to find them out but in a length of time, that is, after I had been deprived of a multitude of those little creatures, the life and preservation of which I could not but have much at heart. I am equally bound to acquaint the reader with every one of these different causes: it is incumbent on me to spare him all disheartning attempts, and I am sorry that I cannot possibly do it without entering into a number of minute particulars which must needs be tiresome to all those who do not think of falling to this work themselves: but, the work I proposed to write is only useful, not entertaining.

I have had many occasions to complain of those artificial mothers, of which I have made so many and so well deserved encomiums, or rather I have had frequent reasons to blame myself for not having sufficiently seen all what their construction and disposition did require. The first I caused to be put into a weaning-box, cost a great many chickens already well grown, which I expected it should do good to, their life. it was open at both ends, the lowest end was placed against the board of the warmest extremity of the weaning-box, but it was not put quite close to it, it left in some places a vacancy, into which the chicken nearest to it was tempted to thrust himself in order to jump upon the mother: he was no sooner got partly into it, but he made efforts to raise his body higher there, he

he strove to heave himself up with his wings, which being tender at that time, were twisted in a very singular manner by these efforts; the tip of the wing stood straight upwards, or was bent towards his back after having made a whole turn. The chicken whose attempts towards coming forward had been needless, went back into the weaning-box, where I was amazed to see him sometimes with only one wing, and sometimes with both wings thus twisted: it was entirely out of his power to restore them to their natural situation: I did this for him by untwisting the wing gently, but what I made him, and more than that, what he made himself suffer, rendered his health very precarious, and killed him very often.

The method to prevent accidents like these seem to be very plain, since one would think it consisted intirely in clapping the hinder part of the artificial mother exactly close to the chicken, or the weaning-house, or better, still by stopping that end by nailing a lamb-skin against it: but a much better means than all is, to leave an interval sufficiently large between the extremity of the weaning, or of the chicken-house, and that of the mother; for, other accidents will soon shew us, that whenever the artificial mothers are made of the first form mentioned; it is of great importance that the two ends of it should be open, and the chickens be able to get out at the lower extremity though with more difficulty than they can go in and out at the other.

The greatest fault I committed in the construction of the first mothers was the excessive lowness of their hinder-part: I imagined that by keeping them very low, and even so low as that the roof or upper-part of each might almost touch on one side the plan on which it stood, it would but the better answer what I expected from it, and that the

chickens would be but the more sure of finding padded places against which they could clap or even push their backs. The only inconveniency I could apprehend in keeping the hinder part of the mother very low, was, that if it should be so to such a degree that the body of a chicken could not get into it, the capacity of their dwelling would be thereby diminished : but there was another inconveniency which I was not informed of till I had lost a great many chickens. The first notice I received of it was, the death of two very pretty ones, whom their fine coats and large and beautiful tufts made me take a great liking to ; they were hatched on the fifteenth of *January*, they had not been affected by the sharp cold of the air without the place ; they had grown in three weeks time as much as chickens could have grown in the same space of time in the finest of seasons ; they were as lusty as any chickens of their age could be ; they had appeared thus to my own eyes but two hours before : my gardener came dejected to tell me he had just found them both dead under the mother : they had killed, and as it were crushed themselves to death there : invited by the warm air, or by some other motive, in endeavouring to reach the extremity of the artificial mother, their efforts had carried them much too far : those repeated efforts served only to put their bodies into the state of a too violent compression ; they never thought of using their strength to retire, and having exhausted all their vigour, it was no longer in their power to extricate themselves out of their sad situation. Although one had not seen to what degree their body was squeezed, it might have been conceived by considering the large and deep impression which remained in the fur-lining of the mother.

Many a chicken was afterwards brought to me, found dead under the mother, with the body quite flat,

flat, before I ever suspected they had occasioned it themselves; my notion of it was that they had been trod upon before and after their death by those with whom they had lived; and I often attributed to the scratching of the others a dismal effect, they had themselves been the only cause of.

I was no sooner apprised that it was possible for young chickens to kill themselves under too low a mother, but the cause of the sad condition in which I had seen a multitude of them ceased to be a secret. I knew not what reason to assign for the trembling of the legs of some; this was so very remarkable, that they seemed unable to support their body, coming from under the mother to enter the chicken-house, they ran a few steps, then tumbled down, and could not immediately get up again; nor was it in their power to step in a more steady or regular manner: that difficulty of standing was an almost certain indication of approaching death. They had put themselves in that condition by the violent efforts they had made to go first too deep under the mother, and then in striving to extricate themselves from it.

The rule which these observations prescribe to us with regard to the construction of the artificial mothers, is, always to give their hinder-part such an elevation, that the chicken which makes any attempts to go to the very bottom of that he is under, may find no insurmountable opposition in any part of it, but may be able to walk or at least to drag himself thro' with his feet gathered up, in the lowest places: he then runs no danger under it, and has room enough to clap his back against the fur-lining of the under-part of the roof, or it would even be enough to clap it against one of its sides. The reader will from thence conclude that as the chickens grow bigger, higher artificial mothers must be given them; and he may be afraid of the
necessity

necessity of multiplying these mothers too far. But that multiplication is not by much so considerable as may be imagined: mothers of four different heights may suffice for the whole bringing of the chickens up: there is not indeed so much comfort in them, but then there is no manner of danger in keeping them under mothers a little too high for their bodies; their backs may, even in these, meet with some of the hair hanging from the roof, and the sides will supply them in plenty with choice of places, against which they may clap their backs by turning themselves a little that way, as they very well know how to do. Another thing which excuses our multiplying the number of the mothers, is that the artificial mother, whose height is best proportioned to the chickens just hatched, may be rendered fit for older chickens, by giving it an height equal to the increase of the chickens it is intended for*. The piece that raises the mother, consists of a couple of wooden ledges†, each of which is as long as one of the sides of the mother, and is lined as the mother is. Each of these ledges is put under one side of the mother, they are easily fixt there in an unmoveable position: a couple of iron or wooden-pins fixed in the narrow edge of the ledge which is to lie uppermost, meet with a couple of holes bored and ready to receive them in the nether-part of the under cross board; and that suffices for a solid connection. This additional piece is taken off as easily as it is put on; and one wider still may be substituted in its room at pleasure, to raise the roof of the mother still higher.

* Plat. II.

Fig. 2.

† K, L.

But why, it will be asked, did I before observe, that the lowest end of the mother was to remain open? The foremost aperture seems to be sufficient for the chickens to go in and out at; it affords them a very ample door, and they would be but the warmer under

under the mother, and would find more of a wide and soft support, were that end closed up with a skin nailed on its edges. I do indeed accordingly stop it with a skin, but that skin is nailed only at top, and does no more than the office of a piece of tapestry hung before a door to keep out the wind *; the chicken that has a mind to come out gets under it very easily. The necessity of leaving that place open for them, was taught me as well as all the rest, by the loss of a vast number of chickens: and among the accidents that have been fatal to them, hardly any has proved more so than that from the mothers opened only before.

* Plat. II.
Fig. 2. T.

Those which have taken their meat first in the chicken-house, and have tired themselves with walking about, are the first that return under the mother, there to rest in a warmer place; they always push further into it, till they are got quite to the end: those which come after in their turn under the mother take the very same method, and they all of them get as deep into it as they can: the chickens therefore are all crowding together towards the extremity of the mother, they are for ever drawing up closer and closer, the strongest get on the back of the weakest who were squatted; I have seen some of these crushed and stifled every hour in the day. Those which are nearest to the hinder extremity lie in the warmest place of all, when that end is closed up: in vain they would strive to get forth to enjoy a more moderate air; they are never able to break through the crowd in their way, or get to the door of the mother; the heat which becomes excessive to them, leaves them barely a faint breath of life, which is at last entirely taken from them, and they are smothered by the weight and perpetual trampling of those that are mounted on their backs.

this

This situation becomes more dangerous in proportion as the number of the occupants is greater, and a variety of circumstances combine, to make the degree of heat rise there: their multitude is of that number, and the heat of the external is frequently another. Sister *Mary* of the society of *L'Enfant Jesus*, who has made so good a use of the instructions given her, that the eggs have been warmed and the little chickens reared in that convent with much greater success than at my house; this lady, I say, going about ten or eleven o'clock at night, after a very warm day, to visit her chicken-houses, had the mortification to find under one mother, about forty chickens either dead or expiring; others in a greater number, had some faint appearance of vigour left; she saved them by putting them under shelter in the chicken-house itself, where she let them pass the remainder of the night, after having taken away the mother which had proved so fatal to the rest.

Whenever there shall not be under the artificial mother a greater number of chickens than there are generally under a hen, these disasters will seldom happen: but let their number be ever so great, the chickens nearest the bottom of the mother are no longer exposed to such dangers when that end is stopt with nothing but a loose rough skin; because those which want to go out are able to lift it up. There results another advantage from the looseness of this skin, *viz.* that the chickens are never so wedg'd together: the resistance which favours the pressure is wanting; so that those which get at top of the rest, cannot so easily stand up there; you will even hinder them from doing it at all, by not making the hinder part too low for two chickens in that situation.

You may have nevertheless mothers with one single aperture, and under which the chickens will be in still less danger of being stifled or crushed,
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than under those that have two: these new mothers suppose chicken-houses a little less simple but in many respects more commodious than any of those I have hitherto mentioned: what renders them more convenient is, that they have besides the long box, a cask lined with plaister like those which perform the office of ovens *: that cask has * Plat. II. a little above the height of the wicket a square aper- Fig. 5. ture † which we shall give the dimensions of when † K. we come to mention its use: it is appointed to receive one of the extremities of the long box § from §lmnop. which the small board that shuts it has been removed. The reader will readily guess the reason why this end of the box is to be opened: it is easy to imagine that the intention of it is to enlarge the apartment of the chickens of a whole cask ||, and || abde. that a floor must be added to this, level with the height of the bottom of the box. This additional piece has several advantages; the cask wants to be warmer than the rest, and it is more easy to be warmed than the boxes: as its depth allows you to surround it with a thicker layer of dung, and preserves of course its heat much longer than the dung in which the boxes are buried, it needs not be warmed again so frequently. It is not of consequence then to warm the box so very often, it will even be better, as we are going to set forth, not to warm it at all, except on such days as are extremely cold.

It is sufficiently plain that the cask is the place where the artificial mother is to be put ¶, and the ¶ Plat. II. form of it is sufficient intimation that the mother Fig. 5, must be of a shape different from the oblong k i, fg. square form of the other, if one would make use of the heat of the cask to warm it. Its basis is nearly the segment of a circle whose diameter is equal to that of the cask; its curvature is in the whole height of its hinder part the same as that

of its basis ; in such manner that this hinder-part may be applied to it and fit the sides of the cask, which make it presently assume a degree of heat nearly equal to that of their own. The idea we have just given of the new artificial mother, will intimate that there are different ways of construct-

* Fig. 4. ing the wood-work of it *, that it might be made of nothing but hoops and of a few bearers to support them, and that it may be easily made by a joiner, as I have had some. The timber-work is designed only to support the pieces of fur with which the mother is to be lined ; the slighter it is the softer the places against which the chickens are to rest and lean will be. What we have said of the inclination of the roof of the other mothers may serve as a rule for the bias of the roof of this. The whole fore-part of it must be open †, or at most closed with a curtain of fur which must not come quite down to the floor. This door has for its breadth the chord of the arch nearly, that makes the circumference of the mother.

† Plat. II.
Fig. 3.

What ought farther to be observed concerning this mother is, that it is indifferent to the chickens in which part of its inner circumference they chuse to be, and that the said circumference is very wide, so that the chickens have room to spread as it were, and are not obliged to double their ranks : in order to put a greater number of them into the same chicken-house, I even place two mothers in each cask over against one another §, which are separated only by a kind of street ; some of the chickens go into the one, and some into the other, and they most commonly are pretty equally inhabited.

§ Fig. 3.
k i, f. g.

As I am desirous not to omit the mentioning of any thing that may be usefully employed in peculiar cases, I am obliged to say that I have made use of mothers that were perfectly round, for this
name

name may be given to round baskets whose edge is a little higher than that of the baskets wherein the eggs are put to be warmed: their inward surface was lined all over with fur, and their bottom was covered with straw. When the chicken-houses seemed to me to be grown too cool, I caused a great number of chickens to be put into one of these baskets, which was carried directly into an oven made with dung, that they might pass the night there, which they indeed did without any the least accident whatever. However, there happened a mischance once that was fatal to nearly forty of the first chickens, which I had hatched in the beginning of winter: the manager of the ovens had not been careful enough in regulating the heat of the oven, wherein they had remained all night; when he went to see them in the morning he found the heat risen to thirty eight degrees; but then he found a dozen chickens dead, almost as many expiring, and the others shewed, by their repeated gaspings, the urgent need they were in of breathing a more temperate air; but this was a reprimand that served the man who had now reason to reproach himself with excessive negligence to be more upon his guard.

These round mothers or furred-baskets may even be very usefully imployed for new-hatched chickens, and for those yet very young: after they have taken their food and filled their little crops very well in the chicken-house, they like extremely to be put into the furred-basket, and to remain for two or three hours together in the oven, whence they are taken out to feed, and then returned to the oven. This operation repeated several times a day and many days together, shelters them from a great many accidents, and makes them grow strong apace.

Sister

Sister *Mary* of the society of *L'Enfant Jesus*, wholly taken up with the care of her chickens, used to carry them thus backwards and forwards when very young from the chicken-house to the cask, and from the cask to the chicken-house, which proved very successful. She began by bringing up chickens in her chicken-houses with the mothers of a rectangular form, before she had had any hatched in the ovens where she caused the eggs to be warmed; she took from a hen the chicks that were but just hatched under her, to make a trial of the new method of rearing them, which procured her an opportunity of reaping the benefit of the good disposition her hen seemed to be in of sitting again: she was so well pleased with her first trial, that she continued to rob all her hens of their new hatched chickens. Her repeated experiments convinced her, that besides the greater number of eggs to be had over and above by this method, there was a benefit to be had by rearing the chickens in the chicken-houses; because there are not so many that die there, as do under the hens.

One part of the good success of this understanding person, was owing to her attention; but my gardener, to whom the bringing of my chickens up was entrusted, was not guilty of any want of attention, nor did he want a competent share of understanding; a hen could not be fonder of her chicks than he was of those he had caused to be hatched; nor did he see them perish with the indifference shewn by the hen when her chickens die: however, a time came when all the accidents that might be owing to the chicken-houses, the heat, and the cold, were prevented, and when a number of chickens, sometimes more, sometimes fewer, was nevertheless lost to him every day. The mortality fell mostly upon those of a numerous crowd

crowd, and then that crowd was almost reduced to nothing in a week or a fortnight's time: sometimes it fell upon a number of chickens that were but about three weeks old, and sometimes upon another parcel of chickens that were five or six weeks old. Commonly their death was foreboded some days before it happened, by the drooping condition they seemed to be in; their wings became weak and flagged, they no longer cared for jumping, and they walked very little, and that but slowly; many of these fed however, and died with their crops full: a bad opinion was always entertained of those which had their crops at break of day yet full, with the grain they had filled it with the night before. As they seemed to want nothing of what could contribute to make them healthy, I judged at last that their death could not well be attributed to any other cause but the air of the place wherein I kept them. It is of no less moment to animals than to ourselves to breathe a wholesome air: the air they lived in was clogged with those very vapours which had proved mortal to so many chickens as yet inclosed in their shells: I had no apprehension of such an air for those that were already produced as I ought to have had, because we daily see hens and their chickens stay long upon dunghills and yet thrive very well; but because these birds were not the worse for breathing a few hours in the day, an air which has but a moderate mixture of the vapours of dung in it, I ought not to have concluded from it, that it was possible for them to breathe an air clogged with the same vapours, nay to breathe it continually, without being damaged by it. 'Tis true, the chickens brought up at the society of *L'Enfant Jesus*, had indeed been reared up by means of the hot-bed which served to warm the eggs, but the vapours did not hang about that hot-bed as they did about

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mine,

mine, where they were detained in so great a quantity by the disposition of the place, that I was at last obliged to take my ovens quite from it.

Being thus instructed by disagreeable experiments, I plainly saw the reason why the mortality had fallen upon some of my broods sooner than on the rest: it was not difficult to observe, that where chicken-houses were placed nearer the window, that is, in an air less loaded with vapours, the chickens had held it out longer, and that fewer of them had lost their lives.

Although one should conclude from what has just been said, that the frequent renewal of the air of the oven where the chicken-houses are is a most essential point, yet that renewal needs not be so constant nor so considerable, when the dung shall not diffuse the same quantity of vapours in the air: I mean that this will not be so necessary, in case you avoid making use of a very moist and nearly wet kind of dung for the reviving of the heat, and are very critical in keeping in the place where the chicken-houses are, no more than just the quantity of dung which is necessary to warm them again. In the place where I had put my chicken-houses when the little creatures breathed an air that was so fatal to them, the whole ground had been intirely covered with a thick bed of dung that hardly left room enough for the door to open; this vast quantity of dung was afterwards considerably diminished, when the ovens had been removed from thence: there remained no more of it in the place but what was necessary to warm the part of the chicken-house that stood in greatest need of it, I mean, that where the artificial mother was; and by that means the chickens which were then in a much better air, ceased being in a drooping condition, and did not die by numbers as before.

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Therefore, whenever the chicken-ovens to be warmed with dung shall not be built in a place that is well aired and has a high cieling, as they are at the society of *L'Enfant Jesus*, you must not think of making any use of the hot-bed that has the heat requisite for the warming of the eggs, for the maintaining a warm air in the chicken-houses; these must be established in some other place: but in what place soever they may be put, you must take a few more precautions, of the importance of which I was not soon enough apprized. The bottom of my first chicken-houses was laid immediately upon dung which was often very moist: this bottom consisted only of a board which was gradually penetrated by the moisture: when the chickens were sitting squat, their belly received the impressions of that moisture, so far as to be sometimes wet: they will be kept drier, if the bottom of the chicken-house is separated from the surface of the dung by a thick board on which it must be only laid, not fastened down: it may likewise be put upon a foundation of bricks or of stone. Besides, I don't know why I did not cause the sides of my first chicken-houses to be plaistered over as I had done those of the ovens; for I ought to have feared that the moisture which had proved fatal to the eggs would also be hurtful to the chickens: but I am very careful now to have the insides of those I use for this purpose lined well with plaister.

Chickens may be brought up however in spacious chicken-houses, where a warm air is constantly maintained by dung, without being altered by any moisture, or by the vapours of the dung. Those rectangular chicken-ovens, of which we have given the description at the end of the fifth Memoir, may be as usefully employed to rear chickens as to cause them

* Plat. III
and IV.

† Plat.
IV. u u.
§ 22.

to be hatched: you will be at liberty to make these ovens of what size you please, that is, wide in proportion to the number of chickens you expect to lodge in them. The same oven may stand instead of two very large chicken-houses*: its height may be divided into two unequal parts, by a slight floor supported by a couple of ledges for it to slide upon: the height remaining between that floor and the inferior side of the upper part of the oven, may be but about one third of the distance from that floor to the lower-part of the oven: you may have there two rooms as it were, one on the ground floor †, and the other on the first story §; the latter for the new-hatched chickens, as it is fit they should be lodged in the warmest place; nor must they be brought down till they are grown strong, that is at about four or five weeks old: the ground floor is to be inhabited by the chickens taken out of the upper-room.

We have not however yet sufficiently explained what must be added to both the in and the outside of a rectangular oven, when instead of making it serve to warm the eggs you have a mind to apply it to the bringing up of the chickens. They will be sheltered there from all the dangers they are exposed into the chicken-houses we have spoken of, and the nicest people may enjoy the pleasure of seeing them, without having their eyes or smell offended by the dung to which the chickens shall be indebted for the good condition they shall apparently be in. One is obliged, in order to procure them more convenience, to lengthen the oven

|| Plat. III.
ABCDI-
HGQ.

on the side of its aperture ||, which to outward appearance is not unlike those raree-shews which oftentimes draw together the common people and their children to entertain themselves with them. The additional length we speak of, is clapt against the mouth of the oven*, to which it may, if you will, be fastened

* A B C.

fastened only with hooks. It is a kind of large box of joiners-work, which ought to have some neatness, because it is to be seen, and is in no risk of decaying or of being spoilt. That box has both in its height and breadth, exactly the same dimensions as the mouth of the oven to which it is hooked on. The length given it may be at pleasure; that which I caused to be made was three and twenty inches in length, nor would I afterwards have had it either longer or shorter: it has besides the hooks that fasten it to the mouth of the oven, a couple of feet † to support it, which are portions † G N, of the pieces which join the body of the timber-^{O Q}work.

The use this box is designed for, will shew the necessity of the things that give it a clean and even a neat pretty look. The chickens, to be reared, must be put in a warm place, but it is not proper to keep them in the dark; they must be at liberty to enjoy the light at least for several hours of the day; and they should be seen by those who look after and provide them with food. This additional piece of the oven is designed to give them light: the greatest part of the upper opening of the box is filled up by a couple of large glass panes ||, || Plat. III. each whereof is set in a wooden-frame, which L, K. may be freely moved one way or other, and always horizontally in the grooves which receive them. The panes set in their frames are horizontal windows for the chickens of the upper chicken-house: they serve to introduce the light into it, and when opened either intirely or only in part, they moreover serve to moderate the heat when it is grown excessive, and finally to renew the air, which might have been breathed too often over and over by these little creatures, and be over-charged with the matter of their perspiration.

* Plat.
III. M.

The chickens of the inferior chicken-house have also their windows *, but these are vertical as all windows in general are, and their use is absolutely the same as that of the horizontal windows. The vertical ones consist likewise each of them of a square pane of glass set in a wooden-frame sliding in grooves: there is but one of these panes on each side of the box, and both together procure all the light which the chickens of the under chicken-house stand in need of.

† P P.

|| Q Q.

The box has a door in its fore-part; what I had made for it was a two leaved door †, as is that of an horizontal oven, which we have had an occasion to speak of heretofore; it is against the under edge of the fore-part of the box that this door is fixed with double hinges || below the folding; it is furnished on each side with a hook, which being hooked into a pin with a round eye or a staple fastened at the same height in the side of the box, keeps the under leaf of the said door in the vertical position. By means of two other hooks and of another couple of staples, the upper-part of that door is fixed and shuts up the aperture as intended. That door is opened intirely when you would examine the chickens of both these chicken-houses; and you open the upper part of it only, when you would look into the first story.

¶ Plat. IV.
hglfmech.

We have not as yet tried to give an idea of these two chicken-houses sufficiently compleat. We have suffered the reader to imagine that the upper one consisted only of a plain floor horizontally supported by a couple of wooden-ledges, each of them as long as the oven, and fastened against its sides within, one on one side, the other on the other: but what we have only called a floor, is indeed a real distinct box ¶, which was to be drawn from time to time out of the oven either in part or intirely, and which on this account had need to be garnished

nished with casters * underneath. It has four on * a a. a side in its whole length, viz. one at each end on each side, and the others at equal intermediate distances: the exact position of these last casters will be better determined by saying farther, that our box is transversely divided into two equal parts † † c, c 3, which adhere together only by a couple of hooks c 2. which are fastened against one half of the box, and enter into the rings of a couple of opposite round-eyes fastened in the other half; they are two boxes put one at the end of the other, and which make now but one, because the board which is needful to make each of them a compleat box, is wanting at the hinder end of the one and at the foremost of the other.

The reader is sensible that there are times when the chicken-house must be cleaned; the air which the chicks breathe would have a bad smell and become unwholesome, if their excrements were suffered to increase in the long box: now it is very convenient, when it is to be cleaned, you are not obliged to draw it intirely out of the oven, but are able to divide it into two equal parts: a box seven feet and a half long would indeed be too troublesome to be handled. Before you divide the fore-part from the hinder one, you make all the chicks pass from one into the other, that is into the part which you shall omit, and put directly again into the oven: this half is rendered a compleat box, by introducing a small board between two vertical grooves ||, || Plat. IV. cut purposely to receive it, one over-against the other a b, g. in the side-boards and at their very ends. A small raker making a right angle with its socket, and to which the socket may be in lieu of a handle, is an instrument with which you will easily scrape off all the filth that sticks to the bottom of the half of the chicken-house you would clean. However, you are seldom under the necessity of scraping

the chicken-house, provided you take care to strew the bottom of it with a little coarse sand, as is usually done in the cages of small birds. The excrements mix with that sand, and soon grow into a dry consistent body with it: besides, it is near the foremost end of the box that the chickens lay the greatest quantity of it; it is there they keep during the major part of the day; it is there they find their meat and drink; and as their food and water must be in the lightsome corner of the box, they will reside of course in the glazed part of it.

If you have a mind to husband the meat you give them, and to hinder the chickens from throwing and scattering it about, and from rendering it disgustful to themselves by mixing with it their own dung, you must keep their grain in a leaden or a wooden-drawer (no matter which) from which the chickens shall not take it, but by thrusting
 *Plat. IV. their heads between bars. The drawer must be
 1 m, n o. inclosed between two rows of bars * stuck into a narrow board, which must be wide enough to receive the drawer notwithstanding the row of bars or wires on each side of it. The upper-part of the little bars is stuck into a board like, and equal to that of the basis: the drawer is taken in and out at one or the other end of this double rack. That drawer is more immediately necessary when you give the chickens a liquid paste, which may be rendered more disgustful than the dry grain by their perpetual scratching, which dawbs their feet and feathers, and which in short renders them dirty, and of course impairs their health: for the same reason it is proper that the drinking drawers be also between two grates of wooden-bars. The number of the chickens that may eat at one and the same time, and without troubling one another, will be the greater in proportion as the drawers are longer; their length may be that of the whole glazed part of the box.

The

The upper chicken-house may be changed into two different chicken-houses of equal or of unequal breadth, at your pleasure, and of the same length: and this is done by dividing its breadth from one end to the other into two parts, by a partition parallel to its sides, and as long as one of them, the double rack excepted. The division is begun by the said rack and finished by the partition: this rests upon a narrow board, at most as broad as the basis of the rack; the foot that supports the partition makes it easy to change its place, according as you are minded; one of the chicken-houses should be larger than the other. One of the chicken-houses formed by this division is designed to receive the new-born chickens, and you put into the other none but such as might hurt the weakest in the first chicken-house, and have nothing to fear from the strongest chickens of the other.

We have nothing to say about the inferior chicken-house, which is not to differ from the upper-one, except that being designed to receive larger chickens it needs not be divided into two parts lengthwise: however, no chickens must be introduced therein, but those that are already big enough, and need not to be kept so warm as those a hen sits on.

There is none of the chicken-houses, wherein the chickens can perceive the changes of seasons so little as in the upper apartments of our rectangular ovens; they enjoy there both the temperature of the air of the spring, and an air warmer than that of our warmest summers: they find in the length of seven or eight feet they have to expatiate in, all the different degrees of heat they can possibly require, and are at liberty to fix in the place where the degree which suits them best is constantly to be had: the artificial mothers become perfectly needless to them in those chicken-houses,
towards

towards the bottom of which they find as much and rather more warmth than a real mother could communicate to them. The fur-lining of the artificial mothers against which we saw them endeavour to clap their back in another place, is not at all necessary to them here, because the upper-air is the warmest in our new chicken-houses; which is not to be met with in the chicken-houses which are buried in a hot-bed of dung and open at top. The excessive crowding of the chickens is not to be feared at all in the new chicken-houses, they never strive to get one upon the other: when the chickens attempt it there, they do it only to procure to themselves a degree of heat which they want, and which the air does not afford them; now they find that degree in the new chicken-house, without being obliged to clap their back close to that of the others.

This last observation is of the utmost importance: it teaches us that the sure means of hindering the chickens from stifling one another in the chicken-houses and under the mothers is, to preserve there as great a degree of heat as they can possibly want, in which case you will never see them crowd one over the other; this will be furthermore confirmed by a chicken-house, or mother of another kind, whose utility is no less certain than that of the foregoing, and which I am still to speak of.

There is no need of hesitating upon the choice of the place the fittest to bring up chickens, when the hatching of them has been procured by means of a stove four or five feet high warmed by the heat of a baking-oven; they never can find any where an air less liable to dismal changes and vicissitudes, than in the very place where they are born, that is, in a portion of that stove separated from the rest purposely to lodge them as they come out
of

of the shell: They will keep in health there, and will grow during the hardest colds of winter, without being at all affected by them. They have tried as I said, over and over, at the society of *L'Enfant Jesus*, several kinds of ovens to hatch chickens, and they have also tried several methods of rearing them: and they thought it proper to follow the advice I gave them of keeping chickens in the stove from the very moment of their birth, till they arrived to the age when they are able to bear the changes which happen in the external air. The portion of the stove which was appointed for them, was separated from the rest by a lattice made of hurdles that reached from the bottom of the stove up to its cieling*: that portion was* Mem. I. afterwards divided into many others by partitions as Plat. III. high as the above-mentioned, and made likewise of and IV. hurdles: they had by that means a variety of lodges, each whereof was peopled with chickens much of an age, and either younger or older than those of the other lodges.

Although chickens are caused to be hatched by means of the heat of dung, we may, at a very cheap rate procure a stove to bring them up, that will be equivalent to that of a baking-oven. I thought it proper to try what it would cost in wood to keep up a proper heat there. My own house supplied me with a small room fit for that trial†, situated on the ground floor, which had† Plat. V. been the closet of a bath: it is nearly square, two of its sides are eight feet and a half long apiece, the other two sides are three inches less, and its height is five feet nine inches. If I had had it made on purpose, I had perhaps diminished all its dimensions, and for certain its height: a room into which a man could not enter without much stooping would be high enough, it would be more easy to be warmed, and would have its warmest

warmest column of air less distant from the floor.
 || Plat. V. I ordered a small stove ||, which I happened to
 Fig. 1. have, to be put in the middle of this room: its
 figure which was round, made me prefer it to
 a square one of nearly the same size, which I also
 had: its roundness caused it to spread the heat
 with a kind of equality on all sides: it was one of
 those, into which the wood is put at top, and which
 * A have a cover * like those of a porridge-pot. I
 ordered four chicken-houses to be put at some
 † P, Q, R. distance † from the stove, directed towards the
 four angles of the room; they were the plainest of
 their kind, meer boxes, and all of them much of
 the same length, that is, as long as the place could
 allow, being some deeper, some shallower; the
 four boxes were also supported in the same man-
 ner, viz. by a couple of props, made of four or
 five bricks laid one upon another.

None of the chicken-houses now in question had
 its peculiar mother, but they had one which was
 common to them all. We have not as yet men-
 tioned a mother of a form like that which I
 || GH.IK. thought to be fittest for these last chicken-houses ||;
 its figure was annular. This mother was a kind of
 ring, something excentrick to the stove: the out-
 ward surface of this, which was but eight or nine
 inches distant from the ring on one side, was above
 eleven or twelve inches distant from it on the other.
 That ring to stand in lieu of a mother, must have
 been a box, and was indeed a very narrow one. I
 had judged that it must be made but just as broad
 as was necessary to make it able to contain two or
 three chicks a breast, and no more, that is, about five
 inches broad: that the chickens might not crowd
 too many of them one upon another, and I had
 made it but four inches high, for fear they should run
 up on a heap. There was still a deduction to be
 made from the breadth I have just mentioned, viz.
 the

the breadth of two fillets of lamb-skin well garnished with hair, each of the two inward surfaces of the circuit being lined with one of those bands. The wood which turners use for making of bushels, pails, and of several other works whose contour is circular, was first used for the making of both the largest and the smallest contour of this mother; but it was thought necessary afterwards to make them of more substantial wood: its bottom was flat, and was let into common boards; and it was against the edges of that bottom the wooden-bands bent into a circular form were fastened.

We have considered both the contours of this new mother as being quite plain, the outward one, I mean that which had the largest diameter, had nevertheless four apertures: the reader will judge exactly enough of their largeness, if he but recalls that we said that the annular mother was to be in common for four different chicken-houses. Each chicken house had accordingly a square hole * bo-
red in the extremity nearest the mother; there came out of that hole a very short square pipe, which was clapt against the aperture made in the mother, or entered a small matter into it: this short pipe was the door through which the chickens were at liberty to pass from each of the chicken-houses into the mother, and then back again.

* Plat. V.
Fig. 1. P.

The proximity of the stove may be dangerous for such a mother, which becomes soon dry enough to be easily fired: we must then think of defending it against the coals, which falling from the stove, may roll too near a wood inclined to take fire. I need not have wanted to see one of these mothers on fire to convince me of the necessity of screening it from that danger; I really saw above two thirds of one of them burnt, and it would have been intirely consumed, if it had been taken notice of a little later. An inclosure of plates of tin,
or

† Plat. V.
Fig. 1.
D E.

or of a tile †, placed between the stove and the mother, raised a few inches above the brink of the latter, and bearing upon the floor, secures it against all danger of being burnt: nor did it once take fire, after it was provided with the fence here mentioned. I had at first clapt the tin close to the outward concave surface of the mother; but I found afterwards that it was more proper to keep them distant at least three or four inches from it: therefore I ordered a greater diameter to be given to a second mother I had caused to be constructed, than I had ordered for the first. The outward concave surface of that second mother was in some places above eighteen inches distant from the outside of the stove.

The chickens themselves require one to hinder them from being either broiled or killed by a too violent degree of heat: they might in some of their pranks fly inconsiderately over the tin-leaves up to the stove and over it, and from thence fall into the space between the stove and the fence of metal: the least mischief that could happen in consequence of this, would be their being stifled by excessive heat, if they should remain too long in a cavity which it is not so easy for them to get out of. They are rendered incapable of getting into so dangerous a place, by a net-work of iron-wire made in form of a cone, or of a truncated funnel*: this kind of funnel surrounds the stove exactly below the cover by that of its extremities which has a less diameter; the other and widest extremity bears upon the inclosure of tin-plates. The chickens that fly upon the grating, are not liable to be too warm there, and if any one happens to fly on the very top of the stove, he is soon warned by the heat he feels, to withdraw, which he can easily do; for which reason I judged it needless to raise the net work above the head of the stove.

* Plat. V.
Fig. 1.
B. C.

The

The inclosure of tin-plates, and the mother, each whereof the reader may imagine to be of one piece, may nevertheless be both divided into two equal parts if you please, or, which is sufficient, into two parts, one of which is but a quarter, and the other three quarters of the circumference: hooks will keep close the two parts, which together fill up the whole circumference of the circle. They are easily separated, and one of them is taken out of its place in a trice, when the management of the stove requires it, and when the quantity of the ashes that have fallen under and spread about it, is become excessive. What I now say of the ashes that fall under that stove is a sufficient intimation of its being one of those which are bored at bottom: however the management of the stove does not absolutely require this division of the mother.

We have hitherto left our annular mother intirely open at top, and it may remain thus uncovered during the major part of the day; but there are times at which it is proper to cover it: it is sometimes proper to cover it intirely, and it is sometimes sufficient to cover it but in part: there are some that want a very thin wrought cover, and others that must have it quite plain: the first * is made of pieces of wood disposed like those of a grate, with* Plat. V. meshes so small, that they permit not the smallest Fig. FG, chicken to get out of the mother; the second is made of pretty thin boards, bored full of holes about one or two lines in diameter. The use for which these two covers are designed, informs us sufficiently what their breadth and contour must be; all what remains to be said of them is, that both of them must be divided into many parts (four at least) that it may be in your power to cover the mother in part only, when you think it ought not be covered intirely, and to cover one portion of

of it with the grated cover, and the rest with the plain one.

This mother is inhabited at most hours of the day by the youngest chickens, and by those which, though older, yet are weak; in short by all those that stand in greater need of warmth than the rest; they know how to seek and find it: there is no reason to fear they should be accumulated to a degree prejudicial to them, so long as it remains uncovered. There are among the other chickens some that walk about or are at rest in the chicken-houses, but there is a much greater number dispersed about the room; they make the best advantage of the large area to run and dance, and exercise their little wings by fluttering. A plot of green turf with which I take care to have one part of the floor covered with, and which is renewed when dry, invites them to keep on the outside the chicken-houses: they remain upon the grass, so long as they find an air that seems sufficiently warm: but, whenever its warmth diminishes to a certain degree, they return to the chicken-houses one after another, and thence retire under the mother. So long as it remains uncovered they seldom happen to range themselves under it so awkwardly and so much on a heap, as that some of them are smothered: the smallest and weakest are the only ones in danger in that case; but, if the stove is carefully looked after, and a heat nearly equal to that they go and seek for under the mother is constantly kept in it, the number of those that shall repair to it will always be small in proportion to its capacity. They have under the same mother choice of more warm or cooler places; it is not warmed equally every where by the stove, and this is one necessary result of its position, ex-

There are chickens which must be compelled to remain within the mother, notwithstanding the desire they might have of leaving it, I mean such as are but two or three days old at most, or those which are weak; if they were allowed the liberty of ranging about with the rest, they would be in danger of being run over by their neighbours, and so rendered unable to rise again. So large a room as that of the mother is not wanted for a small number of chickens, it is enough to devote one part of it to them, the remainder is at the disposal of the rest. A portion of it is previously selected from the rest, and appointed for a small infirmary, and this is effected by putting a partition in each of the two places where it is intended to terminate. These partitions consist of two small and thin pieces of board*, * Plat. V. whose breadth is nearly equal to that of the mother, and its height to the depth of the latter. Fig. 1. G, M. The said partitions are sufficiently retained in their place by bearing against the two bands of lamb-skin between which they are squeezed and confined.

Thus several lodgings may be taken within the compass of the mother according to exigencies; there are even much smaller lodgments contrived in it, than what we have just spoken of; and sometimes one to hold not above one or two of the smallest chickens. The whole of the manner of multiplying these sorts of lodgings, always consists in erecting two small partitions which are ready made, for you must have a number of them ready.

It is on account of these separate lodgings contrived in the mother that the grated † cover is necessary, and it is for the same reason, that the said cover is divided into several portions. One of these is put over the part of the mother that has
U been

† Plat. V.
Fig. F.

been separated from the rest by partitions. This part of the grated cover must have a circumference equal at least to that of the separate room it is appointed to cover: without this cover, the weak and puny chickens would not be exempt as intended, from being trampled on by the stronger: these would often come or rather jump down into the habitation of the weak ones, if the upper part of it was uncovered.

It is chiefly at night that it is proper to divide the inside of the mother into many rooms that have no communication with each other: when night draws near, one ought to take all necessary precautions, that the chickens may pass it in a warm place, and secure from all dangers whatever: they would not always have a good night, if they were suffered to go to bed themselves: this is a care which it is essential you should undertake, that none but the chickens of the same age may be put together at night. The chicken-house may be divided into three or four parts, each whereof may be designed for chickens of a certain size, and a more spacious habitation ought to be granted to those whose numbers and shape require it.

The plain cover is very necessary to procure a good night to the very little ones, when the rats and mice are able to get into the stove, which they are tempted to do by the grains dispersed about in it, they never spare such chickens as are at any time unable to stand in their own defence, and less so when they are fast asleep. I have had sometimes the mortification in the morning to find five or six of them killed in a night, where I had not taken the precaution of putting a cover over them, or when they had had a cover too open. The night was no less fatal to such other chickens, as having crept under the chicken-houses.

or elsewhere, had escaped the notice of those who were to house them in a secure place. However, if the rats spare not the chickens more than we, it is not indeed to make so good a use of them as we do: for, I observe that they contented themselves with gnawing a few of the claws, and a little of the leg of five or six chickens they had killed: this is their dainty bit, I have however found other chickens, but in a much lesser number, whose scull and brain had been partly eaten up.

The chickens of a certain age, such as have the feathers of the wings and tail formed, and some besides on their back, may pass the night in places less warm than such as are necessary for chickens as yet only covered with down: the first may be made to lye in the chicken-houses, and that they may live more comfortably there, one of our old artificial mothers may be given them: But great care must be taken to cover the chicken-house with a wicker covering, or even with a board, that will help to preserve the heat. The rats would not perhaps venture to attack there chickens already capable of standing against them in their own defence; but these chickens may very well have nothing to fear from the mice, and yet not be secure from the rats, which are stronger and much bolder.

Our faithful guide, the thermometer, which serves us so well to enable us to rule the heat of the ovens and of the chicken-houses of all kinds, is no less necessary to make us capable of judging whether the stove gives the air of the room the degree of heat which the chickens require. The heat ought to be so managed, as that its degree at the height of two or three feet, and very near the walls, may never be under the 24th or the 25th, and the manager must propose to himself to

keep it of nearly thirty, or thirty two degrees: there is scarce any reason to fear it should rise excessively: it is always much weaker a little above the level of the floor, the chickens walk on, than it is something higher: I have observed that whilst it was of 32, or 33 degrees at a distance of three or four feet from the floor, it was of but 18 or 19 degrees at an inch's distance from the same floor. The plainest thermometers, and those whose number may be multiplied without any great cost, are sufficient here: you must have in different corners of the hot room small glass-bottles full of butter either alone or mixt with tallow, hanging by a small
 * Plat. V. packthread fastened to the cieling*; that butter
 Fig. 3. b. must always be what has been melted; and when it has been made fluid by the heat of the stove, you must put no new supply of wood into the stove till it coagulates again.

But, in order to make the best use of the heat of the stove, and to procure for the least chickens during the night a heat more necessary to them than the others, you must put into the hot room a second annular mother, raised 20, or 30 inches higher than the first; it must be supported by a number of feet sufficient to make it steady: this mother is to have no manner of communication with the chicken-houses; and as it is designed for none but the smallest kind of chickens, they will have room enough to exercise their legs, although they be in great number there.

The consumption of the wood to be burnt in that stove, will be greater in winter time than in the spring, and greater in the spring than in summer: it will amount to very little in the season last mentioned, and at no time of the year whatever, will it ever be considerable enough to raise the price of the chickens considerably, for the preservation and growth of which we shall be indebted
 to

to it. In days not over cold, and when the morning is not frosty, you will not be obliged to put wood into the stove more than four times a day; you must begin to put some in as soon as you get up, that is, about five or six in the morning, and sooner if possible; then you may put some for the second time betwixt ten and eleven, for the third time about three or four in the afternoon, and for the last time betwixt nine and ten at night: the quantity put in at once may consist of two pieces of wood, amounting to two halves of another piece that was cloven, and is but the quarter-part of a billet. It will give a sufficient idea of the bigness and length of the logs, to say that I found a hundred and sixty two of them in a cart load: the whole load will not then be consumed but in a like number of days, since you will burn but one single log a day. Let us suppose our cart-load of wood to have been bought at *Paris*, and that wood is always at the price it is at in war time, let it cost twenty livres when brought into the hot room, yet will the stove not cost above two sous and a half a day. Chickens must have lived about two months in the hot room, before they are grown big enough to be roasted, I mean that they must have laid you under the necessity of consuming there wood, to the value of sixty times two sous and a half, that is, of seven livres and ten sous worth of wood: if no more than twelve or fifteen chickens were brought up at a time in the stove, they would be no cheap chickens indeed, but if you keep there at a time several hundreds and even a thousand chickens, as you may very well, the expence of the wood will never raise the price so as to frighten the buyer.

It would be needless here to observe to the reader how small this expence in wood will be in the countries where it is common; but it may be

reduced to much less than what we have just reckoned even at *Paris* ; you shall diminish your room better than a third, if you put the cieling of the hot room more than one third lower than that of ours is, which we have already proposed in another place ; this lowering of the cieling will be no diminution of the capacity of the hot room, with regard to the chickens, as it will never hinder it from holding just the same number of them.

The stove we have made use of is a common one, a kind of stove is now promised us which shall, with a quantity of wood less by half, preserve in a room the same degree of heat as is procured by the stoves now in use : this is the character given to this invention worthy of a considerable reward, by a very eminent person who was commissioned to examine it ; but we may, without altering any thing in the usual form of our stoves, make a much more extensive use than is generally made, and than I myself have made at first, of the kind of stove designed to warm a hot room. No body regard the heaps of bricks or of pebbles and stones in a place seeing intended to have an air of cleanliness, neatness, and good order . I caused the empty space which was between the round stove of my hot room, and the inclosure of iron plates, to be filled with those bricks and stones, because I was persuaded that these solid bodies, which would not let the heat they should have acquired go so freely away as the air lets it go, would serve as well as the stove itself to hinder the air of the hot room from cooling. Whenever I have had recourse to this very plain expedient, it has always sufficed to put wood three times a day into the stove. The consumption of wood will be still less considerable, if you put a valve or register in the pipe of the stove a little above the place at which it goes out of the hot room, as I have myself practised,

practised, when the wood shall be well kindled, and even reduced to embers, you will, by shutting up that valve, hinder the heat from going off.

When you shall have put a valve in the pipe of the stove, you must take care not to shut it before the wood is intirely reduced to clear coals. The servant I had ordered to look to the hot room, very often close the valve too soon in order to spare the wood; which filled the room presently with smoak: a bad disposition of the pipes of the stove, contributed also to cause the smoak to enter into the room, and this lasted during the whole fortnight after this stove had been put into it. The chickens which are not less, perhaps more affected by the smoak than ourselves, grew weak and unable to stand on their legs, and died at last: such was the fate of fifteen or twenty chickens, that were put first in my hot room; and this would have given me a bad opinion of it, had I not very plainly seen that the smoak which had been incessantly there, had been their destruction: it was no hard matter to hinder those I afterwards put in from being damaged by the smoak: the pipes were better disposed, and the register was never shut but when it could be done without the forementioned inconvenience, and when there were in the stove none but clear coals, incapable of smoaking.

The smoak I have just mentioned is the only cross adventure the chickens ever had to undergo in the hot room; they throve there much beyond my expectation; whole weeks passed, and not one out of two hundred chickens died; therefore this method of rearing them is the surest, and I would advise the reader to prefer it to any other.

Lastly, the small expence the hot room occasions, may without diminishing the number of the chickens it will help to rear, be of another benefit to

us: it may help to hatch chickens. I have already said in the first memoir, that they might be hatched at a very cheap rate in hot rooms, without being at any further expence than is necessary to keep the chickens warm: I found in my hot room the degree of heat which is proper to warm eggs; I hung to the cieling a basket capable of containing two hundred of them: the man who had the care of regulating the fire, was not at first enough upon his guard, and he let the heat rise to such a degree that the first eggs were roasted by it; but being forewarned by this disaster, he kept those which were afterwards put into the basket in lieu of the first, in the degree of heat fit to warm them with success; the chickens were hatched there as they would have been in an oven built at top of a baking-oven; which prompted me afterwards to increase the number of the egg-baskets in the room.

The manner in which I hang up the basket ought to be explained here, because it informs us of the method of encreasing or moderating the warmth of the eggs at pleasure. An iron-rod *
 Fig 4. a d. like those of our window-curtains, or a plain angular iron-bar, is supported by a couple of pins with round eyes at half an inch distance from the cieling like a curtain-rod: an iron ring is put on that rod; a hole is bored in the ring large enough to receive and let turn freely the shank of an iron-hook riveted within the ring: a rope is fastened to that hook, with four other ropes meeting at top, and which are fastened to the four handles of the basket. The several intentions answered by this kind of suspension are self-evident: the basket is in an air by so much the warmer as is it nearer the pipe of the stove. You put it nearer to or further from that pipe according to the side toward which you make the running-ring to turn. In fine, the
 side

side of the basket which is nearer the pipe is the side on which a warmer air is thrown ; you easily cause all the portions of the circumference of the basket successively to fill the place where the greatest heat is constant, and, for that purpose, you need only turn the basket which is already rendered easy, because the hook to which the rope the basket hangs on is fastened, turns freely within the ring.

Again, you have another means, the moving the egg-basket into a warmer or a colder air by putting it higher or lower, for there is choice of many different temperatures between the several horizontal columns of air from the floor of the hot room which you tread on quite up to the ceiling. We have already observed to the reader, that near the above-mentioned floor, the fluid of the thermometer stood at 18 or 19 degrees, at certain times when the same would have risen to thirty two or thirty three degrees, and even more, had it been placed three or four feet higher : now nothing can be procured in a plainer manner than the raising or the lowering of the basket full of eggs, according as the heat of the air it is in, is judged to be too intense or too languid. Instead of hanging the basket on the hook, you need but fasten a pulley to that hook * on which you put the rope * Plat. V. that carries the basket. If this basket is bored at Fig. 4. the center, you will not even be incumbered in the hot room with the end of the rope by which you cause the basket to move ; this end shall be vertically brought again to the center of the basket, through the center of which you will make it pass to convey it under the basket, where it may be hitched on a stick laid horizontally.

I was not satisfied with one single basket, I had three hung up in the hot room : four of them might be placed in it very conveniently, each
whereof

whereof would hold above two hundred and fifty eggs : and if you had a mind, you might even double and treble the number of the baskets.

However, the more you multiply the chickens in the hot room, the more you will be obliged to use your attention to keep them clean there in proportion. If you suffered their excrements to increase in the room, it would render the air very unwholesome for them, and more capable than the vapours of the dung to hinder the eggs from being warmed with success. The expence of the fire necessary for such a hot room being so very small, I would advise you to have two ; one of which would serve to hatch the chickens, and the other to rear them, that's the surest method.

Notwithstanding the many particulars into which I have entered with regard to the different methods by means of which chickens may be reared with success without the assistance of the real mothers, I have hardly given any thing more than barely the hints for those methods ; the reader will improve and perfect what I shall have left in embryo. This is a subject which admits of a great variety of contrivances, and on which a great many different proceedings may be conceived : but, if you fix upon and pursue with attention any one of those I have pointed out, you will see in proportion a much less number of chickens die, than the chickens which are led and tended by the hen. You must not however entertain any hopes of saving them all : we have not the capacity of bringing all children to the age of men : thousands of them die in their infancy : chickens have their illnesses as well as we, nor are we better physicians for them than for ourselves ; they have ailments of which we cannot discover the causes. They have epidemick diseases, which cause great mortalities among them in some years, and which proceed from causes,
not

not always easy to trace and guess at; as that which I happened to find out, though it was not but till after it had occasioned the loss of a multitude of chickens for a fortnight or three weeks together: they eat very well, and yet grew visibly lean, and then died. All their illness proceeded from a kind of vermin, which had prodigiously multiplied upon them, and which lay concealed in their feathers in form of spots: the vermin was a sort of lice very different by their figure from the lice common to fowls: these are of a figure much like that of the insects which are upon the flesh of dirty men; the others, shorter, flatter and smaller, had a greater resemblance to a kind of ticks found on rabbits, and on the dogs that hunt much in woods and bushes, or to a sort of large reddish mites. I neglected to have one of those of my chickens drawn, imagining I should never want them, and I destroyed them so compleatly, that I could find none when I thought it proper to observe them in the microscope; but I have reasons to think that it is the insect which *Redi* has caused to be represented under the denomination of the hen-louse, in the second of the plates wherein he gave the figures of the insects that live on the larger animals.

I suspected that my chickens had received these insects from the fur, wherewith the artificial mothers were lined; because upon examination of the fur-linings of which I opened the hair, I found on the skins spots of them larger than a six-penny piece. They were so close to each other there, that not the least vacancy could be seen. I caused all those of the mothers to die, by exposing them to the heat of an oven out of which the bread was just drawn, and into which all the mothers were put to a degree of heat which these animals were never able to resist. This method is the surest

est of all to destroy the insects; and by the by, there is nothing more effectual toward destroying the bugs which have fixt their habitation in a bedstead and curtains, than putting both the wood work and the curtains into an oven not hot enough to burn the wood or singe the curtains, but warm enough to render its heat insupportable to insects. We might, if we were but willing improve this hint in a very beneficial manner, and preserve our grain against the insects which devour it in our granaries: which operation would be of still greater importance than the rearing of chickens.

When all the insects of the mothers were destroyed, the number of those of the chickens diminished so very fast, that in a few days I could not find so much as a single one among them.

An Explanation of the figures of the seventh Memoir.

The Head-piece.

The head-piece of this memoir exhibits the inward cavity of the part of a barn which has been designed for the rearing of chickens by means of the chicken-houses buried in a hot-bed of dung. They have succeeded as well at the society of *L'Enfant J. sus*, in bringing up chickens in a place like this as they have in causing them to be hatched in the same, because that place had a high ceiling, and an easy free circulation of the air. But, we ought never to think of bringing them up in the manner represented here, if we cannot be certain that the air of the upper-part of the hot-bed will not be clogged with too much moisture: it being almost as fatal to the chickens already hatched as to those yet in the shell.

The first fig. drops a few grains of corn into a chicken-house which is not very long, and of course proportionable to the size of the new-hatched chickens which are in it.

The second fig. is busy about examining the chickens lodged in a chicken-house longer than the foregoing, to see whether they want any thing.

The third fig. brings in a basket of chickens which are but just hatched, to put them into a chicken-house.

The fourth fig. covers with a hurdle a long box which, together with the cask it is joined with, makes up one of those chicken-houses less simple than the common ones.

Two artificial semicircular mothers are placed in the cask. There is no mother in the box.

The fifth fig. is observing how the chickens are ranged in the two semicircular mothers of a cask. There is a communication of that cask with the box S, that has a lattice or grating at top: this box, and the cask, make together a weaning-box, designed for the chickens that begin to be able to fly.

pq, is a box fit for ducklings, the fore-part of it has been taken off, that the little pond b, and the artificial mother might be seen.

The Head-piece of the eighth Memoir.

The head-piece of the eighth memoir is also designed, to represent the manner of bringing up chickens described in the seventh memoir; it exhibits two of those chicken-houses, whose longest part is an horizontal oven covered with dung like those which are usefully employed to warm eggs. This longest part of the chicken-house is its hinder-part, it is placed in a room different from that where the shortest and fore-part of it is: this is

glazed at top and on both sides. In this drawing no more than the fore-parts of the two chicken-houses represented are to be seen.

The first fig. which has thrust one of his arms into the glazed chicken-house, gives the chickens their food, or is doing something to their habitation of use to them.

Fig. 2 and 3. are busy about another glazed chicken-house. Fig. 2. has taken partly out of it the box in which the chickens are lodged. The fig. 3. is helping fig. 2. to support and pull the box out of the chicken-house.

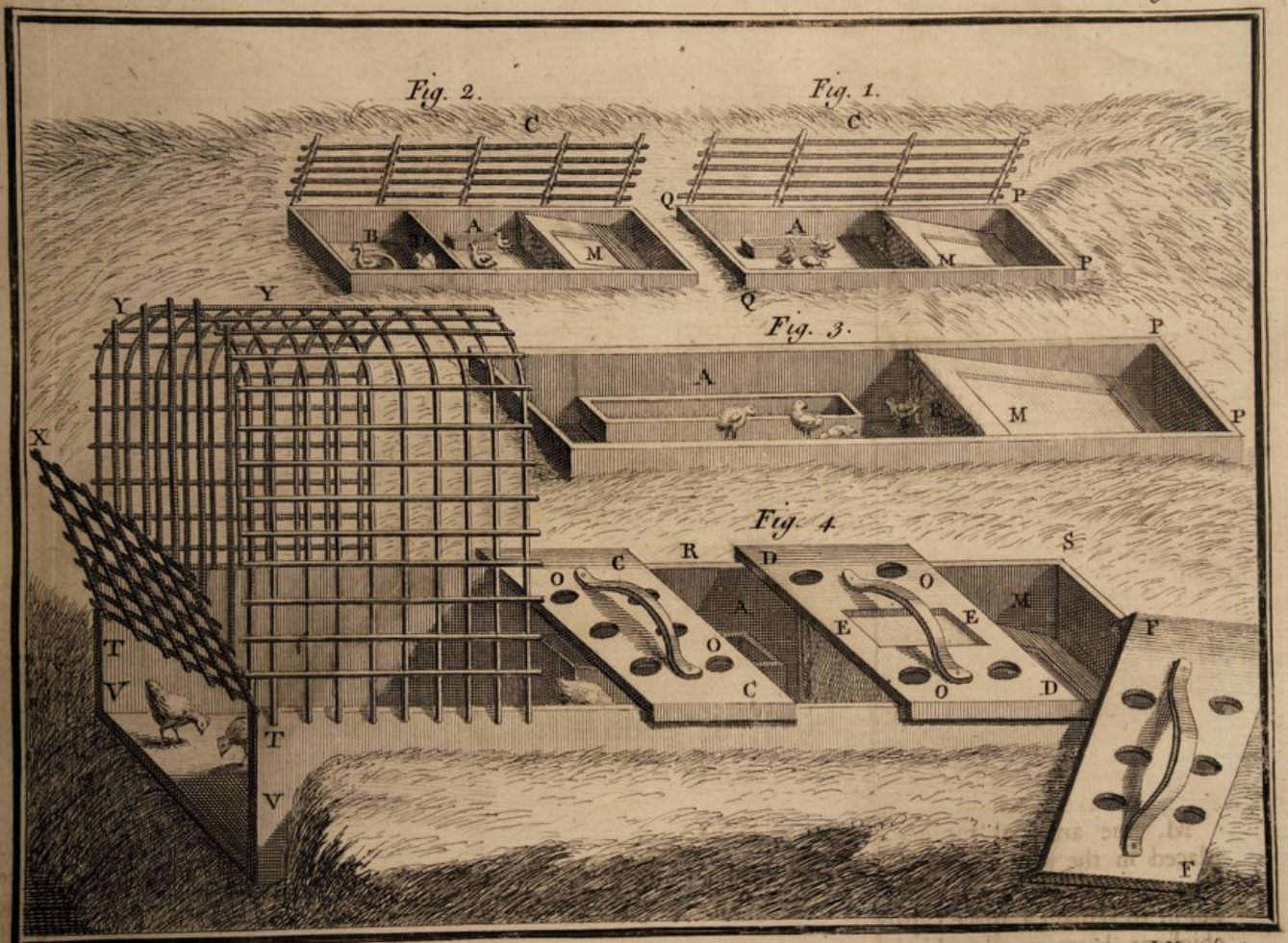
PLATE I.

The figures 1, 2 and 3 represent so many chicken-houses buried in dung. Those marked 1 and 2, which are shorter by half than that marked 3, serve to lodge the chickens which are but just hatched: they are put in that of fig. 3. when being grown big, they want to be removed into a longer place, where they have more room. You are at liberty to make these last chicken-houses as long as the place they are in will allow: but you have not the same liberty to increase their breadth; the broader they are, the more difficult it is to bring the air in them to the degree of heat necessary to the chickens.

One of the extremities PP of the chicken-house is and ought to be here buried deeper in the dung than the other.

M, the artificial mother which ought to be placed in the warmest part of the chicken-house. R, a curtain that shuts it at the fore-part; there ought to remain a space capable of holding many chickens between the hinder-extremity of that mother and the end of the chicken-house nearest to it.

QQ.



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cause the degree of the heat of the weaning-house
cover is necessary whenever you have a mind to
weaning-house, which is without the power. This
make up a constant cover for the part of the
the chicken-house and quite close to each other.
DD, FF, three pieces which being put upon
as may freely walk about.

QQ, the extremity of the chicken-house which is higher above the dung than the rest, and near which the air not so warm as in any other part of it.

A, the drawer wherein the paste for the chickens is put.

C, fig. 1 and 2, a hurdle with which the chicken-house is covered when it is thought proper: the sticks it is made with ought to be closer to each other than they are represented here, so as not to permit the smallest chickens to get out, the chicken-house of fig. 3. ought also to have a hurdle of its own.

The chicken-house of fig. 2. is made for ducklings just hatched: there is at D a partition that has a door or hole, through which the ducklings pass to go into the part of the chicken-house separated from the rest by the partition, and return from thence into the more spacious part. In the part shut up by the partition, B points out a bowl or small dish full of water, which serves the ducklings instead of a pond.

The fourth fig. is that of a weaning-box or chicken-house which is proportioned to the size of the chickens that begin to make use of their wings. These grown stronger, are not the worse for an air that would not be warm enough for the others.

RSTV, a box which forms the body of the weaning-house, its extremity TV is open; it cannot be shut but with the grated door X; this door is fastened to the latticed-bower YY, under which the chickens may freely walk about.

CC, DD, FF, three pieces which being put upon the chicken-house and quite close to each other, make up a compleat cover for the part of the weaning-house which is without the bower. This cover is necessary whenever you have a mind to cause the degree of the heat of the weaning-house
to

to rise. Holes are seen in that cover, some of which have been marked O, they are left open when you have a mind to moderate the heat, and they are stopped with wooden plugs, when you would increase it.

EE, point out upon one of the portions of the cover an aperture through which you may thrust your hand into the weaning-house to put the paste in or for any other purpose, without being obliged to let too much air in to the said weaning-house, or (which is the same thing) to cool to an excess the air of its cavity: when there is no need of this aperture, it is shut up with a small door, only a square piece of board.

M, the artificial mother.

A, one of the drawers wherein the paste or the corn is put.

PLATE II.

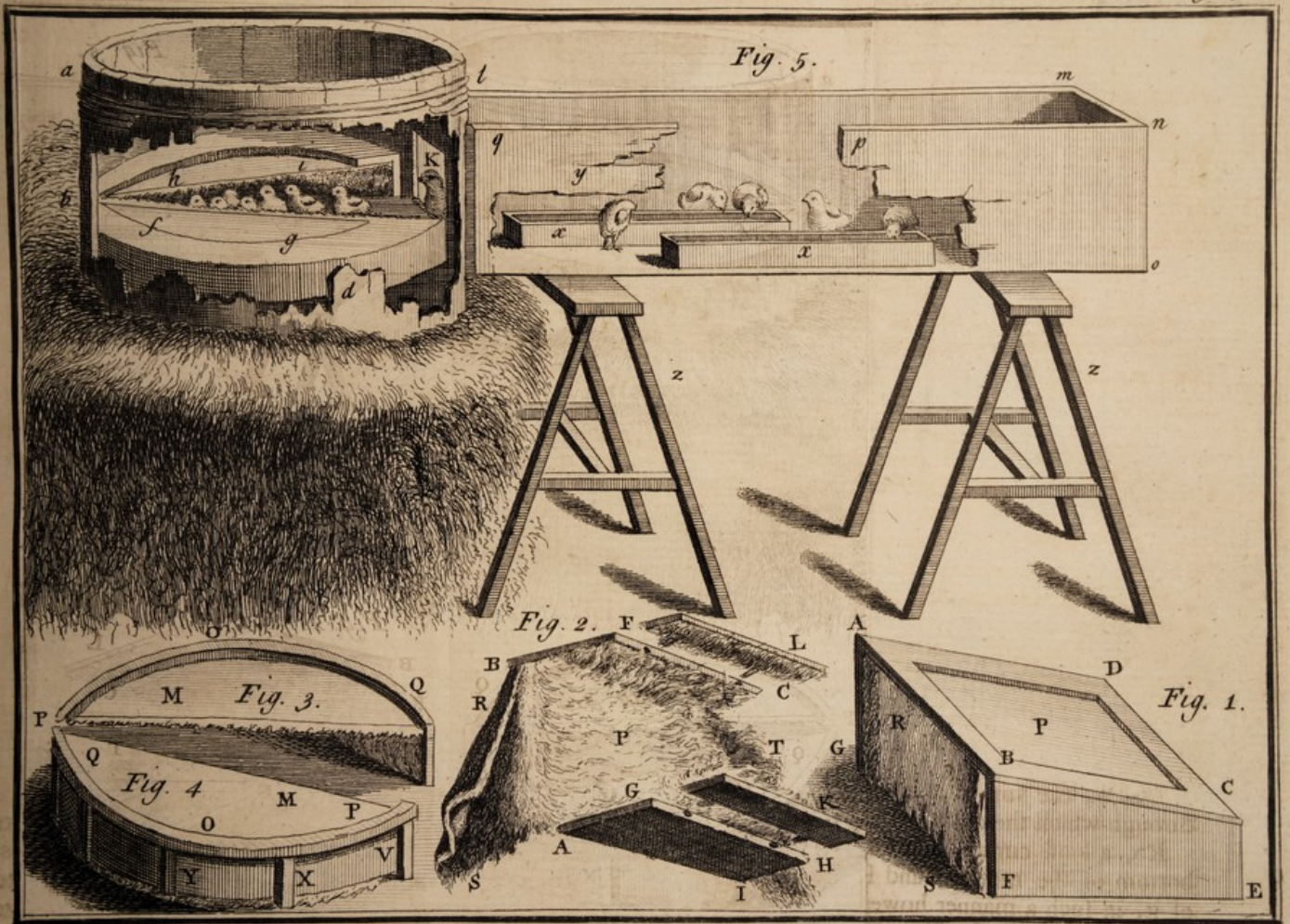
The first. fig. represents an artificial mother seen at top, before, and sideways.

ABCD, a wooden frame which makes the solid portion of the upper-part, and against which a lamb-skin P is nailed, whose woolly side is within the mother.

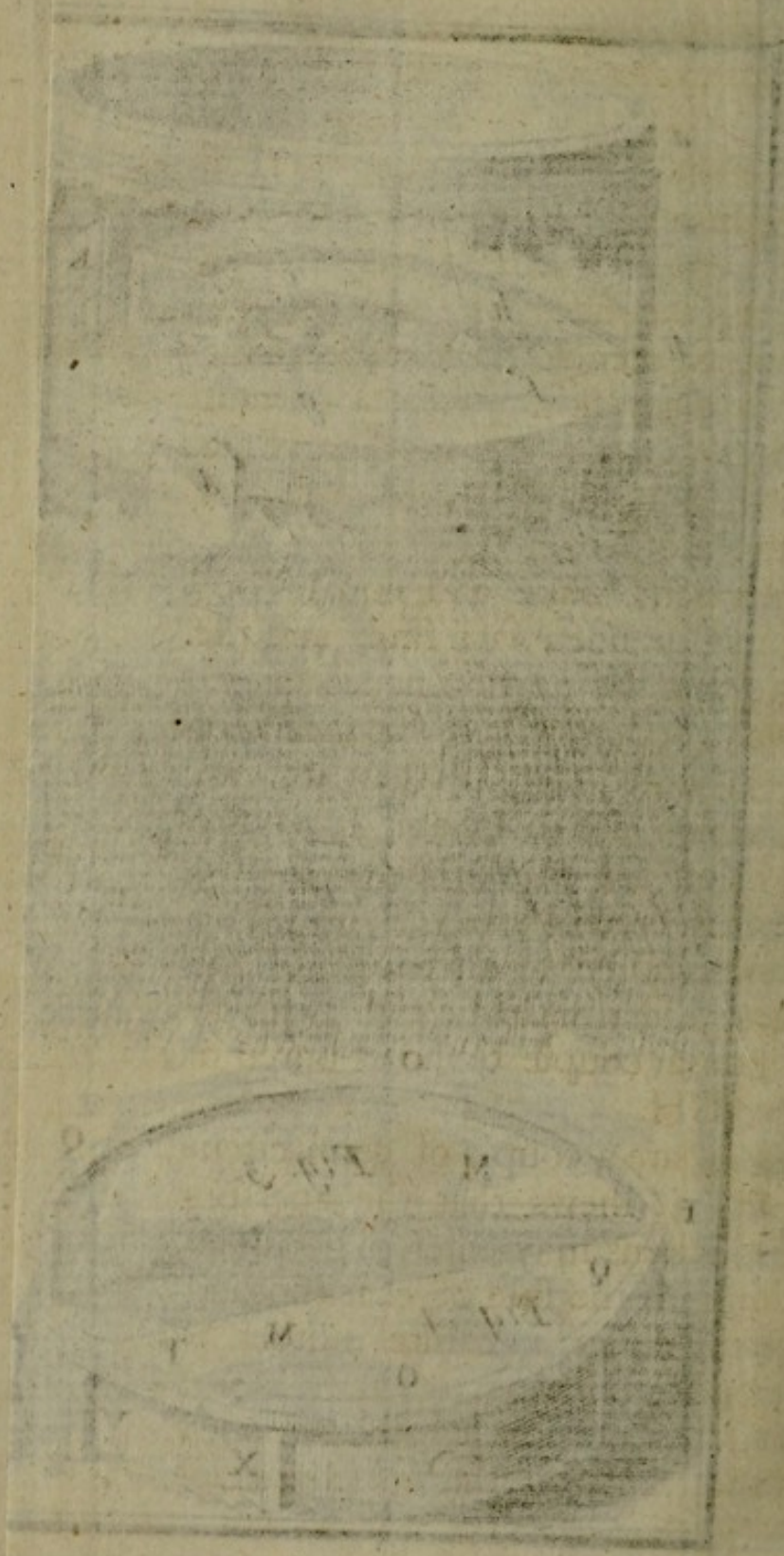
BCEF, is one of the sides of the mother which may be made of a thin board, whose inward surface is lined with lamb-skin: that side may, as well as the upper-part, be made with only a wooden frame.

AGFB, the fore-part or front of the mother, through which the chickens enter into it.

RS, a loose curtain that falls almost quite to the bottom of the mother, and stops the whole front of it, in such a manner however, that it takes not from the chickens the liberty of getting under the mother; they remove and lift it up easily, when they



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they have a mind to go in and out: the hinder extremity, which is a small matter lower than the formemost, is likewise inclosed with a curtain.

AGIHCFB, an artificial mother, which has been turned upside down, to set the inside of it in view.

P, a sheep-skin which lines the upper-part of the mother, and furnishes a good warm fur for the back of the chickens. AGHI, one of the sides of the mother seen at the out-side. CF, one of the sides of the same mother seen at the surface of it which is lined with a sheep-skin. RS, a curtain that shuts up the fore-part of the mother. T, a curtain shorter than the foregoing, nailed at top of the hinder part of the mother.

KL, two pieces perfectly alike and equal, one of which is seen on its side lined with skin, and the other on the outside that has no skin nailed on it. These pieces are two wooden ledges, by means of which the mother is raised higher than it was, when the chickens which are to inhabit it require it to be made so. You see in the piece L two pegs placed so that they enter whenever you please into a couple of holes bored in the edge of the piece FC. The piece K has likewise two pegs so disposed as enter into a couple of holes bored in the edge of the piece GH.

The figures 3 and 4, are a couple of semi-circular mothers. The fig. 3. shews that the aperture through which the chickens may enter to go under the mother is as long as the side of that mother, which is in a streight line. A like mother is seen at its circumference in fig. 4.

QOP, fig. 3 and 4, a portion of the wooden hoop which forms the frame of the upper-part of the mother.

M, a band of lamb-skin seen at the bare-side, fixt on the hoop QOP.

In fig. 4, you see the raisers VXY, and a few others which have not been marked with letters, which support the wooden-hoop QOP. A band of sheep-skin, which is seen here on the bare side, is fastened on these bearers, the height of which is that of the mother.

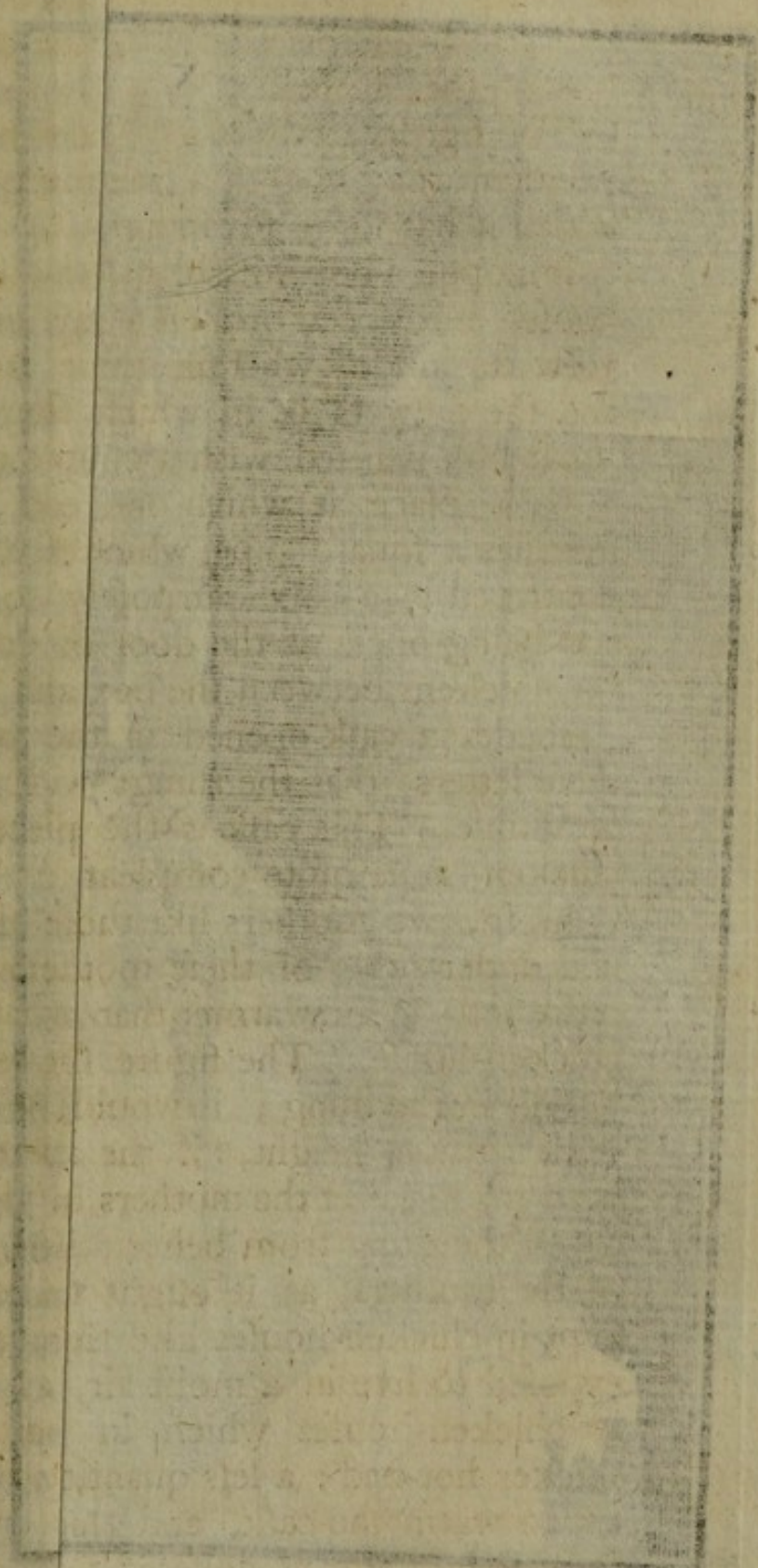
The fig. 5. exhibits a chicken-house more finished than those of the foregoing plate, and over which it has some advantages.

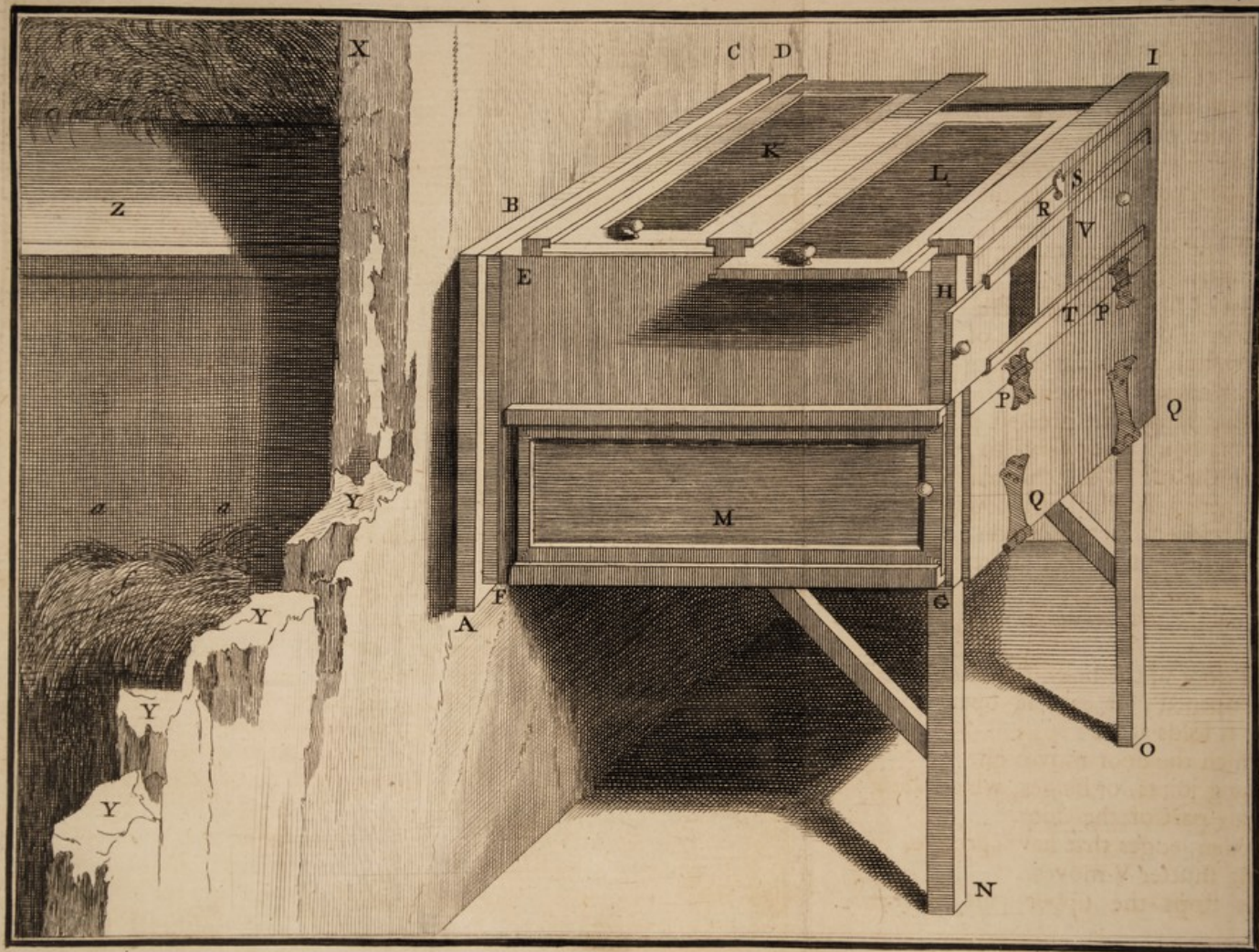
lmnopq, a box which makes part of the chicken-house: it has been broken at qy and p, to expose to view its inside, wherein there are small chickens, and the drawers xx in which they have their food. That box is fitted with a couple of treffels zz.

K, a place at which one end of the foregoing box has a square pipe which fixes in an aperture contrived in a cask purposely to receive it: this end being open, is the door of communication for the chickens between the box and the cask.

abcde, a cask opened in the place marked by these letters, that the things within its cavity may be visible. This cask is the piece that makes the chicken-house quite compleat.

hi, fg, two mothers like those of the fig. 3 and 4: it is under either of these mothers that the chickens retire into an air warmer than what they have in the chicken-house. The figure shews that the cask is buried in the dung; it would be covered with it to a greater height, if the apertures which have been made to set the mothers in view, had not hindered the dung from being raised above the height of the mothers, as it ought to be. The chickens kept in chicken-houses like this, are not so much exposed to live in a moist air, as those that dwell in chicken-houses which in part are buried in a thicker hot-bed: a less quantity of dung is sufficient to warm the cask, and this preserves its heat, because it is always covered with a cover like unto that





that of the casks with which ovens fit to warm eggs are constructed.

PLATE XII.

This plate represents the out-side of the part which, being added to an horizontal-oven warmed with dung, incloses together with the said oven a place very fit to rear chickens newly hatched, a place in short where there are several chicken-houses that have the degree of heat the chickens want.

AB, BC, one of the sides and the upper-part of the oven warmed with dung.

DEFGHI, a sort of box fastened at DEF against the mouth ABD of the oven: the side of the box which is clapt against that mouth, is quite open.

K, L, two glazed frames, moveable in an horizontal direction, that fill up the greatest portion of the upper-part of the box; they serve to enlighten that box within for the use of the chickens.

The frame L is here a small matter beyond HE, it might have been placed likewise beyond DI.

M, another glazed frame, that serves to give light to the lower part of the box.

NGH, OQI, bearers that serve as a support to the box.

QQPPTR, the door of the box: this door must be let down to be opened; it can be opened but half way, because it folds at PP.

QQ, hinges which the door moves on.

PP, double turning joints, or hinges, which allow you to open but one part of the door.

T, R, two wooden ledges that have grooves in them, in which the shutter V moves.

S, a hook that stops the upper part of the door.

XXXXY, a wall that has been demolished in part to set the body of the oven in open view. Z, the upper-part of the oven. aa, one of its sides. The dung with which that side and the upper-part of the oven was covered has been taken away. f, the dung the oven rests upon.

PLATE XIII.

The intention of this plate has been to shew the inside of the large glazed chicken-house, of which one sees only the outside in the foregoing plate; and to shew that this larger chicken-house is divided into three smaller ones, and how every thing is disposed there so as that the chickens may be kept warm, clean and safe in it. What serves to shut the glazed box, *viz.* the panes, the glazed frame, &c. has been taken away; there are only fragments of them left, but the bearers and the cross-pieces which are the principal timbers of the whole building have been left intire.

AB, BC, one of the sides and the upper-part of the oven warmed with dung.

D, the remainder of the upper-part of the top of the box which was fastened against the upperledge of the oven.

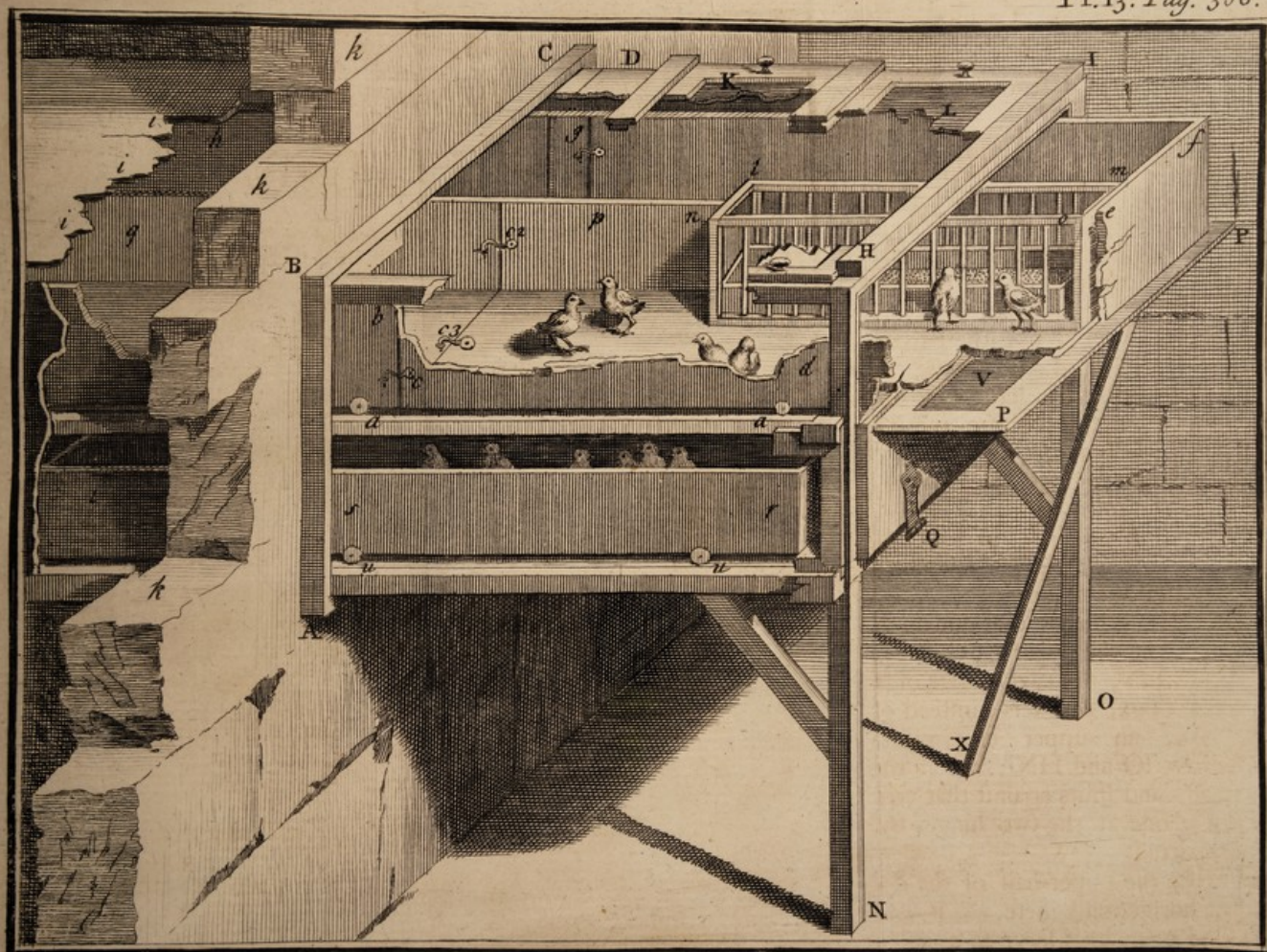
K, L, portions that remained of the two glazed frames of the upper-part.

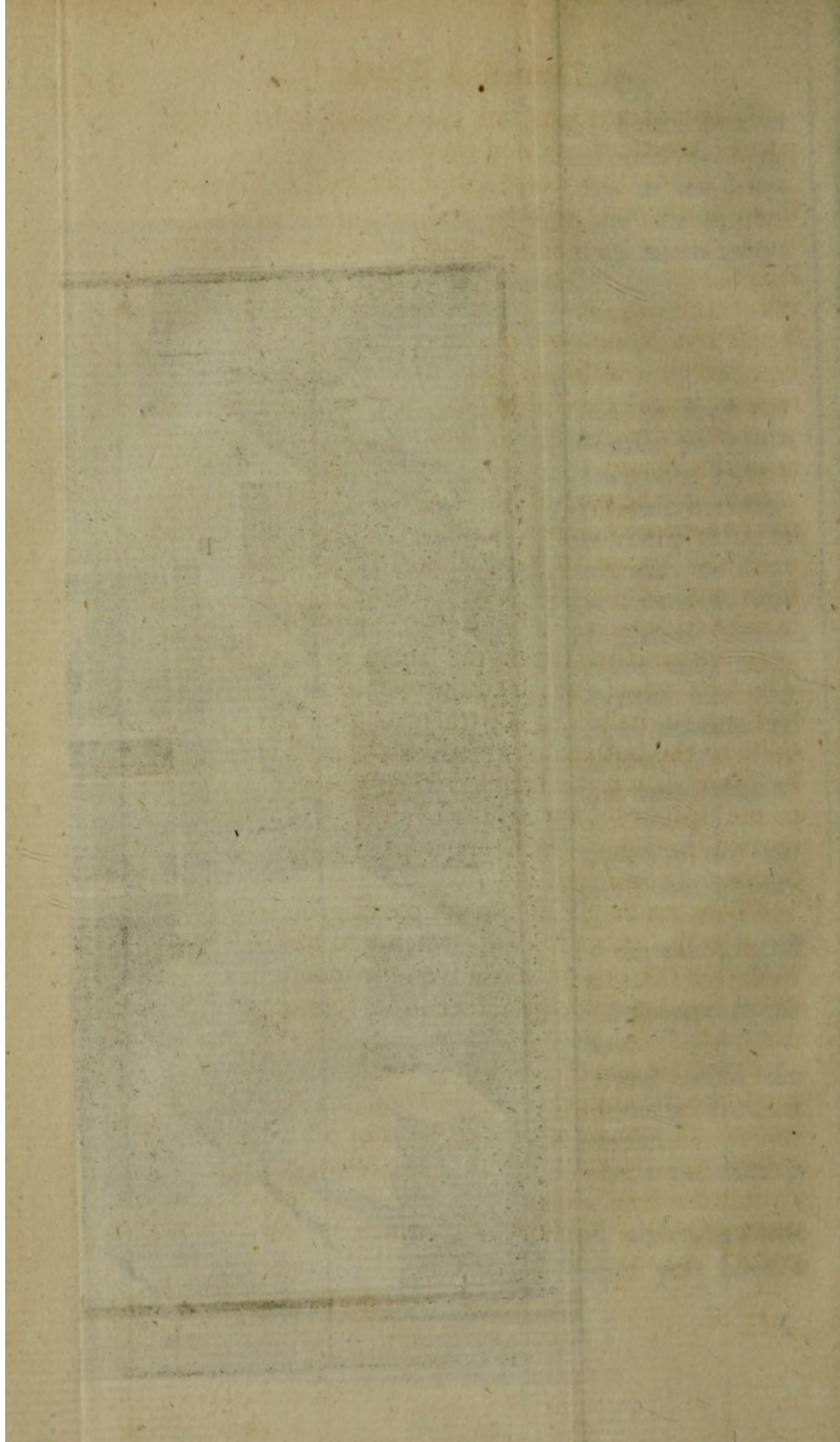
IO, HN, the two bearers of the fore-part of the glazed box, that serve instead of feet.

IH, an upper cross-piece fitted with the bearers IO and HN; when the door is shut, it strikes and shuts against that cross-piece.

Q, one of the two hinges by which the door is supported.

PP, the upper-half of the door, which has been put horizontally here, as it is when you have a mind to make it serve as a table.





V, one of the panes of glass which is set in that part of the door, as in a frame.

X, a stick that keeps the upper half of the door in an horizontal position.

aa, a floor that consists only of a strong wooden ledge: the opposite side has one equal to this in every respect, and placed at the same height. These two ledges are the floor that bears a long box which constitutes the upper chicken-house, and is even equivalent to two chicken-houses, when it is divided in two according to its length, as in this figure.

bcdefg, the part of the long box which supplies the two upper chicken-houses.

at bcd, quite to e, the boards of one of the sides and of part of the extremity, have been broken to set in open view the things in the box.

c, a hook that fastens the part c to the part b. The box which we are now considering is seven feet and a half long or thereabouts; it reaches quite to the bottom of the oven; and that it may be more easy to be handled when you have a mind to pull it intirely out of the oven, it is divided into two portions which are kept together by the hooks c, c 2, and c 3.

There are at g and b a couple of grooves which serve to fix a small board, when you have a mind to divide the box in a transverse manner, in order to confine the chickens either in its fore or its hinder-part.

There are above aa, which mark the floor that supports the upper chicken-house, a couple of casters, that make it easy to be moved, when you have a mind to draw it out of the oven. It is partly drawn out of it in this figure; its fore-part rests upon the kind of table PP which is the upper-part of the door.

kkk, &c. a wall that has been pulled down to set in open view the part of the oven which is to be covered over with dung.

h, is the inward surface of one side of the box, which forms the upper chicken-house.

iii, the remainder of the boards that covered the upper-part of the oven.

lm, no, a couple of racks between, and along which there are drawers that contain the food of the chickens, and their drink, which is nothing but plain water.

p, c c, q, a thin partition which being contiguous by one of its ends to that of the racks, and prolonged quite to the bottom of the box, divides it into two equal chicken-houses, either of an equal or an unequal breadth, as may be thought proper.

rst, one of the sides of the box that constitutes the inferior chicken-house; a few chickens lodged in it are shewing their heads.

uu, casters that facilitate the motion of the inferior chicken-house.

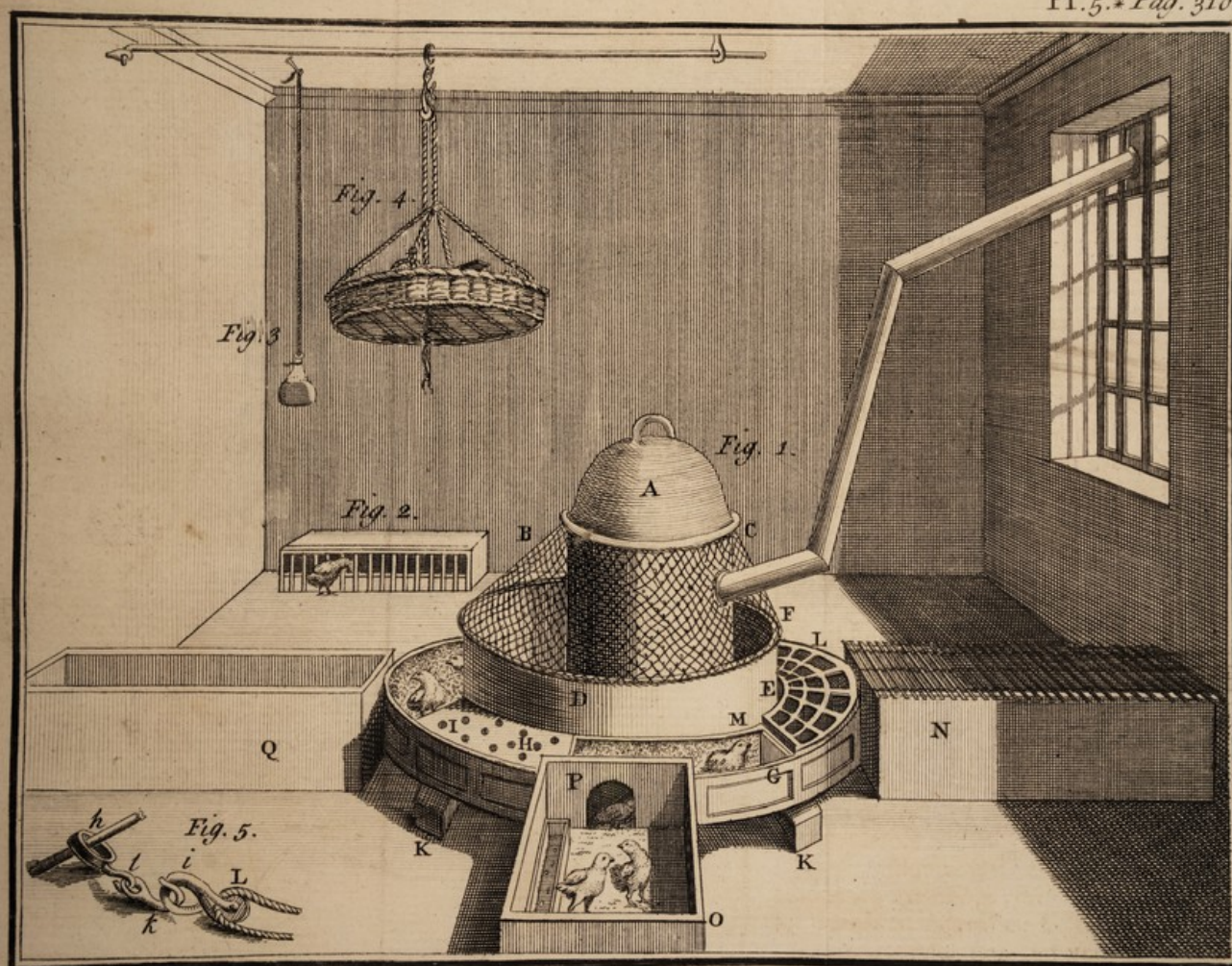
PLATE V.

This plate exhibits the inside of a hot-room designed to bring up chickens in, and which may be as usefully employed to hatch them: it is five feet nine inches high, eight feet six inches in length, and three inches less in breadth.

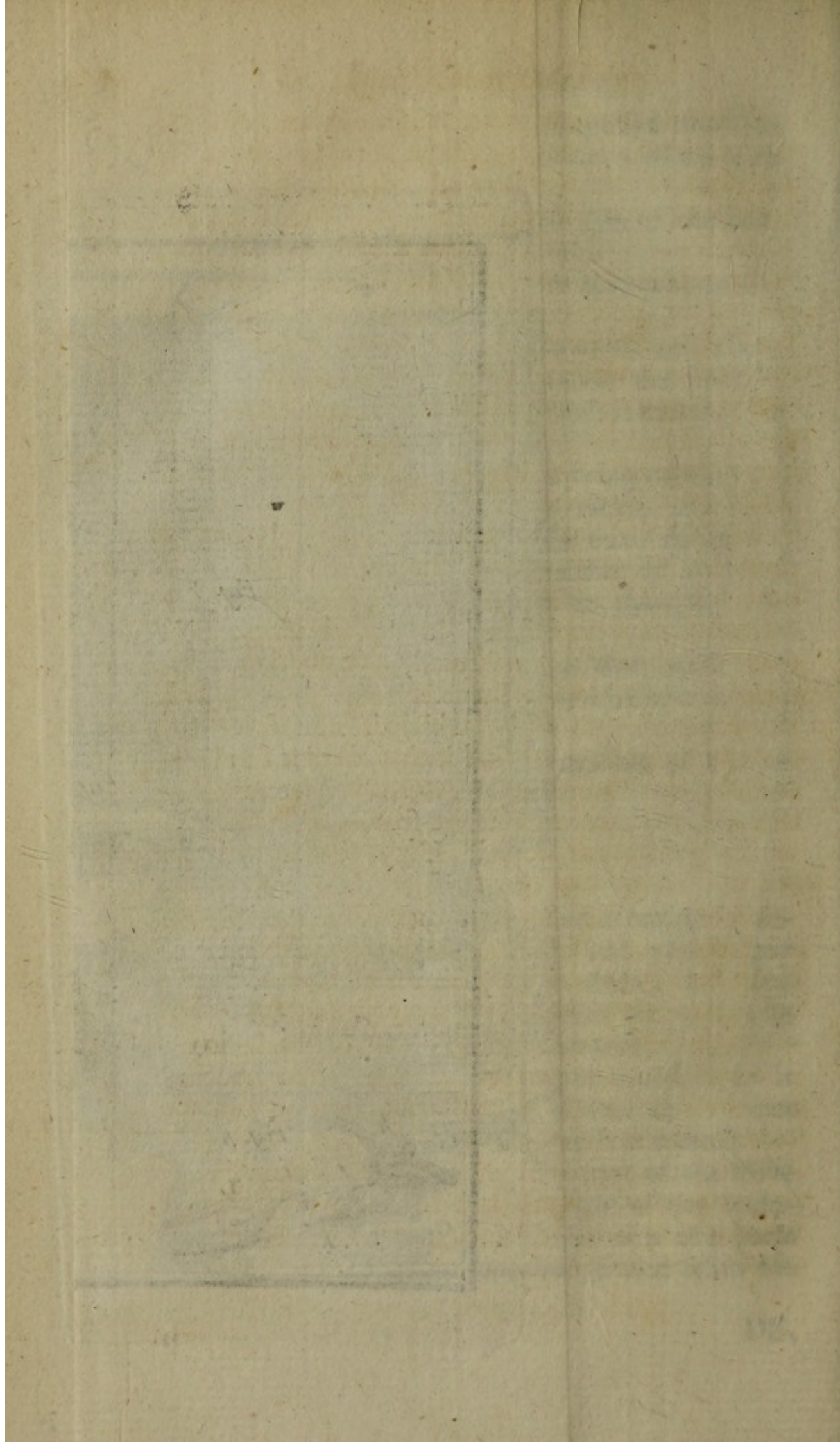
A, marks the cover of a stove whose body is cylindrical. It is by taking off that cover, that one puts wood into the stove when it is wanted.

BC, a grate that surrounds the part of the stove below the cover, quite to the height of the inclosure DE. This grate is divided into two parts which may be, and which are separated when the ashes of the stove are taken away.

DE,



J. Mynde sc.



DE, an inclosure made with tile, or with tin plates, which is to be distant from the stove by the breadth of a common brick at least, and which may be distant from it the length of the same brick. This assemblage of plates or tiles, is the fender that confines the burning coals and the ashes, and hinders the giddy chickens from roasting themselves. If the space which is between that fender and the stove is filled with bricks laid plainly one upon another, the consumption of the wood necessary to preserve in the room a certain degree of heat, will be much diminished by it.

FGHI, the annular chicken-house; it is here clapt immediately against the fender. The first I caused to be constructed was so, but inconveniences which I have found in that position, have made me alter it. I now actually give the ring which forms the mother, a diameter large enough that the circumference of it, which is nearest to the stove, may be four or five inches distant from the fender; by that means the mother is never exposed to take fire, nor even to be scorched, when the fender grows too warm. If the fender and the mother happen to warp, if too near each other, there are cavities between them into which the chickens cannot fall without being in danger of being burnt, because they cannot get out of them: when the empty space is greater and equal every where between the mother, the chickens jump down without any danger. If the fender touches the chicken-house, it must not in that case be warmed by the bricks.

KKK, the feet or supports of the mother.

I, a part of the chicken-house covered with a board which is bored with small holes only.

L, a part of the mother covered with a grate.

M, a part of the mother separated from the rest by a couple of small partitions.

N, O, Q, three chicken-houses which have a communication with the annular mother, and which are fixt against it. A fourth chicken-house, which is placed in fymmetry to the chicken-house; O, is hidden by the stove.

P, the door through which the chickens may come from the chicken-house O, into the mother and return. Each of the other chicken-houses has a like door.

R, a hurdle that covers the chicken-house.

The second fig. exhibits the kind of grated box in which the drawers which contain the dry grains or the paste given the chickens are.

The third fig. is that of a butter-thermometer hung to the cieling; you must have of them in several parts of the hot-room.

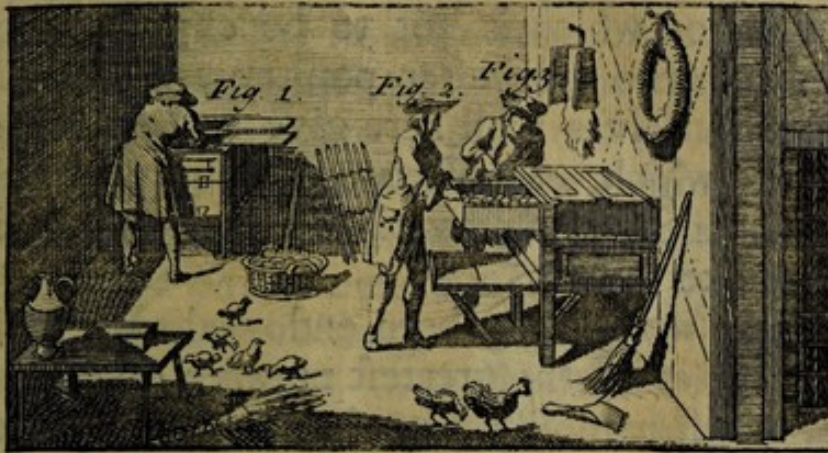
In fig. 4, ad is an iron-rod which the basket full of the eggs to be warmed by the heat of the stove hangs on. The weight of the basket and of the things in and about it, is borne by a ring which slides upon the rod, by means whereof the basket may be drawn near or removed from the pipe of the stove, according as you would have it, in a warmer or cooler air.

The fig. 5. represents more at large than fig. 4, the iron-pieces that serve to hand up the basket.

h, the ring that slides on the iron-rod.

l, the shank of another ring that goes through the first, within which its extremity is rivetted. This shank may turn freely within the hole which receives it. K, a hook, one of the ends whereof is ingaged into the ring i.

l, a pulley fixt within the ring. The rope at which the four other ropes that hold the four handles of the basket meet together, is put round that pulley.



MEMOIR VIII.

The sequel of the manner of bringing up chickens. And of the several kinds of food that may be given them.



THE reader has judged, no doubt, that if we omitted mentioning, in the foregoing memoir, the foods which are fittest to be given to chickens, we did it with an intention to enlarge upon that subject in this. We never could rear any chickens, if we did not give them wholesome food, or, which is commonly the same thing for animals, if we did not give them food to their liking. However, the people of the country would never be at a loss with regard to the quality of the foods to be given to the chickens that are hatched in ovens, although we should say never a word about it: the foods which it is proper to give them no way differ from those given to chickens hatched under hens: but what belongs to the manner of feeding them, either with regard to the method for rendering their food more beneficial to them

them, or with regard to the management and husbanding the foods they consume till they come to be hens and cocks, and even after that, deserves an examination which is not to be expected from any of those who look after poultry-yards, and of which we ourselves shall here give but an imperfect sketch, which may afterwards be improved by the experiments and observations others may be invited to make.

The birds which have been endowed with an inclination to set on the greatest number of eggs at a time, must naturally have been, as they in reality are, discharged of the care of carrying beak-fulls of food to the little ones they hatch: for how could a hen, a partridge, a turkey, &c. be able to fill with grain the crops of twelve or fifteen young? The cock and hens which are under the necessity of giving bill-fulls of food to theirs, as the pigeons, thrushes, jack-daws, magpies, ravens, sparrows, &c. do, have but a few of them to feed, sometimes but two, and generally not more than five or six at most. There are hardly any exceptions to this rule; the tit-mouse of the smallest kind is one however. We are uneasy for the little mother when we find her with twelve or fifteen young ones to feed; she seems to be in the case which would much embarrass hens, partridges, turkey-hens, &c. till we reflect that the tit-mouse makes them feed upon snails and worms, one single one of which may satisfy any one of her children: what she does for it with one single bill-full, a hen could not do it for one of her chickens but by bill-fulls very frequently repeated, did each consist of a single grain of corn, or millet. The distribution of flying birds into those which are free from, and those which are charged with the care of feeding their young, that is, into those of a very fruitful, and others of a different kind, has
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been made much to our advantage : we should be great losers, if birds of prey, crows, magpies, &c. were as fruitful as hens and partridges, and these were not more fruitful in proportion than birds that do us so much harm, and which we know not what to do with, actually are ; these are dispositions we do not consider with all the gratitude we ought to express towards him to whom we are indebted for them.

The little bird which found in the egg sufficient supplies for his unfolding, and his growth, and which enables him to break his shell, comes out of it with a provision of food to support him a certain time, till he has acquired the strength of seeing out and providing for himself. Some authors say, but I much question the certainty of their observations, that the ravens remain seven days after their birth without receiving any food from their fathers and mothers : what is more certain is, that the chicken is under no manner of necessity of introducing any thing into his crop, for four and twenty hours, and even more ; you may tempt and oblige him to take his food sooner, by offering him corn ten or twelve hours after he is hatched, but in that case you make him eat before he is hungry. A considerable part of the yolk has not been consumed by the little bird lodged in the shell ; it enters into his body a little before he comes to light ; it is digested there, and nourishes him of course : it is then no wonder to see the little creature grow stronger, notwithstanding he hath fasted above four and twenty hours.

The first actions of a chicken put under an artificial mother are more easy to be observed than those of chickens attended by a real mother. If he has there met with companions older than himself, he is not long among them without determining by their example to go with short and quick steps into the chicken-house :
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he always finds there something to pick up, and pecks the bottom of the box several times, between which he rests and leaves pretty long intervals; he seems to do it rather to begin to exercise himself than to indulge any desire of eating; and when he begins to be hungry in reality, his pecking grows brisker still.

We saw just now that the last food the chickens have received from nature is yolk of egg; for which reason people have thought that the best thing that could be offered to them for their first meals was yolk of egg: it is customary to give them the yolk of an egg boiled hard, after having strewed in some crums: others chop hard yolk of egg and crums of bread together. I have given it both ways to my new-hatched chickens, so long as the number of them was but small; but as this food might become very expensive in case one had a great number of chickens to provide for, I have endeavoured to make myself certain whether they would not be as well pleased with plain crums of bread: I have seen them eat these with as good a stomach as the yolk of egg, and those who have lived upon it have been as healthy as any of the rest. You will excite them to eat it by crumbling it between your fingers, and by letting a shower of small crums fall round them.

You must not omit dropping a few grains of millet along with the crums of bread. They very readily pick them up and swallow them first when they begin to eat, and their stomach is then strong enough to digest them. But though you should not excite their appetite by this shower of small grains and crums, they would nevertheless know very well how to pick up and fill their crops with what should be dispersed upon the floor of the chicken-house; they would even soon learn to go and fetch these foods from the drawer and small cup

cup where they shall have been put, to avoid their being mixt with too much filth. The same vessel may be filled with crums of bread mixt with millet, or you may have two vessels, one of which shall have nothing but bare crums in it, and the other nothing but the millet.

They are dry almost as soon as they are hungry; for which reason you must not forget soon to provide them a small vessel full of water, which must be so fixed, as that they cannot fling it down. It must be neither wide nor deep; nor is it enough to prevent their falling into it by its being too small for that, it must besides be so shallow, that they may not be able to wet any thing but their feet in it: but they will most commonly keep without the vessel, and take in with their bill drops of water, which you shall see them swallow, lifting up their neck and head.

The food which I gave them on the first days, may be given them so long as they remain in the first chicken-house; they may continue to feed upon it in the second, and even in the weaning-house: in short, they may with bread and millet, which are not a very dear diet, be brought up to the size of large chickens.

However, it is not enough to have thought of making them eat, we must think likewise of helping their digestion. The grains of gravel and small stones which we find the gizzard of fowls and of so many other birds of their class partly filled with, such as turkeys, &c. have caused observers to suspect, that these hard bodies, out of which no nutritive juice whatever can be extracted, were not however sought for and swallowed by them to no purpose; that they were the instruments by means of which that thick solid consistent stomach called the gizzard, is able to triturate the grains and other matters which are conveyed into its capacity,

capacity, and that they are to it so many very small, indeed, but very numerous mill-stones. This is no place to mention the experiments I have made to convince myself that this notion is exactly true; but I must needs observe here, that the stomach of even the youngest chickens, must, as well as that of the hens, make use of grains of gravel to help on their digestion, and that consequently it is essential to spread upon the floor of the chicken-houses fine grains of gravel or sand for them to pick up whenever they please. I think that my little chickens have been much more healthy ever since I have taken this precaution, than they were before I reflected it was not to be over-looked.

The chickens that run freely about our poultry-yards, find grass there, they now and then eat some on't, they also pick worms out of the ground, and sometimes catch flies and gnats, which are very great dainties to them. It has been my study, that those which are detained in the chicken-houses should not be deprived of all these comforts; that they might have the same variety of dainty bits as those that lead a freer life; and that they might not be reduced to such an excessive uniformity in point of foods, as might render these either less inviting or less wholesome to them. In order to this, I caused a plot of very green turf to be put at the end of each chicken-house: the little chickens come thither to pick up the grass, and scrape the ground, out of which they now and then have the good luck to fetch some worms.

But, what I never could have expected, and what my continual care for them did not at all further, is, that the uncovered chicken-houses warmed with dung, afford more insects to them, and with greater ease too, than poultry-yards and orchards can possibly yield to the chickens which are allowed to run about them. The study I have
made

made of insects had nevertheless taught me, that dung is the native place of a great many kinds of them, and that worms of various species feed and grow in it, and are metamorphosed into flies there. A multitude of gnats of an excessive smallness, which renders them sometimes imperceptible to our eyes, proceed from the minutest of these worms; other gnats, a small matter larger, whose form and bigness is much like that of our common gnats, and which I have distinguished in another work by the name of *Tipules*, have also been dung-worms: all these minute flies enter by swarms into the open chicken-houses, and adhere to their sides. The chickens which see them much better than ever we do, and which are eager to hunt for them, never fail to catch in their bills those which are within their reach; they stand on tip-toe, they jump, and even flutter a little to raise themselves up to the small flies that happen to be above them.

The product of their hunting in point of flies and gnats, is nevertheless small in comparison to that of another kind of insects, which have no wings. The wood-lice love damp places, and such where the air is mild and temperate; they are commonly found in cellars, people take them to make a powder which is looked upon as an efficacious remedy against many distempers. There are some equally fond of dunghills; these have been multiplied in the hot-bed of my chickens, to a degree which I never could have expected: and when the hot-bed was destroyed in places near the wall, an innumerable multitude were discovered, which had been concealed in it. This is the place also where wood-lice like to keep during the day: they come out of their retirement in the evening, and disperse all over the place where the hot-bed is. At night, if you visit the chicken-houses with a light in your hand, in summer time especially,

you will see the bottom and sides of them covered with these insects: there is hardly any place an inch wide but what is covered with wood-lice, and there are sometimes above seven or eight of them together within that narrow compass; and as they are of all ages and sizes, the chickens may pick and chuse at pleasure. I have elsewhere said that the chickens are invited by the light to come out from under the artificial mother, and that they are as well disposed to eat in the middle of the night as they are at noon; if therefore you have a mind to give them a regale of wood-lice, you need but go with a candle at night: they pick them up with much greater eagerness than they do their millet, and even prefer them to it. The wood-lice do not repair to the chicken-houses in that quantity by day, but yet they then lye there, and are incessantly caught by the chickens: these insects chuse to reside in the artificial mothers rather than any where else.

Since chickens find grafs in their habitations, and a greater quantity of insects than they would find in the country, the expence of bringing them up in the chicken-houses cannot be sensibly greater than by letting them run freely about the hen-yard, and which we nevertheless supply with corn. But what do these charges amount to? This is a question which ought to be asked by all who would know the proportion of the product with the expence, and who would not chuse to venture the sowing more than they can reap. It might be difficult here to make an estimate to satisfy them, but it is self-evident that men had not persisted in causing part of the eggs to be sat on by hens during so long an uninterrupted series of years, if a multitude of continually repeated experiments, had not taught them there was something to be got, or at least nothing to be lost by selling chickens instead of selling the eggs they were hatched from when
chickens

chickens are very small, and when their crop is no bigger than a pea, to the age when it is about as big as a cherry, that is, from the birth of a chicken till it is a month old, the daily charge of the bread and millet it eats is exceeding small: we shall mention hereafter some experiments whence it may be rated very near the truth; and other experiments will shew, that a chicken is still fed at no great charge during the second month, after which time he may be set at liberty.

But what do chickens at liberty cost till they are grown as big as they need be? What is the charge of feeding hens, cocks, and capons? No body, that I know of, ever made the experiments to enable us to answer this question: however, it is a subject on which it is of importance to us to be well informed, as it is the basis of the œconomy and management of a poultry-yard. The experiments which I have begun, and which deserve to be continued, will enable us to judge what can be the outside of the expence occasioned by the best fed poultry, and what is the amount of the expence of fowls not tended with the utmost care, I mean of fowls which we would feed at the cheapest rate that may be.

Grains of all sorts are the food given to poultry in general. They love oats, buck-wheat, barley, Indian corn, rye and wheat. They are fed by way of preference with some one of these sorts of grains in particular, according to the year and country. We are used to throw once or twice a day to the fowls of a poultry-yard a quantity of grain, which is generally somewhat less than that which they would consume if it was left to their disposal. However, fowls are not so insatiable as one would be apt to think, from the greediness with which they eat the portion of food given them. I judged it to be not only a curious, but also a useful thing to

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know what quantity of each sort of grain a hen would eat in one day, if she had it at her discretion from morning till night: these experiments are fit not only to teach us what the outside of the expence to be made in a year for one single hen can be; (a thing which must be known at least to those who have a mind in town to feed hens kept in coops) they serve moreover to inform us what sort of grain must be given them in order to feed them at the cheapest rate.

There are greater eaters among hens as well as among other animals. We naturally judge, and are not deceived, that those of the largest size eat most of any: I have found upon examination, that the quantity of grain consumed in one day by a large hen, was to the quantity of the same grain consumed in the same day by an ordinary hen, in the proportion of four to three, and that it was to the quantity eaten by hens of the smallest kind, which are rightly called dwarf-hens, as two to one. There are also among the hens of the same size and kind some that want more food than others. I have sometimes seen four of our common hens eat as much as eight others, among which there were three of the largest size, and three of the remaining five were little inferior to the biggest; but these rare cases are no impeachment of the general rules.

In order to be able to lay down some of these general rules, I kept hens under several chicken-baskets: each hen was alone in her separate cage. I put others in lodges, or in large huts shut up with grates, where they were much more at convenience, even so much as to be able there to lay eggs as if they had been intirely at liberty: and I even gave to the hens of each lodge a cock, that nothing might be wanting; there were seven hens in some of the lodges, and there were but two in those

those which had the least number. For several days together I gave, both to the hens that lived single in cages, and to those that lived in company in the lodges, the same sort of grain measured, and which was more than sufficient to fill their craw: there remained every hour of the day, some of that grain in the small wooden-drawer that was to contain it. The length of that drawer was more than it was broad; there was at bottom and on every side of it, a piece of board, and that long enough to jet out five or six inches on each side of it: these pieces rendered its basis very firm, and put it out of all danger of being overfet by any of the hens jumping into it; the sides of the drawer were lastly high enough, to put it out of the power of the hens to scrape the grains of corn out of the box. These small precautions were necessary to prevent any diminution of the corn that could not have been easily accounted for. Nor did I forget to cause some gravel to be spread upon the bottom of each lodge and cage, and to have a quantity of it put besides in a separate vessel, because I thought it proper to hasten their digestion.

The measure of corn which a hen was satisfied with every day, was nearly the same, whether it was oats, buck-wheat, or barley: therefore that of these three grains that happen to be cheapest in any year, or any country, is the kind which ought to be given to hens, without minding the greater price of the other two. The difference of seasons may occasion variations in the appetite of the hens which I am not as yet acquainted with: they may require a greater quantity of food at some times than at others: what I know is, that in the months of *January* and *February* a common hen, that has from morning till night corn of one of these three sorts lying before her, eats of it in a

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day

* A wood-day but the quarter part of a *Litron* *, *Paris-*
en measure measure. I even make the dose too great for a
containing common hen; for there remained generally some-
something thing of two *litrons* given to a very large cock, and
more than two hens of *Caux* †, of two others of a middling
a pint. size, between that of the latter, and that of the

† A place size, between that of the latter, and that of the
 in Nor- common hens, and of three hens of the usual
 mandy size. However, I have seen hens of *Caux* eat each
 very fa- of them daily the third part of a *litron* of either
 mous for barley, or oats, or buck-wheat.

One would be apt to think that wheat is the most
 exquisite kind of grain for fowls; the voracious man-
 ner in which they eat it, would incline us to think,
 that they would eat much more of it than of barley
 or of oats; just as our peasants that should be
 served with none but the finest of bread would eat
 more of it than of the very brown bread they live
 upon. Nevertheless, hens that have wheat lying at
 discretion, eat of it in a day but a measure, which is
 about one quarter part smaller than what they eat
 of the above-mentioned common grains. I never
 saw a hen eat above $\frac{1}{6}$ of a *litron* of the finest
 wheat; but we are to observe that this difference
 in the bulk, is more than compensated by the dif-
 ference in the weight, $\frac{1}{6}$ of wheat weighing more
 than $\frac{4}{6}$ of oats.

However, a compensation of the nature of that
 we have just mentioned, is not, or at least is not
 always the reason why a hen is satisfied with a smaller
 measure of one certain grain for her daily food
 than of another. Rye does not weigh more than
 wheat, it even weighs a small matter less: ne-
 vertheless, the measure of rye, which satisfies
 a hen from morning till night, is smaller than
 the measure of wheat necessary to produce the same
 effect; nay it is smaller to a degree that surprised
 me by its oddness, it being but one half of the
 other. The seven hens and the large cock above-
 mentioned,

mentioned, which eat together one litron and a half of wheat in a day, did not eat in the same time above three quarters of a litron of rye; therefore the consumption at a medium of the rye eaten by each of these hens was but $\frac{3}{4}$, whilst that of the wheat was $\frac{6}{32}$ of a litron.

The measure of *Indian* corn which a hen eat daily at my house was much greater than that of the rye she consumed, though a small matter less than that of the wheat. The greatest eaters were contented the first day with eating $\frac{1}{8}$ of a litron, but they took a greater liking to it afterwards, and the cock and the seven hens already mentioned, which I look upon as being all together something above the middling rate of eaters, consumed daily a litron and $\frac{1}{4}$ of that grain: $\frac{5}{4}$ of a litron of *Indian* corn did then stand to them in lieu of $\frac{6}{4}$ of a litron of wheat, and were for them equivalent to no more than $\frac{3}{4}$ of a litron of rye.

We estimate a little too high the consumption of each grain daily made by a common hen, by taking it up at that which has been made by the cock and the seven hens, among which there were some of the largest size; but we chuse to commit mistakes rather by excess than an under rate, in these estimates, which relate to expences which are to be frequently repeated; what we spend less than what we were satisfied with and willing to spend, becomes thus clear gain. Therefore, we may reckon that a common hen having all day long grain at discretion, will cost for her daily food

Of barley, of buck-wheat or of oats, but	
$\frac{1}{4}$ of a litron, or — — — — —	$\frac{8}{32}$ of a litron.
Of wheat — — — — —	$\frac{6}{32}$
Of Indian corn — — — — —	$\frac{5}{32}$
Of rye — — — — —	$\frac{3}{32}$

The observation made above upon the proportion which the specifick weight of wheat bears to that of rye, has already shewed us, that if a hen eats a greater measure of one sort of grain than of another, it is not because of its being lighter : but this is again confirmed by the following little tables, wherein the proportion of the specifick weights of the severall grains which hens feed upon are expressed. The first of these tables gives the weight of a *litron* of each of those six different grains, such as it was found when they were brought to me from the corn-chandler.

The quantity of each of these grains which had been weighed was put into a paper bag ; then it was left in a low and excessively moist room for almost two months, after which it was weighed again. The measure of some of them, which had been no more than level with the brim when weighed for the first time, was swelled much above it, when weighed again. The second table gives the weight of each grain in this second weighing.

The self same grains were weighed a third time, after having been kept for almost three months together in a hot room, where a heat fit to cause chickens to be hatched had been constantly maintained, and the quantity of each grain, which had already been weighed twice before, proved then to be too small to fill the *litron*-measure : the bulk of some of them left in it a vacancy of four lines and a half : the third table shews what was at that time the respective weight of these originally equal quantities of different grains.

One of these three tables would be more than sufficient for the use we chuse actually to make of it, but they shew, when compared together, how many precautions ought to be taken, if we were willing to know the specifick weight of each grain with a degree of exactness to be of use.

The first weighing of the six different sorts of grains, such as they were when brought first from the seed-shop. The weight of the litron of

			Oun.	Dr.	Gr.
Wheat	_____	} was found to be	19	1	52
Rye	_____		18	4	12
Indian corn	_____		17	5	48
Buck-wheat	_____		16	7	12
Barley	_____		14	0	48
Oats	_____		10	3	12

The second weighing of the self-same grains, after their having been kept in a moist place near two months together,

		Oun.	Dr.	Gr.
Wheat	_____	19	3	48
Rye	_____	19	3	36
Indian corn	_____	17	6	12
Buck-wheat	_____	17	0	48
Barley	_____	13	7	12
Oats.	_____	10	3	12

The third weighing of the self-same grains, after their having been kept in a hot room for three months together,

		Oun.	Dr.	Gr.
Wheat	_____	18	1	54
Rye	_____	18	1	18
Indian corn	_____	16	3	18
Buck-wheat	_____	15	7	36
Barley	_____	12	6	6
Oats	_____	9	5	12

It is plainly proved by these last tables, that buck-wheat is heavier than barley and oats; yet cannot a hen be sufficiently fed in a day but by a measure of buck-wheat equal to what she would eat of either of the two other grains. Shall we think it is their palate that invites them to eat more of one grain than of another? Is it gluttony, which prompts us not to be satisfied with a quantity of exquisite foods, equal to that we are satisfied with when we are entertained with but common things, also a vice of the fowl-kind? Is it because wheat is more pleasing to their palate that they eat a quantity double to that they eat of rye? Being willing to discover if this was the reason, I ordered a partition to be put in the box in which the daily food of the hens of a lodge was put; so that the box was divided into two equal cavities by that partition; a measure of wheat was put into one of them, and a measure of rye into the other. Three hens and one cock, to whom these two dishes, as I may say, were served up at a time, did not shew a greater liking to the one than the other: there remained after their first morning-meal nearly as much wheat as rye. They, in the course of the day, finished eating what they had left of them, and emptied intirely both the box of the rye, and that of the wheat nearly at the same time: nor did they do any thing that shewed that they any better liked the kind of grain of which a smaller quantity is capable of satiating them.

The foregoing experiment is one of those which may easily and which ought to be repeated: it is no matter of indifference to know the sorts of grain hens have the greatest liking to, because they are those which ought *cæteris paribus* to be given them in preferably. I then thought it proper to try the taste of hens with regard to the different grains, and I have done it not only by offering to them the said grains

grains put in different boxes as above, but also by filling one and the same box with two different grains mixt together. For instance, a measure of oats was mixt with a measure of wheat. A hen and a cock to whom this mixture was given, shewed somewhat more of appetite for the wheat than for the oats: there remained at night in the box a portion of the oats, which was not indeed a quarter, nor even a sixth part of the whole, but among which there was not a single grain of wheat left: the hen and cock had eaten the wheat with more pleasure than the oats. But I made another experiment, whence I gathered that this was not the general taste of hens; it was perhaps but the transitory taste of that day, the humour in particular of the above mentioned couple of fowls. I gave the same day to a hen, that was kept alone under a cage, a measure of wheat in one half, and a measure of oats in the other half of the same box. The hen eat in the course of the day the whole measure of oats to a grain, and left almost half of the measure of wheat. A measure of rye was given her the next day; and she preferred the eating it rather than that she had left of her portion of wheat the day before.

A measure of wheat and a measure of oats mixt together were given to the same hen; she took up grains of both sorts with her bill, but rather more of the oats than of the other; as she proceeded in picking up both together, the wheat appeared more and more to predominate in the mixture; the whole of the oats was consumed at last even to a single grain; and the remainder of the wheat was nearly one sixth part of the measure that was first given her of it.

Another experiment taught me also, that hens have not all of them the same fancy for the same kind of food. I once served at a time to a cock
and

and a hen kept in the same lodging, three different dishes, each whereof was put separately into a partition of one and the same box, *viz.* buck-wheat, oats, and *Indian* corn. The cock came first to the *Indian* corn, and after having looked at it for a while, he disdained it at last. He did not do the same to the buck-wheat and oats; he began by picking up a few grains of the buck-wheat, and then went to the oats: and continued for some minutes to take alternately a little of the one and a little of the other: the hen, on the contrary, no sooner saw the *Indian* corn, but she fell foul upon it without once thinking of quitting it. I caused the partitions of the common drawer to be turned the other way, purposely to invite the hen to eat some of the buck-wheat and oats, by putting them more within her reach than the *Indian* corn, and to see whether the taste of the cock could not be determined in favour of this last grain, which was almost under his bill: but he would not so much as touch it, and drew again near the other two kinds of grain for which he had already shewed a greater inclination; and the hen went round to her *Indian* corn, which she began to pick up again with great avidity.

The next day the same cock and hen were served with the very same grains: they, neither of them, seemed to care for the *Indian* corn; the hen fixed upon the buck-wheat, which the cock himself seemed to like better than the oats, which he now and then went to pick up a grain of and left it again directly. All the buck-wheat was soon dispatched, and a great part of the oats besides; and the remainder of this and of the *Indian* corn were picked up in the course of the same day.

As to the *Indian* corn, I must not forget an observation, which informs us of the kind of it which ought to be bought preferably; the grains
of

of the most common kind are yellow, but there is one sort whose grains are red or reddish, or of a reddish brown colour this is best.

The six sorts of grains which are most generally given to hens, and which we have spoken of hitherto, were presented at once, that is an equal quantity of each, in a common box divided by partitions into six equal parts, each whereof contained but one sort of grain: the whole quantity was such, that it sufficed for them for above two days. The whole of the buck-wheat was dispatched the very first day; there was no barley left on the second morning; the *Indian* corn and the wheat were intirely consumed and nearly together in the second afternoon, and a little rye and oats were left for the third day.

It would be needless here to mention a greater number of experiments of the kind of the foregoing ones; I have varied and combined them a thousand ways, and repeated them over and over; the whole sum of what they have taught me is, that it is not so easy a thing as one would have thought, to pronounce, what are the grains which hens love best of any: it seemed to me, that there were some hens which eat more readily the grain which they had been used to, than any other new grain that was offered them: it seemed to me, on the contrary, that the appetite of some other hens was excited by a new kind of grain; in short, we find among them instances of the same oddnesses which are found among men in point of taste. It is very certain, at least, that it is not because one sort of grain is lighter or more to their liking, that they eat a greater quantity of it: it is probable that the grain of which the smallest quantity is sufficient for them, is that which supplies them in greatest abundance with that milky extract which is to mix with the blood, and serve to repair the
continual

continual losses which are made within them, as well as within any other animal body. Other experiments there are which must not be omitted upon any account, will furnish us with proofs that the foods which are most easy to be digested by hens are those which they take in greater quantity: however, it seemed to me demonstrable, that of the six different grains now in question, that which they are soonest tired and least fond of is rye.

The several grains are not always given to poultry in their dry form, we commonly boil that with which we have a mind to fatten them: we boil it in water, till it is grown soft enough to be easily mashed between our fingers: the water makes it swell to such a degree, that the flower, by dilating, obliges the skin which contained it to burst and split: boiling any grain to that degree is what we call bursting it. Although burst grain is looked upon as fitter to fatten fowls than the dry, I know not whether this notion has been established upon comparative experiments made with a sufficient accuracy: 'tis what they indeed ought to be, and I shall make it my task in time, but they are in fact no part of the matter in hand: the point in which they may be thought pertinent to it, is, to know whether it costs more to feed fowls with burst grain, than with that which has not been boiled, whether a hen eats more or less of the burst grain than of that which is not so. To make myself sure of this I caused four *litrons* of each of the six different grains now in question to be boiled. The following table gives the proportion of the increase, in point of bulk, procured in each kind of grain by the boiling that caused their skins to burst, and soften them so, as to be mashed between the fingers.

Dry

*Dry Grain**Burst Grain*

4 Litrons of oats, after having been boiled to bursting have filled	7 litrons.
4 Litrons of barley, after having been burst, have filled nearly —	10 litrons.
4 Litrons of buck-wheat, after be- ing burst, have almost filled —	14 litrons.
4 Litrons of <i>Indian</i> corn, after having been burst, have filled a- bove — — — — —	13 litrons.
4 Litrons of wheat, after having been burst, have filled a little more than — — — — —	10 litrons.
4 Litrons of rye, after being burst, have filled nearly — — — — —	15 litrons.

Although rice is not common enough in *France* to have been thought of as a proper food for fowls, I nevertheless thought myself obliged to make myself sure of the degree of the increase of its bulk procured by boiling: I knew very well that it swelled it to an infinitely greater degree than any of our usual grains.

The reader doubtless thinks that I must have tried the taste of hens with regard to the several boiled grains as I had tried it with regard to the dry ones; that I must have endeavoured to discover by experiments like unto those above-mentioned, whether the boiling would render each kind of grain more or less inviting to hens, and what among the different kinds of boiled grains were those which they liked best. The experiments were varied and repeated for that purpose beyond what was necessary: hens were served with two, three, four, five and six different dishes: sometimes all the divisions of the box which were in lieu of the drawer, were filled with burst grain, but

but every one of them with a kind different from that of the rest; sometimes each kind of grain filled a couple of divisions, one of them having nothing but boiled, and the other nothing but dry grain in it. All I have been able to collect from these often repeated trials, is, that the number of the hens which prefer boiled grain to the raw, is the greatest, but that there are many of them, that will chuse eating the dry grain on certain days. I have not as yet been able to find any permanency in the preference they gave to any kind of burst grain: those which had been fonder of boiled wheat on one day in particular, have, on another day, preferred the buck-wheat, or the *Indian* corn, the oats or the barley, or even sometimes the rye: however, I judged that the last of these, whether boiled or raw, was in general what they liked least of any. These experiments serve at least to make us easy as to the choice of the grain they must be fed with; as they leave us at liberty to give the preference to the cheapest of all.

But other experiments of the same kind were necessary to inform us, whether there was any œconomy, in feeding hens with boiled grain, or no benefit at all to be got by cooking it that way, or rather even a detriment resulting from it. So long as we already knew the quantity of a dry grain which a hen could consume in one day; all what remained to be examined was, whether after the swelling procured by the boiling in a like quantity of the same grain, the hen would or would not eat it in one day: the results of my experiments that way, are these.

Notwithstanding the considerable swelling procured in the rye by boiling, the consumption made of it in that condition by the hens, far from being diminished, would rather be increased a small matter. The seven hens and the cock which had eaten

but $\frac{3}{4}$ of a litron of dry rye in one day, eat in the same time three litrons of the same grain boiled: now, eating three litrons of boiled rye, is consuming $\frac{4}{5}$ of a litron of the dry one, which is a quantity greater by $\frac{1}{20}$ than $\frac{3}{4}$ of a litron: therefore it would cost $\frac{1}{20}$ more to feed hens with boiled rye, than to feed them with the same kind of grain dry.

The hens which would have eaten four litrons of common oats in a couple of days; eat also in two days the same quantity of that grain, although the boiling which had made it burst, had swelled it so as to make it fill seven litrons: it costs therefore as much to feed hens with boiled oats, as it costs to feed them with dry ones.

Buck-wheat swells yet more by bursting than oats do: and the four litrons of that grain that have undergone a pretty long boiling, become fourteen litrons; and yet there is nothing, or at the most a very trifle to be got by boiling that grain: the hens are able to dispatch the fourteen litrons of that swelled wheat nearly in the same time in which they eat the four litrons of the same grain left in its natural state.

But there would be œconomy in feeding hens rather with *Indian* corn boiled, than with the same grain in its natural condition: those who would have eaten a litron and $\frac{1}{4}$ of this last grain, eat but three litrons a day of the same grain boiled, which are not equivalent to one litron of that which has not been swelled by boiling it: it was for two days and no more that they have been able to eat three litrons of it in one day: in every one of the two following days they had enough of a couple of litrons of that boiled grain, whether the food of the two days before, had enabled them to do afterwards with a lesser quantity of it, or whether their fancy for that prepared grain had slackened. Nevertheless, there would be a benefit of above $\frac{1}{5}$ if

if they were to eat three litrons of boiled *Indian* corn a day, and the profit would be much more considerable, if they continued to be satisfied every day with a couple of litrons, which would not be equivalent to $\frac{2}{3}$ of a litron of the same grain dry: there would be $\frac{1}{3}$ and $\frac{1}{3}$ to be got upon the quantity of it which they must have in a day, and as $\frac{2}{3}$ and $\frac{1}{3}$ are equal to $\frac{3}{3}$, this would be saving above one half.

Again, there is great benefit to be got by feeding hens rather with boiled than with dry barley. Hens which would have eaten two litrons of the latter in one day, eat but three litrons of the former: now 10 litrons of boiled barley being the product of 4 litrons of the dry one, three litrons of boiled barley are the equivalent of no more than $\frac{6}{5}$ of a litron of the dry; therefore the expence in dry barley is to that of the boiled, as $\frac{10}{3}$ to $\frac{6}{3}$, as 10 to 6, or as 5 to 3; so that there is $\frac{2}{5}$ of the quantity of that grain to be saved, by giving it to the fowls boiled rather than dry.

The foregoing table shews that the swelling of boiled wheat is nearly the same as that of boiled barley; but my hens have taught me that there is not so much to be got by boiling the former as by boiling the latter: the benefit of it amounts to no more than $\frac{1}{5}$, which is but one half of the other profit: the same hens which had eaten three litrons of boiled barley in one day, eat likewise three litrons of boiled wheat. These three last litrons do not stand in stead of as great a quantity of dry wheat, as the three litrons of boiled barley stand in lieu of so much dry, since the hens in question could not eat above one litron and a half of dry wheat in one day, whereas they eat two of the dry barley; again, the litron of boiled wheat is equivalent to no more than $\frac{2}{3}$ of the same grain dry,

dry, and the three litrons of boiled barley stand in lieu of only $\frac{6}{5}$ of the dry one. Whilst the hens eat in boiled wheat no more than the value of $\frac{6}{5}$ of the same grain dry, they would have eaten a litron and a half or $\frac{1.5}{1.0}$ of a litron of wheat in its natural state; therefore, the proportion of what they eat of corn when dry, is to what they eat of it when boiled, as $\frac{1.5}{1.0}$ to $\frac{6}{5}$ or $\frac{1.2}{1.0}$, or as 15 to 12, or as 5 to 4; there is then a benefit of $\frac{1}{5}$ to be got by feeding hens with boiled wheat.

We are able, by means of the experiments we have just mentioned, to judge in every country which is the food œconomy prescribes to be there given to poultry. These experiments teach us, that if they are fed with wheat, barley, and *Indian* corn, there is a great profit to be got by never giving them the said grains but when they have been well boiled, because the expence of the fire necessary to boil these grains till they are quite soft and burst, is but small in comparison of what is saved upon the quantity of them: in the families where a porridge-pot is constantly upon the fire, the expence of the said boiling is nearly made, as a very small addition of wood will suffice to make the water of the kettle, wherein these grains shall be put, to boil. But the same experiments have shewed us, that there is no husbandry in boiling oats and buck-wheat, and that there would even result an increase of expence, (though a trifling one in the main) from feeding fowls with boiled rye.

In short, the same experiments will make it easy to be decided every where, whether the charges of the feeding of fowls that have as much grain as they can possibly consume in their power, do not exceed the product that may be expected from them; and whether the hens which are kept in coops, or other places that supply little or no addition

to the food given them, may repay us in eggs what they cost us in keeping. Why should we not be curious to know how much a hen would cost a year, when kept in a very unfavourable place, and even over fed with a certain sort of grain? Let us suppose that grain to be barley; we have already seen that if a quarter of a litron of it is given her every day, she will have enough and to spare; therefore, she will eat 365 quarters of a litron, or 91 litrons and $\frac{1}{4}$ every year, which being divided by 16, will be reduced into bushels, *Paris* measure: the quotient of that division is 5 bushels, 11 litrons and $\frac{1}{4}$, which are an ample provision of food for a common hen during the course of a whole year. Let us suppose that provision to be 6 bushels, in order to have a round sum which does not much increase the expence, and makes the calculation more easy; those six bushels make half a *Settier*, *Paris* measure. When the settier of barley is bought in this town at seven *livres* and ten *sous*, which is the price it cost me the last year, the hen costs in a year 3 *livres* and 15 *sous* which she will have repayed with interest, whenever the number of the eggs she shall have laid in the course of that year shall be above 75; for there is no season in which a new-laid-egg is not worth at least a penny at *Paris*, and there are times when it costs two, three, or even sometimes four *sous*.

If instead of dry barley, which we have given this hen, we never give it her other than boiled, there will be $\frac{2}{5}$ to be deducted from the annual expence, which will be then reduced to 45 *sous*.

The expence just set down is that of a hen deprived not only of the liberty of going to feed on some green plot, but even of that of going to scratch on a dunghill: this last privilege may lessen the expence more than we are apt to think, and
reduce

reduce it to about one half. I had one and twenty hens, among which there were some young ones, but so large for their age, that some of them already laid eggs; they all of them hated to leave the hot-bed whereon they had been hatched, and reared; they had besides a mutual affection for each other: my gardener, who had tended them from their hatching, and who used them like creatures he was very fond of, had found, by a great many experiments often repeated, that three litrons of oats, or three litrons of dry barley, which come up to the same, were more than all these hens could compass in a day; they would have sufficed 24 hens of the same size. Each hen had cost but $\frac{1}{8}$ of a litron of dry barley a day, that is, one half of the barley which we have seen our hen eat under a cage. The expence of the latter would then be diminished by half; if she had the liberty of scratching a dunghill, and that expence would not exceed two and twenty sous and a half.

If besides the liberty of scratching dunghills, your hens have green plots to go a grazing from morning till night, which they are naturally inclined to do, and which they certainly will do out of a kind of necessity if you give them corn but sparingly, you will be able to diminish above one half of the sum which a hen would cost you that should have boiled grain almost at discretion: in which case each hen would be very well fed during the course of a whole year, for eleven *sous* and three quarters.

If the reader wants an example in the great to prove that the last reduction far from being excessive, is even yet too small, the hens of my own poultry-yard may afford him one. I love they should be well fed: my poultry consisted, during the months of *November* and *December*, of about three hundred animals, not all of the hen kind, nor even all of

their class: there were among them turkeys, peacocks, pheasants, and ducks: these last, the pheasants excepted, eat more grain than the hens. The hunger of all the different little tribes was satisfied with a single bushel of barley, which was not given them till boiled, and that at twice; for hens are satisfied when they have two good meals allowed them every day, and when you have given them, at hours pretty equally distant, enough to fill their crop twice. They amused themselves between whiles, in hunting after insects and picking up the grass. It is not the same with young chickens: they digest more in proportion than the hens, and are almost always ready to eat. The morning portion, a small matter larger than the other, my poultry had between seven and eight or thereabouts, and the last portion was given them at one in the afternoon. The hens, 'tis true, found supplements in the dunghills of the yard and the stables, and greater helps still in a couple of grass-plots which were the ornament of a yard. But the green turf did not supply them with as much grass in these two months, as in several other months of the year. I am of opinion, that if all my poultry had been only hens and chickens, and they had been 365 in number, they would have lived very well upon the same bushel of barley, which had supplied only 300 birds, among whom there were some that eat a great deal more than the hens: the expence of one of these for a whole year, had then been no more than a bushel of raw barley, that is, under eight *sous*, reckoning the settier of barley at 7 livres and 10 sous: but that grain is much dearer in proportion to the other kinds at *Paris* than in the country.

Bran is oftentimes given to poultry instead of grain, to avoid expence: these bruised skins, wherein remains but very little of the flowery substance,

seem not to be so fit to afford nourishment as the grain itself which has all the flower in it. Is then the benefit of substituting the bran to the grain so very great as people seem to think it? The experiments I have made do not prove this. Bran is given reduced to a paste by means of water with which it is mixt; some people make it boil, but its bulk is not increased by the boiling to any quantity worth the minding. Two measures of dry bran diluted in water, served the chickens to which I gave them, instead of one single measure of boiled barley, and consequently of but $\frac{3}{5}$ of a like measure of barley in its natural state; therefore, two settiers of bran would not feed the hens a longer time than would $\frac{3}{4}$ of a settier of barley. Whilst barley was bought in at the price of seven livres and ten *sous* for a settier, the same measure of a middling sort of bran cost me two livres and fourteen *sous*. My hens which eat 5 livres and 8 *sous* worths of that bran, would then have eaten but four livres and ten *sous* of barley, which, on the other hand, seems to be a much better food for them.

Although we have under-rated the annual expence of each hen fed in town with boiled barley, with what she can pick up from dunghills and with the grafs she may eat, we nevertheless have rated it above what the hens which live at full liberty in the country in farms and villa's, cost their masters: those who love their hens best in the said places, are contented with ordering a few handfuls of corn to be thrown to them in the morning and in the afternoon, seemingly rather to see them assembled together than to satiate them: but then those who happen not to be present at these distributions, do not pass the day the less comfortably for that. There are some to which that distribution is allowed but once a day during the

major part of the year: corn is given twice a day in the hard season only, when grass is wanting on the ground, now grown too hard to be scratched up. That grain which is given them sparingly, is in great measure of no price at all, it consists most commonly of siftings, or is of that which has been spoiled, and which no body would give any thing for. Mr. *Jalabert*, a learned professor of *Geneva*, has informed me, that hens are fed with hardly any thing but tares in the adjacent places to that town: that grain bears a price there proportioned to that of the others. Hens find better corn about barns, and in the neighbourhood of the other places where corn is thrashed, round stables, and in all the roads where straw has been carried and scattered. When they have very wide places to expatiate in, the dunghills and green plots supply them in great abundance with foods of many other kinds; but then we never see hens die for hunger, even among the peasants who give them nothing, or hardly any thing almost throughout the whole year; they are able to live although we take no manner of care of them; the time about which they are at any expence, is when we have a mind to fatten them more than it is necessary they should be for their health.

Besides, should you bestow meat on your hens in a lavish manner, they would always have their eggs to pay for their keeping; but is it the same with the chickens, that can never pay the expence you are at, but by their flesh? The estimate of what they cost is not easy to be made; their daily consumption at first is so very small, that it can hardly be calculated, it increases with their age. The new hatched chicken has a crop which may be filled with a quantity of food no bigger than a pea; at the end of a few weeks, his crop will contain a quantity of food no bigger than a cherry; and he is come to being eatable, when
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the capacity of his crop is such as would hold a small pippin. The crop of a hen crammed with corn, is bigger than a common apple. It is these variations in the capacity of the crop, or (which is all one) in the quantity of food digested every day, which render the estimate of what the chicken spends, till it is fit for the table, difficult: however, these very variations may incline us to see with less surprise that a chicken three or four months old is most commonly sold for no more than two sous or two sous and a half in countries a hundred leagues from *Paris*, even in years when corn is not cheaper there than in the countries adjacent to that large and populous town. We have proved the possibility of feeding a hen a whole year for less than eight-pence, and consequently for two sous or thereabouts during three months: supposing the chicken to be fed with the same diet as the hen, if we knew the proportion of the consumption of foods he makes till he is three months old, to the consumption made during the same time by a hen, what he costs for his food might be estimated exactly enough: we ought to judge at least that what he consumes in food is but a very small portion of what the other eats, and that therefore the bringing up of the chicken costs but a small part of two sous. It must needs be so, since the experiments repeated during a long series of years, have not informed the country people, that they were at all hurt by selling their chickens at so small a price, since, in short, they have not taught them that they would be greater gainers by selling the eggs, than by causing chickens to be hatched from them. The truth is, that these chickens live in the country after the same manner as the hens that lead them, and that it is only during a few weeks, that millet is distributed among them at several hours of the day, which grain is not dearer, and often much cheaper than wheat; that grain or any other is

terwards given them but two or three times a day at most, as an entertainment.

These observations are sufficient to shew that the charges we are at by the ancient method of feeding and rearing chickens are very small; but they never will prevent our fears, that the feeding of chickens kept in chicken-houses, and in weaning-boxes, may be more expensive. We shall be enabled, in the fine seasons of the year, and at all other times when chickens are reared in the country, not to keep a great while in those long boxes the chickens that have been hatched in ovens, we shall be enabled to put them under cages upon the green grass, and to bring them up after the very same manner as those which are bred under hens.

It will be only the chickens you may have a mind to bring up in such times of year when none are reared in the country, that must not be suffered to go out of the chicken-houses, the weaning boxes, and the hot rooms before they are grown big and strong. Their rarity at those times will always keep them at a price that will be more than a compensation for the over-plus of what they shall have stood in for their food more than other chickens, be that over-plus ever so considerable; it is nevertheless but very moderate, the trial I have made towards making myself able to estimate them, have convinced me of it, although they have not been carried so far as one might wish, and as I could have wished myself.

If chickens and hens were multiplied to such a degree, that the compass in which they would be kept should not be proportioned to their number, the ground upon which they would disperse themselves would then be always naked in the places where it ought to be covered with grass; the green blades of grass ready to spring out of the ground,

ground, would be cut off by some beak or other as soon as they should begin to peep; the grains that should fall to the ground in stirring up the straw, would be picked up almost as soon as fallen; dunghills would be totally destitute of insects, the very worms of the ground might become scarce: all the poultry would then have almost nothing to feed upon but the corn that should be given them, the quantity of which would then become an object well worthy our attention. Geese and their goslings, ducks and their ducklings, know how to go in search of food beyond the house of their master, they know how to go and live abroad. Young turkeys, which are so very tender in their youth, during which they have been fed with nice things, when come to a certain size, are no longer liable to any impressions of the air, and will feed upon any thing: the greater the number of the young turkeys is, the less it costs to find them with food, because you have for a constancy nothing to pay but the victuals of a young boy charged with the care of leading them to the fields, of keeping them together there, and of bringing them back at night. It were to be wished that one might likewise lead to the field large flocks of chickens; I say of chickens, because there might be an inconvenience in mixing with them the hens that sit; you might in that case multiply the number of your poultry at your pleasure, and the charge of feeding them would not be increased by it. It would perhaps be difficult to render the chickens which have been brought up after the usual manner as tractable as turkeys are, so as to suffer themselves to be led in large flocks to the fields: however, the accounts of a great many travellers do not only incline us to believe that this may be done, they oblige us to think that this practice is already established in several countries: they

they assure us, for instance, that the inhabitants of one of the islands of the green cape, lead in the morning their poultry, hens, and chickens to the mountain, and bring them home again at night.

But what might be difficult to be brought about for chickens hatched under hens, and reared after the usual manner, would not be so difficult for chickens hatched in ovens, and brought up without ever seeing a hen among them : As a greater number of these may be fed, and several hundreds and even thousands of them be put together, they, as it were, contract a greater degree of sociableness, and their habitual taste inclines them to live more in company. Besides, having always been tended by either a man or a woman that stood them in stead of a mother and a nurse, they are extremely tamed : I have seen some of them, that came at the call of my gardener in what place soever they were, and suffered themselves to be taken up and handled by him whenever he pleased : it depended intirely on him to make them follow his steps in the yards, and it would certainly have been in his power to lead them very far into the country : they very often became troublesome to him, by their fond eagerness to be with him ; they obstinately came and kept between his feet, so as to make him be afraid to crush and step upon them.

But we may, without turning our poultry out of their yard, feed them with something of the things which the country affords them in greatest plenty, and for which they will leave all the rest, and we may do it without being at any other charge but that of the trouble of collecting that food for them. A hen thinks herself very happy, when after having scratched the ground she has the pleasure of plucking a long worm out of it : however, it frequently happens that her prey is snatched away from her by her companions, who
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see it hang on her bill, and who are as greedy of it as herself: there is no food whatever, than can be so much to the liking of chickens as that. But the proposal of feeding a great number in good measure with ground-worms, will appear a kind of chimera: where can one find a quantity of ground-worms equivalent to bushels and loads of corn? How is it possible to fetch that multitude of worms out of the ground? We are not sufficiently informed how largely the ground is and must needs be stocked with these insects; they are the fund of food assigned to an amazing number of different species of birds, and almost the only one to preserve their life during the winter: as long as it lasts, the ravens, the crows, the mag-pipes, the jack-daws, the wood-cocks, the plouvers, the lapwings, the thrushes, the larks, and so many others, the endless list of which would be too tedious, and in which partridges and pheasants may be included in some degree, as long as the winter lasts, I say, all these birds borrow their chief subsistence from the worms of the ground. A man led, as I have been, from the study of the history of insects to the study of the history of these worms, is all amazement at the consideration of the immense multitude of those which lie concealed under ground. Husbandmen, in the most plentiful years, and by dint of the hardest labour, are not able perhaps to raise in their fields, when ploughed and sowed, a number of ears of corn containing a quantity of grains in weight equal to that of the worms that lie hidden in the earth of those very fields: there are probably in each field more worms than ears of corn, and there is many a worm that weighs more than all the large grains of the ear that has the greatest number of them. However, the grounds that swarm with the greatest number of worms, and of large worms too, are
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not the fields sowed with wheat : the cool moist soils have a far greater quantity ; meadows are infinitely more full of them. They multiply a great deal too much in our gardens in the opinion of the gardeners : although they prefer there the earth rendered light by the spade that digs it, and kept cool by the plants that grow upon it, they are obliged on account of their multitude to disperse in walks where the ground is more compact and naked : we shall have some notion of the prodigious quantity of these worms, if we examine those walks in the morning, after a rainy or a moist night ; we shall see their surface made like a sieve with minute holes, each of which has a small eminence of fine earth turned into a spiral, or a small piece of vermicelly of earth : each little cylinder turned into fashion of a spiral, is made of the excrements which the worm came up to void during the night. The quantity of these excrements is large enough to vex the gardeners, who have taken care to smooth their walks, as it spoils their work, by rendering them rough and rugged. But, if we have a mind to see the worms themselves, we need but go and observe the walks in the nights when the air is quite calm, with a light in our hand held close to the ground : the earth, especially when it is moist, is covered on all sides with worms come in great measure out of their holes and much extended : the presence of the observer gives them uneasiness, and determines them to creep into the earth again with great speed, it occasions a great deal of motion on all parts.

We may then convince ourselves, that there is no exaggeration in asserting that the provisions of grains of different kinds which men procure themselves by continual and hard toils, are not by a vast deal so considerable as the provisions of worms which the author of nature has hidden under
ground

ground for birds : those for whom they are designed are not charged with the care of causing insects to multiply, and they have been provided with bills fit to dig them out of their subterranean habitations. May we not with justice share those insects with wild birds, in favour of our domestick fowls ? Although we should make the portion of these ever so great, the others will never suffer by it. But how can we, some will ask, make collections of these worms so considerable as a poultry-yard would require them to be ? To do this, we need only be willing it should be done : these provisions will not require the robust hands of our harvest-men ; children will be able to perform that work in the country : we need, in order to ingage them to it, or rather in order to ingage their fathers to compel them to that work, only to render ground-worms a vendible commodity, and set a price on them, which, though much inferior to that of the cheapest grains, will serve to reward those who shall not have spent their time in a state of absolute idleness.

Two different means of making in a short time a very plentiful collection of worms are known to fishermen, who use them when they are to bait the hooks of a great many lines : these are only two equivalent methods of determining worms to come out of their holes : when they are out either intirely or in part, it is very easy to take them with the hand. Those insects have, and it is likely they know that they have a very formidable enemy, which dwells under ground as well as they. The mole never spares those she finds in her way : it is probable her motive for undermining so many new roads is, to provide herself food when she is hungry. The worms informed that the motions made under ground may prove fatal to them, and are signs of the approaching of a mole, are thereby deter-

determined to get out of their holes. That they have this knowledge is very well proved by the two methods used by fishermen as above-mentioned: both ways require that a couple of men should be employed in this business. The first method supposes a man armed with a three prong'd pitchfork: he thrusts the three points of it about half their length or more, that is, 4 or 5 inches deep into the ground; when he judges they are deep enough, he continues to handle the fork, and to move it several times backwards and forwards: by which means he makes the earth above the fork to move, which frightens the worms and gives them terror: they leave their hole to come out on the grass, where they are taken by the companion of him that frightens them.

The second way of forcing worms out of their holes, does not require a man thus armed: he must have wooden-shoes on his feet, and stamp and kick the ground as hard as he can, letting each foot charged with the whole weight of his body, fall alternately, and several times together upon the very same spot: these repeated blows shake the ground, and, as well as the motions of the fork, hurry the frightned worms out of their holes.

I have in no long time, in less than half an hour, seen anglers fill up with worms, and that by each of the two above-mentioned methods, pots or wooden-bowls that held above a couple of litrons.

This work, when it shall have a still greater object, will produce a great many worms, if one takes care only to pick up all those it shall produce to view: there is no square plot of ground in a garden after it has been turned up after wet weather, that will not procure a good many of them, if the gardener will but give himself the trouble
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to gather those that shall appear in the earth turned up by each stroke of the spade: my gardener has sometimes filled with worms in one morning above two thirds of one of those little earthen pots wherein flowers are put, that is, enough to fill almost a couple of litrons.

We are taught by the example of ravens and crows, and by that of smaller birds of many different species, a means of making greater collections of these worms; they follow from morning till night the plough of our plough-men, which, by turning up the clods of earth, offers them choice of worms which they need but only take without giving themselves the trouble of digging very deep into hard ground, as they are obliged to do at other times. Our husbandmen's children need only do as the ravens, the crows, and the other birds, to collect a prodigious quantity of these insects in one day.

You may without going out of your gardens, make very plentiful collections of worms, in a great many days, or rather nights of the year, I mean, in all the nights which are somewhat moist, or that have not been preceded by a long drought. We have already observed to the reader, that the earth is covered at some times with the worms that get abroad; although they be always ready to retire into their holes again, which they do with great speed so soon as they see any one drawing near: you'll be able to surprize a great many of them, notwithstanding the light you are obliged to carry in your hand, if you approach them without noise, and are skilled by custom in that kind of hunting. Those that are intirely out of their hole, and those that are out of it in good part, those who are joined to multiply their species, and that are busy about fertilizing each other mutually, will not have time to escape before they are laid hold of.

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Our poultry would be very badly and unequally fed, if we never gave them any but the collection of worms of the day ; there would be days that would produce nothing, and others that would produce too much. The worms know how to dive very deep into the ground in cold weather and long droughts. They, by that means, shelter themselves against both excessive cold and excessive heat, and find the moist earth which suits them well, but they find it in a place whence it would be too difficult to fetch them. If then we have a mind to feed our hens, chickens, and other poultry with worms, we must have them in store as we have our corn ; we must keep them alive in a place where they may be taken with ease, and in what quantity we think fit : this will be of the utmost facility, and will occasion almost no expence or trouble at all. You must have casks filled but one quarter, or a third part with earth, you may throw into one of these casks the worms you have collected, and you may go and fetch daily out of the same casks the worms you would give your poultry ; they will be easy to be found, because they will live comfortably in such a cask although their bulk should be equal to, or even larger than that of the earth. Fathers who shall employ their children in collecting worms, may have hogsheds filled with them in this manner, and may sell them by measure as they do corn, to those whose poultry-yards may require a great many of them.

I speak within compass when I say they might be preserved alive with little or no care at all ; for I think it next to none to observe that the earth of the casks should not grow too dry, and now and then to throw a little water upon it. But I must forewarn the reader, that if the worm-casks are kept in a place where they are exposed to the rain, it is necessary to give each of them a cover to
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hinder the water from falling into it: if it should enter it in a quantity sufficient to turn the earth into mire and overflow it, the worms would be drowned there; for though it is wholesome for them to be kept in a moist earth; it is no less mortal to them to be kept in pure water.

If you choose to have in your poultry-yard a place that should always be frequented by the fowls, and where they delight to be, you must have a hollow in it of a diameter proportionable to the number intended; it ought to be a foot deep at least, and caped with stones like the reservoirs of water; were it made of lead it would be still more perfect as to the use it is designed for: its bottom ought to be covered with a stratum of earth two or three inches thick, that would be kept moist by watering; worms might be thrown from to time upon that earth, that would not be long without creeping into it: and if you had a mind to stock it very well with these insects, they ought to be thrown here very often and in great quantity. Your poultry would not cease scratching the earth to dig them out. The hollow, however, ought to be so constructed, as that the water might run off; otherwise, the worms would be in danger of being drowned by heavy rains. The grate through which the superfluous water should go away, ought not to be bored with holes larger than those of a rasp for snuff, that they might not permit any large worms to get away.

The last year, having left uncovered a cask which had been filled in great part with ground worms taken in my garden, they all of them died and were drowned in it, at a time when it was difficult to renew my provision: having not enough of other worms that I could dispose of, I contented myself with giving no other food

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but worms to one single hen, I fed her in that manner for a fortnight, and no more, because I wanted to keep a quantity of them to treat my chickens with: she seemed extremely well pleased with the manner in which she had been entertained during that fortnight. No hen had ever been daily at such a plentiful feast; she grew very fat, and her appetite for these worms, which she was supplied with at discretion, far from slackening in time, grew every day keener and keener: she was satisfied with one half of a litron of worms the first day, she afterwards came to eat her litron daily, and then a litron and a half.

How evident soever it may appear, that these worms may be very usefully employed to feed fowls and chickens, I nevertheless have had too frequent opportunities to convince myself that useful novelties are always in danger of being neglected for a great while, or even for ever, to dare to entertain any hopes of seeing worms soon substituted, as they indeed ought to be, to at least a part of the corn consumed in poultry-yards. The establishment of new practices never takes place, but when they are promoted by some happy circumstances: there is ill-luck attending them as well as other things. Let any gentleman take a fixed resolution to cause collections of worms to be made upon his estate, and let him persist in the practice of using them to spare his corn, his neighbours will soon be desirous to imitate him; and that practice spreading from place to place, will go far and wide at last: if the gentleman mentioned, misses his aim for want of going rightly to work, or is too soon tired of it; the practice shall, notwithstanding its vast utility, fall into oblivion, and will be in danger of never being rescued from it.

Fowls, as we have so often had occasion to repeat, are greedy of insects of all kinds; we then

can never be too mindful of multiplying them in the places where they love to feed ; in our poultry-yards, or in any other place where they are permitted to run. We are taught in books of rural œconomy, as a very good practice, to throw pail-fulls of ox-blood upon the dunghills which are at the disposal of hens ; this blood draws swarms of flies thither, and they are inclined to lay their eggs upon that which has formed lumps by coagulating ; the worms from those eggs are a feast for hens and chickens. When the dunghills are not so near the master's house, as that one may apprehend being exposed to a more infectious and more offensive smell than dunghills generally exhale, you may throw upon them 'all the flesh that is given over to corruption ; and that will be a very certain means of multiplying worms fit for your poultry.

Near large towns, where the culture of vegetables is well paid for, and where a great many are raised in hot-beds, one might with ease make a collection of worms bigger than those that go generally by the name of ground-worms, and that collection would be very plentiful. When the hot-beds are broken up in the spring, you find in them worms bigger than your thumb, and eighteen or twenty lines long, which are to be transformed into a large sort of scarabeus of the cock-chaffer-kind, the male of which has on his head a prominence that gives him some resemblance of the head of a monk's-habit ; for which reason these scarabeus's are commonly called capuchin-friars. Nor must the reader imagine that we are now proposing an object too trifling to deserve attention : the bottom of hot-beds is sometimes larded throughout with these big worms : the hot-beds of one single marsh in my neighbourhood, supplied one year a quantity of them more than would have filled a large tumbrel. I have seen in other years

some of these worms thrown along the road which lies nearest to a few other marshes: they were there in large heaps, which might likewise have been sufficient to fill a tumbrel. Our marsh gardeners would readily collect and sell at a very cheap rate these worms, which are fit to supply fowls with a most succulent food. However, I would not have them be crammed and surfeited with it, I would have them be made to long for it: these creatures supply a much greater quantity of food in their state of worms than in that of scarabeus's, in which they are nevertheless eaten by birds: they are almost intirely covered with scales in this last state, whereas they have nothing scaly but their head and feet in the first condition; the rest of their body being a white flesh, or rather a thin paste still whiter, which, one would think, ought to be very inviting food for hens.

I think (though not with any intention of teaching the reader a method to spare the food of chickens) I ought not here to forget mentioning the ingenious and useful manner in which a young lady of my acquaintance thought of herself to feed a number of very small chickens for several days together. Having found the whole heap of the corn of a granary, covered with an incrustation made with grains of wheat matted together with threads spun by a small kind of worms, which we have had an opportunity to mention in another work, and which we ranked in the class of the false moths; she took some of these worms, and threw them to some chickens; she with pleasure saw that they were very relishing to them, and that they eat them a great deal more eagerly than the corn: this was a sufficient hint to her; she immediately ordered the chickens to be carried up into the said corn-loft, where they all of them fell foul with equal fury upon the worms, without so much as

once thinking of touching the corn, which was to them a less dainty food : they were able in a few days to exterminate all that were in the heap of corn, and which were a delicious entertainment to them.

Plants, as well as insects, may afford the fowls of a poultry-yard a very large supply to save corn : I have sufficiently explained what a vast deal of food our fowls borrow from the plants that grow spontaneously and without culture, from all sorts of grafs, and from the other plants of our green-plots : they are still fonder of the greens which we cultivate for ourselves in kitchen-gardens, and there are a great many times in the year at which we may give them a good share of them : we need but to throw to them lettuces of all kinds, spinach, and a great many other plants which are plucked up, because they grow rank and run to seed : beets, cabbages, and other greens which it would be needless to enumerate, may supply them a great many leaves which we reject. The pickings and refuse of all greens are commonly carried from the kitchen into the poultry-yard, and are perfect salads to the fowls. This I mention, not so much to advertise the reader to give up to them whatever is useless among the productions of our kitchen-gardens, as to observe to him, that these productions may afford a great deal of food to poultry in the whole course of the year, and that, whenever a large portion of them is distributed among fowls, there is no room to wonder that a very small quantity of corn should suffice them.

If hens nevertheless were intirely fed with raw greens, or at least with a certain quantity of them, and nothing else, they would perhaps not be better for it ; the trial I have made of one green in particular, inclines me to be of that opinion. The

spinach of one border of my kitchen-garden having run to seed, I intended to feed with it four hens and a cock which I had confined, as long as they should be pleased to eat it: they were plentifully served with spinach every day, but they had nothing else besides. At a few days end, their dung ceased to be consistent, the hens that used to lay eggs, began to give over, and after they had lived intirely upon spinach for eight or nine days running, their combs grew pale and even livid. I then thought I must make them live as the rest, lest the diet I had confined them to should make them die. However, although we like salads very well, the stomach that digests them best would soon be disordered, if no other food was given it to work upon.

There are plants perhaps which fowls might make a longer and more constant use of than of spinach: they ought not perhaps to be confined to one single sort of greens; there are some perhaps, that would rectify the bad effects produced by the others; but these are matters of inquiry.

Instead, finally, of feeding the inhabitants of the poultry-yard with nothing but raw greens, these might be given them boiled. It is customary to boil the nettles which are presented to young turkeys, and which experience has taught us to be a wholesome food for them: large kettle-fulls of boiled nettles would perhaps be very nice dishes for hens and chickens, and they would be cheap enough.

The particulars into which we have entered concerning the management of a poultry-yard, ought to be carried further, and are a large field open to many useful experiments; but they have led us into a digression that made us lose sight of the chickens of the youngest and smallest sort, I mean those which are brought up in the chicken-houses, before we had sufficiently expatiated upon the different

different foods that may be given them: however, that very digression has obliged us to mention a great many foods, which we shall need only refer to afterwards. We have hitherto fed our youngest chicks with nothing but crums of bread and millet, these are two very good kinds of food for them, but they are not the only things you ought to give them, if you have a mind to whet their stomach, and to keep them in that good plight that will prevent your feeling their bones too much and your finding the sternum under their belly excessive sharp whenever you handle one of them. They all of them love the grains which are liked by the little birds we keep in cages, hemp-feed, rape-feed, lettuce-feed, and wheat; these may be given them mixt together, that they may pick and chuse, but they generally take a little of all. Perhaps it is better to make millet the basis of their food in point of grain, and to offer the others to them only twice or thrice a day; it becomes by that means an entertainment for them, and they are cloy'd with what is always at their disposal, at least eat it with much less appetite. I would not have their stomach exert itself upon the hard husks of barley and oats, till they are grown strong. I have given them rice in grain, that is, rice not burst with boiling, which they seemed not to like it better than millet.

It is not under their dry form only, that the different sorts of grains may be offered them; they find them very good, and sometimes better after they have been swelled by boiling: however, they prefer raw millet to that which is boiled: it is in this last condition hardly more in point of bulk than double of what it was before it had been put into the water. I only spoke of the dry barley, when I said just now that they must be very strong before that grain is given them, for chickens as

yet very young would eat it boiled without being at all injured by it ; they might even eat it hulled at that age, as well as oats now known by the name of meal : there are places where it is made the ground of their food, as millet is in many more countries.

However, they have transitory tastes which last but a few days : it seemed to me that boiled rice must be an excellent food for them, and what besides would never be very dear, because the bulk of that grain is considerably increased by the boiling : when I offered any to chickens, they eat it with the utmost greediness, but they were less and less eager after it, and at four or five days end, they generally beheld it with great indifference.

I never found their taste flag for a certain ragoos which I thought of giving them, and which is a real entertainment for them, though very plain in the main : small bits of sheep's heart or of other meats are mixt with the paste of the tenderest among little birds, and of those which, when full grown, do not love to live upon grain : the majority of the people who feed nightingales, linets, &c. with a skewer, mix a great deal of the said sheep's heart minced with their food. I thought it proper to try whether paste mixt with a little minced meat would not also be a wholesome and pleasant food for my young chickens : I mixed in different proportions minced meat, whether raw or dressed, with crums of bread ; the chickens I offered it to, eat it with a greediness which never slackened. The more meat the paste had, the better they liked it : they do like little children, who will not eat their bread, till they have made away with the sweetmeats spread upon it ; little chickens likewise never pick up the crums of bread till they have dispatched with their bill the most apparent morsels of flesh.

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This paste, which they are never tired with, and which feeds them very well, will never be a dear food, at least in the country; the meat I mix with it is ox's heart, liver, and lights, in short that kind of meat which dogs and cats are fed with in families. This meat never cost me above two or three *sous* a pound, and it would have cost the people that had it at the first hand less; there are many countries where butchers cannot sell it at all, and they often throw it away. But, should the paste in question be made with the choicest meat in the market, it would still be good husbandry to give it to new-born chickens, instead of giving them, as it is customary to do, yolks of hard eggs, or paste mixt up with them. I weighed once half a dozen of yolks of hard eggs taken at random, they weighed three ounces and two drams; therefore, the weight of a dozen of yolks of eggs is six ounces and a half: you must then have twenty-nine eggs $\frac{7}{13}$, or nearly two dozens and a half of eggs to make a pound: now in the time when eggs are cheapest and meat dearest, two dozen and a half of eggs cost more than a pound of meat, and especially of meat like what we should apply to that use.

But there will never be any necessity of buying meat, as there will always be enough in most families during flesh-days, wherewith to make good paste for young chickens: the scraps of the roast and boiled meats of all kinds, will serve to make an exquisite paste for them, and will supply a sufficient quantity for a considerable number of chickens in all large families, and corporations. *Sister Mary* of the society of *L'Enfant Jesus* had exceeding well found out the inclination of her chickens for meat; she daily took care to collect all the remnants of meat she could get at: she minced it and put a great deal of crums of bread
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to it; the little chickens ran and flew with all speed towards those messes as soon as they could see them, nor did they leave them till they had picked them quite clean, or when they had filled their crops with it to such a degree that they seemed ready to burst.

The remnants of flesh were not the only ones she took care to collect for them, nor the only ones they liked; they are not perhaps as fond of soup as they are of meat; but yet they like it very well. Sister *Mary* never failed to give her chickens every day a meal of soup and meat together; but the soup ought to be served up first to chickens as well as to ourselves. As it cannot but be a very good food for them, I am used to have it given once or twice a day to my own, as it comes from the table of the servants: nor do they refuse the soup-meagre, when there is no flesh soup, and they seem to like it as well as the other. We must not think however, that any bread soaked with water would be soup to them: they are indeed no great connoisseurs in point of soup; but if you fill one half of their drawer with real soup, and the other half with bread soaked with water, they will not leave the one for the other; they will eat the soup and leave the bread.

Our greatest feeders who make paste for nightingales and all the other little birds which are difficult to be reared, mix the paste they cook for them with a deal of honey: *Olin* did not fail to prescribe it for the paste of which he has given us the receipt with great pomp and apparatus. One of the good effects of honey in the paste is, that it preserves it from corruption, and from growing dry for several months together. I have also soaked in honey many different pastes which I had prepared for chickens; viz. that which is made of crums of bread and minced meat, and that which

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is made of crums of bread and yolks of hard eggs: it made them more pleasant to the taste of the chickens; they greedily fell upon the paste which was mixt with honey, and left for it what differed from it in no respect but by the want of that ingredient.

However, all other foods are nothing to them in comparison to the ground-worms, there is none which they are so generally and so greedily fond of as that. When young chickens have once got acquainted with them, they no sooner see them appear, but they run and fly to them with an avidity superior to that which they express for all other kinds of food. It is a prospect really amusing, to see forty or fifty chickens scattered here and there, run to the plate full of worms, put into their chicken-house, and rush on it the moment they are informed of its being there. He that has first laid hold of a worm, seldom reaps the benefit of it, it is snatched from his bill by the bill of another that runs into a corner to eat it uninterrupted: this second chicken is followed by a crowd of others, one of which snatches the worm from him; and is again deprived of it by another rival: in short, a worm passes the bills of fourteen or fifteen chickens before it is swallowed; and is most commonly the prey of the chick that has got into some corner where his head is not to be got at. The chickens from whom it has been taken, return to the plate, and catch up another worm which exposes them to be pursued in their turn. Although they do nothing but snatch from a chicken the prey he has laid hold of, although those that attempt it have not the least design to knock down nor even to harm the chicken which has got it, yet all that scuffle looks perfectly like a fight, and the seeming combat has sometimes fatal consequences: the chickens which run with very great swiftness, throw
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down those which happen to be in their way ; they trample upon them, those that are on the ground are not only trampled on by those which threw them down, they are also trod under by those that come after them, and they suffer much by it. However amusing this struggle may be, you must not suffer it to be frequent if you love your chickens ; they must not even be entertained with a dish of worms without some sort of caution ; a big long worm would be too difficult to be swallowed by a little chicken : the worms cut to pieces must be distributed into several heaps upon a small board, or in a long drawer. When the compass within which the chickens shall be able to take some of them at once is great, fewer chickens will be tempted to snatch from the bill of another the bit he shall have laid hold of ; they will trouble and disturb one another much less in their nice regale.

We have procured flesh-days for our chickens in the last foods we pointed out as being much to their liking : however, the remnants of our fish-days are not indifferent to them ; what is taken from our tables in point of fish would be no great supplement to their food ; but the remnants of our dishes of beans and pulse may be of much greater help to them, and supply them besides with a dish to their liking : the small white kidney-beans, which are not despised even in the best families, are very palatable for young chickens : however, they prefer to them lentils, which are one of the boiled pulse which they seem to be fondest of. These swell more in the boiling than the beans : when the boiling water has swelled a quantity of lentils, the very same quantity will fill eleven, whereas four litrons of dry kidney-beans will, when boiled, afford but six litrons and two thirds.

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There is then a plentiful choice of different foods that may be given to chickens, it is even so very ample, that a great many people will be at a loss how to chuse, and will require me to determine their choice: the best thing I can do to please them, is, to give them a description of the course of diet, as I may call it, to which I confine chickens from the instant of their birth to the time when they may be left to themselves; I declare it to be good, warning the reader at the same time of his not being bound to a scrupulous observation of it. The first food I order to be offered to chickens about four and twenty hours old is bread crumbled; which is given them next, and in the same day, mixt with a little millet. This mixture, of which the millet is the smallest portion, is the food I keep them to for four or five days; I begin in the following days to make them taste a little paste, whether mixt with flesh, or with the scraps of fish-days: it is put in a drawer different from that which contains the crums of bread and the millet. When they are seven or eight days old, when being grown stronger they have been conveyed from the first into the second chicken-house, they are served for their breakfast with a quantity of paste proportionable to their number, I mean, sufficient to feed them all. The paste I speak of is a kind of ragoë, consisting in great part of boiled barley with a little milk and bread crumbled: it is dished out in the following manner. You throw the boiled barley into a mortar, in which it is pounded, mixing it now and then with a little of your crumbled bread; you keep pounding it till all the grains of barley appear to be mashed, and you have added to it a quantity of crums of bread nearly equal to one quarter of the weight of the barley, more or less of either sort are very indifferent here: then you moisten and emolliate that
paste

paste with milk, but not enough to render it liquid. You must not be contented with having made them make a good breakfast ; the hunger it has abated is oftentimes revived in a trice ; and care must be taken that their drawers should always be partly full of some grain, such as millet, wheat, hemp and rape-feed, &c. that they may always find something to pick when they have a mind to it. Thus they are made to wait for a second meal of paste, which is hardly ever served to them before my people, who very often eat before I do, have finished their dinner. This meal is generally more splendid than the first, it consists of two and sometimes of three dishes : one of them is soup, the other is paste mixt with meat, to which a third dish of greens is now and then added : they are contented the rest of the day with eating the grain they find in their drawers. There is no need of giving them any supper ; however, if they were made to dine sooner than they do with us, for instance, at eleven in the morning, one might make them sup on paste about three or four in the afternoon. Finally, a few leaves of salted or other kitchen-greens are thrown to them twice a day. When you shall have collected a competent provision of ground-worms, that meal will be their greatest entertainment. If they are kept besides in a warm place free from moisture and very clean, they will, by help of this diet, be always in good health, and in very good plight, and when they are fit to come to table, will be found of a nice and delicate taste.

When the season shall be such as not to require the chickens to be kept night and day in chicken-houses, situated where they must be warmed either by the heat of dung, or by that of common fire ; when the days shall be serene, and the temperature of the external air by the thermometer upward

ward of fifteen degrees, the chickens must pass these fine days in cages upon the green grass; apertures must even be contrived through which they may go in and out of their cage, but too small to let the hens, or even chickens of a larger size into it. They must be served in those cages with the same dainties they were to have had in places of a larger compass; those dainties will infallibly bring back to the cages the chickens that shall have dispersed about them; at which time it will be easy for you to catch them again, when you are disposed to carry them back to a place, where they will be sure to pass the night warmer than in the open air.

MEMOIR



M E M O I R IX.

Wherein the utilities resulting from the new methods for hatching and bringing up chickens are enumerated; and the question, whether these methods are liable to any inconveniences as they were suspected to be, is examined.



IT has been fully proved in the foregoing memoirs, that it is intirely in our power, to carry the multiplication of domestic birds as far as we please, by warming their eggs in ovens, nor is there any body that will not be sensible of the most essential benefits resulting from such a multiplication; there is no man who will not look upon it as an advantage to have chickens, young turkys, ducklins, gosslins, &c. at a very cheap rate, and that will not judge that they will be cheaper in proportion as their number is greater. But a variety of circumstances to be examined in this memoir, may help us to borrow from the new methods of hatching and rearing domestick birds,
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a great many utilities, which it may not be improper to observe to the reader. Nor will it even be needless to remove a few apprehensions that have been expressed concerning some certain properties said to be peculiar to the birds hatched by the said methods, and that would be no perfection in them.

It is in the neighbourhood of large towns, and chiefly about the capital, that it is of most importance to multiply the establishment of chicken-ovens; it would be a mistake to imagine that they would be better situated in the remotest provinces, under the notion that fowls might be brought up cheaper there. There would be little or no profit at all to be made in our less populous provinces, upon the grain we should be obliged to give them. As towns grow larger, every thing is so ordered that their inhabitants may well subsist: the precautions taken by our vigilant and careful magistrates, cause bread to be hardly any dearer at *Paris* than in the smallest towns of our remotest provinces; there are even but too many instances of years in which the harvest having been very poor in some provinces, bread was sold there much dearer than at *Paris*. The charges of the transportation of grain which has been made and paid from place to place by way of exchange, are not perceived in large towns; it is quite otherwise with those foods without which we might live, had we but bread and vegetables; the flesh which so many animals of different kinds yield for our nourishment is always dearer at *Paris*, than in the places which are at a great distance from it; a pound of meat will always cost at *Paris* a little more than the double of what it costs in places that are very remote from it: 'tis true, it is rendered dearer by the duties that have been laid upon it, to make every private man contribute as equitably and gently as possible to the exigencies of the state; but these impositions are

not by a great deal all that doubles the price of it : what raises it so considerably is, that oxen are brought directly from places a hundred or a hundred and fifty leagues off ; the expences occasioned by this transportation, are what renders meat dearer. It is likewise the charges of the transportation, or rather a kind of impossibility of making that transportation beyond a certain distance, that makes the price of fowls infinitely higher at *Paris* than that of butcher's meat. In our remote provinces, a couple of chickens are hardly dearer than a pound of butcher's : meat when the latter costs three or four *sous* there, a couple of chickens may be had for the same price ; whereas a couple of chickens is worth about five pounds of butcher's meat at *Paris* : when butcher's meat is sold seven sous and a half, or eight sous a pound at *Paris*, two indifferent chickens cost there near forty *sous*. If chickens could be had from as great distances as oxen, and if they did not occasion proportionably a greater expence to be conveyed to *Paris*, the couple of chickens ought to cost but eight pence there ; or it might, on account of the greater duties put upon chickens than upon butcher's meat perhaps rise to ten-pence, which is about a quarter part of what we pay for them at present ; but it is impossible to have chickens brought a hundred or a hundred and fifty leagues, as we have oxen : the charges of the journey of an ox, are but an inconsiderable part of what he costs : but, besides the danger chickens would be in of dying, or at least of growing lean in coming a hundred leagues, the expences to be made to have them brought from such a long distance, would be a great many times more considerable than what they would have been at prime cost. Experience has taught those whose trade it is to supply *Paris*, and the largest towns with fowls, what are the bounds beyond

yond which they cannot fetch them, so as not to be rendered dearer than one might reasonably expect them. It is then evident, that if the places adjacent to *Paris* were able to supply it annually with a quantity of chickens sufficient for the consumption, fowls would be proportionably as cheap there, as in the remotest countries, and that a couple of chickens would hardly cost us more than a pound of butchers meat. How delightful that would be for its inhabitants! The multiplication of chicken-ovens might procure this advantage to them, if it was carried on to a sufficient degree. It is then near that immense city and in the neighbourhood of our other large towns, that it would be most worth while to make the greatest number of those establishments. The places where they would be most useful, are likewise those where they might be procured with the greatest ease: The persons whom their interest renders active and industrious, are not so scarce there as they are in remote countries, the inhabitants of which are sunk into a sort of sordid indolence, very destructive of the public good.

I am, nevertheless, far from pretending to restrain the establishments of chicken-ovens to none but the neighbourhoods of large cities; I hope, on the contrary, that those who shall have had success in it, will every where encourage their neighbours to multiply them, and will extend them to the remotest parts of the kingdom: the cruel disease that has destroyed a great part of the cattle of so many countries through which it passed, should make us wish we might be able one day or other to find in the speedy increase of our poultry, to make up for the scarcity of butchers meat we are threatened with. That terrible disease affords us motives of uneasiness concerning its return, which are the better grounded, as we see it be-

gin anew in places where it ceased but a very few years ago to rage with great fury, and there are not among the multitude of remedies which have been attempted and proposed towards stopping the progress of it, any one that can be depended upon.

The care to be taken in the hatching of chickens, is a fit province for women; but let the person commissioned to do this, be of what sex soever, a single person will suffice to watch over a number of ovens much greater in all probability than what the largest establishment will ever be carried to; and have besides a great many spare hours every day: the more considerable the object of the care shall be, that is, the more eggs shall be warmed at a time, the less will the expence of food and wages be felt. If the same manager is moreover charged, as indeed he ought to be, with the care of rearing the chickens, that is, of carrying them their foods at the several hours of the day, of examining whether the heat of the artificial mothers of the chicken-houses, and of the weaning-boxes is not become too weak; and if young turkys, ducklins, and other birds were also hatched in great numbers besides the chickens, such a number of occupations would be sufficient to fill up his day's work. Accidents of all kinds will be more surely prevented, when any one shall from morning till night make it his chief business to examine what passes in the ovens, and all their appurtenances.

Besides, let an art be ever so simple, he who is constantly exercising himself in it has a vast advantage over those who make it a meer amusement, and bestow their time upon it but now and then: therefore, though it is in the power of all country people who have poultry and a sufficient stock of dung, to have chicken-ovens of their own
to

to warm eggs and hatch chickens in them, it would perhaps be much more proper, that there never should be in any one village more than one single private person, that should set up this sort of ovens at his own house, and give himself intirely over to the care of them. The good success would depend here on very plain operations ; but it requires a long series of them, which must be done each in their due time, and which will be performed with the utmost exactness by any one that shall have made them his sole and constant business. I would have the chicken-ovens be common, and all the eggs brought from the village, and all the places round it, be received there for some certain retribution : this might be taken upon the chickens to be hatched ; the manager might retain the portion people thought fit to grant him in return for his care, time, and expences. It would be proper to make different bargains according to the different age of the chickens to be returned : if, for instance, a grant was made him of one third of the chickens he should deliver within four and twenty hours after they were hatched, it might be agreed to let him have full one half if he kept them five, six or seven weeks more ; and this, not only as a reward for the continuation of his care, and for having found them in food, but also because those that should die under his tuition, always die at his risk, and would be ever reputed to have made part of his portion.

It were much to be wished, that there were no large village where such common chicken-ovens were not found. However, notwithstanding the benefit which those who should take both the establishment and the management of these ovens upon them might reap from them, we never could expect to see them multiplied to that degree, unless the ministry would, from a thorough conviction of

the vast use they would be of to the public, countenance those that should be willing to bestow their time upon such laudable undertakings. It would be knowing men but very little, to think that self-interest will ever be a sufficient instructor to country-people to determine them to reap the benefit of the new method offered them towards helping them to subsist: they are very far from acting always consistent with their own interest: poultry itself, which we never have had hitherto from any but themselves, affords us proofs of this assertion: they have not hitherto supplied us with fowls in as great plenty as they might and ought to have done. If looking into the farms, tenements, and houses of the peasants of any country, we do but examine the number of hens that are there, there will be found in some of the habitations of the same village contiguous to one another, double, treble, quadruple, &c. of what it is in the neighbouring houses, which are equally well provided with every necessary conveniency for the keeping of poultry; and without observing any other probable cause of this vast odds, but the diligence of the women who live in the one, and sluggishness of those who inhabit the other. Exemptions and privileges discreetly granted, are no expence to the state; nor are they any considerable charge upon the people; those privileges, the most real benefit of which consists very often in sheltering a man from being unjustly vexed, are in very great request in the country; it is in order to enjoy the benefit of them, that some peasants will take upon them the care of keeping a stallion, others that of keeping post-horses, and the like. Would it be thought an inconvenience to grant exemptions and immunities equivalent to that of the keeping of the stallion, to a private man of each borough or large village, who should keep all the year round ovens
warmed

warmed either with common fire or with dung, wherein he should be obliged to hatch at least a certain number of eggs in every season? The advantage of these immunities would determine a great many people, who otherwise would never have thought of it, to establish a number of chicken-ovens, they would even make interest to be permitted to do it on such terms.

As there are places where it is of more importance than others to make ovens serve for the multiplying of chickens, there are times likewise when it is more beneficial to us to busy ourselves with this multiplication, I mean the times when birds of all kinds have done sitting. Nor would it escape the notice of those who make it a matter of great moment to have their table served with the most rare dishes, and with dainties which the season does not afford, and who glory in the reputation of eating well, that our ovens could supply them at any time with what they called by the name of new meat: there is no time of year in which they cannot expect to have very small chickens, young fat fowls, young turkys, ducklins, goslings, &c. because it will be possible in every month of the year to have eggs of all these different kinds artificially hatched: it is true, the females of birds lay but few eggs in winter-time: However, it will be easy to collect a number of eggs sufficient to please our dainty palates, we may even have enough of them to furnish very large broods, if we preserve those which have been laid about the end of *September* and *October*, and do not put them into the ovens before winter. Hens begin to lay again even in *January*, and other domestick birds will give us eggs as early as that; what we want most at that time are brooding hens. The eggs that have been preserved during six weeks or two months of a cold, or but an indifferently warm season, will be

still fit to be sat on; these two months can never alter them so much as three summer-weeks would do: Now, I have seen in summer a hen hatch twenty chickens out of one and twenty eggs she had concealed; there were then among the eggs which had afforded these chickens, some that were three weeks old at least when they were first sat on, supposing that the hen had regularly laid one every day.

It is not only for the warming of the eggs of the different kinds of birds which our poultry-yards are continually exposing before our eyes, that our chicken-ovens may be usefully employed: they may moreover serve for the eggs of birds of any kind whatever, large or small, terrestrial or aquatick, in lieu of the mother that laid them, when youngs one are intended to be hatched from them; and the best of it is, the eggs of those different species of birds may be warmed at one and the same time, and in the same oven, because, as we elsewhere observed, nature has ordained that they should all of them be warmed by the very same degree of heat. The largest birds communicate to the eggs they sit on only the same degree of heat which the smallest communicate to theirs. Nor do eggs grow any warmer under the birds that are best provided with down, than under those which have the fewest and the stiffest feathers: the degree of heat which operates to the unfolding of the swan, the goslin, or the young turkey in his egg, is the very same by which the canary-bird, and probably the humming bird himself is rendered able to come out of his shell: the only difference consists in the time in which that degree of uniform heat is to exert its force upon the large and small kinds; it brings the canary-bird to light in eleven or twelve days at most, whereas it must constantly act nearly four weeks together upon the egg of a
turkey

turkey hen to bring the young turkey to the term of his birth.

There is then no inconvenience in putting eggs of different kinds of birds into the same oven, which procures us the facility of hatching, without expence, the young of many various kinds, even at the time when there is a scarcity of them. The best use could be made of a few eggs laid very early by ducks, turkey-hens, geese, West-Indian-hens, peahens, &c. would be to eat them, if each peculiar species required a peculiar oven to be warmed and hatched in, the requisite care would not be sufficiently repaid if it served only for a very small number of eggs, no body would care to be concerned with them.

The ovens which contain hen eggs and are not intirely filled with them, are then fit and ready to receive those of any other kind of birds whatever, which may daily come to hand to put in them. There is a season when any man who is fond of seeing his land well stocked with game, cannot but be sensible of the benefit of thus finding in a proper time an easy method to replace sitting hen-birds, which are oftentimes looked for to no purpose. When one has discovered and set in open light nests of partridges, by the mowing of fields, or by cutting down corn, and there is room to fear that the eggs should be deserted by the fathers and mothers, or taken away by country people, or even eaten by beasts, one would be very well pleased to have an oven at hand, where the young partridges might be hatched, as they would have been under the mother. This very last summer, the Marquis of *Broglie* made use of our new ovens to very good purpose, though, indeed, in small, and was able to turn out upon his lands above fifty large and strong young partridges, hatched by the heat of dung out of eggs found
in

in corn-fields just reaped. The Marchioness of *Broglia*, who has many ways a right to make me wish to do any thing that may be agreeable to her, had desired and persuaded me to give some instructions to a gardener of hers whom she sent to me; he was an understanding man, and had not been above four and twenty hours under my tuition, but he thought himself sufficiently informed, and went that very day and spread his knowledge all over his neighbourhood.

The captains and inferior officers which have been appointed by the King to be over-seers of his chases and game, do their utmost endeavours to stock his favourite places with fowls; and the ardour with which they discharge that function is sufficiently proved to any that have occasion to cross those fields, from either the multitude of partridges which they spring as they go along, or the vast quantity of those whose tranquillity is not to be disturbed by any passengers, and which walk about and eat the grass as tamely, as hens do in our poultry-yards. And these, to say the truth, are not better stocked with fowls than certain game-fields are with partridges. But, there are years in which the King's officers cannot with all their vigilance, save the young partridges as yet in the eggs or but just hatched, as when rains happen to be very heavy or of too long duration. Our ovens will afford a sure means of preventing the death of many young partridges in those years. It is even customary in the years which are most favourable to the hatching of young partridges, to cause the eggs of a great many nests that have been found and judged too slightly covered, to be sat on by hens. It is frequent at those times to look out in vain for hens inclined to sit on eggs, even when it would be very proper to have some of them ready at hand, not to give the eggs time enough to cool too

too much, which is the cause of a considerable loss of eggs, and consequently of young partridges every year.

What may be done for the multiplying of young partridges, may also be done for that of young pheasants, and many other species of domestick birds, as well come upon our tables as any of the foregoing; I chuse to mention on this subject the experiments made by others more than those by myself. Mr. *De la Roche*, sent to my house about the end of the spring of the year 1748, a young man of the *Menagery* of *Versailles*, of which he is intendant, that I might acquaint him with the construction and the whole management of my ovens, and the manner of rearing the chickens. Three or four lessons enabled this young man to warm with success eggs of birds of different kinds. The attention and care Mr. *De la Roche* had bestowed on the making of this new establishment at the *Menagery*, were rewarded according to his desires, and in a manner which returned upon me, when the King desired to be an eye-witness of the success of our new operations, when his Majesty was pleased to come and see with his own eyes chickens and other birds hatched, and took delight in helping out of their shell those which happened to make in his presence efforts towards breaking it. Young partridges, young pheasants, ducklins, African hens, peacocks, &c. owed their life to our new ovens; and the heat of dung having been as properly employed for the rearing up as it had been for the hatching of them. I had about the latter end of *August*, the satisfaction of seeing birds of all those species reach such a size, as rendered them the greatest strangers to those by whom they had been so tenderly taken care of.

Although I should bring no experiments to prove it, no person would now hesitate to believe that the eggs of birds of both the smallest and the

the largest species, might be warmed in our ovens with as much success as those of hens: I must say, however, that I have hatched sparrows and greenfinches there, and that I might likewise have hatched canary-birds, nightingales, linnets, and wrens, if I had put in eggs of these last in the oven: they have hatched black-birds at the menagery of *Versailles*.

The birds that have not been taught by nature to go as soon as they are hatched in search of, and take themselves to the foods that best suit them, who have no other talent but that of craving these foods from their fathers and mothers, by good luck are not those of which the multiplication is most important to us. There are hardly any of these save those which belong to the class of pigeons, that deserve our concern, should they for a while be obliged to wait till their food is put into their bills. It is not probable that the eggs of these birds, which require too many cares and too much assiduity to be reared, will ever be warmed in any great quantity. A whole profession, I mean the whole trade of the bird-sellers, who supply us with more curious than useful birds, might nevertheless make use of our ovens to hatch and rear birds of a great many kinds. Bird-sellers are never tired with feeding some of them with a skewer, notwithstanding the multitude of those that die every day under their hands. It is most generally cold that kills these tender birds, deprived of a father and a mother which are so necessary to them, to keep them warm: the heat of our hot-beds, stoves, and chicken-ovens, would always prevent their even feeling the absence of their fathers and mothers; they would live and grow under the artificial mother, as though they never had been taken out of their nest. The bird-seller will, moreover, employ his time to much better purpose,

pose, when he shall have a hundred of them to whom he may give bill-fulls of food one after another at a time, than when he has but a small number of them to tend: these will not require less than those which are very numerous, that he should several times a day leave his other occupations for their sakes. The country lads will afterwards supply him in great plenty with either eggs or small birds of all kinds newly hatched.

There are very open countries in the neighbourhood of the sea, where children can get large quantities of eggs in the spring, or in the beginning of the summer, with infinite more ease than they possibly can, by beating about in bushes, hedges, coppices and forests for nests new built. Sea-birds, and those who love marshes, lay their eggs in meadows where grass is not very high, the nest which is almost flat, and which consists of but a few bits of stalks of plants, does not hide the eggs over well: the best hidden of them are in the hollow that has been made by a horse, or an ox-foot after the ground had been softened by the rain. When the time favourable for the laying of the eggs is come, you need only take a walk in those sorts of meadows or marshes: you will see birds spring on every side; and often from the very place where a nest is. Nests are found there in greater quantity than you would imagine: the country-boy who has been beating about for them for a whole morning or an afternoon, very often returns home after having filled a basket as large as those of our grape-gatherers with eggs generally as big and sometimes bigger than pigeons eggs: the whole family is entertained with those eggs which are as good as those of hens; as long as they last, they make amlets with them. Nor did we over rate their merit in asserting their being as good as hen-eggs: the connoisseurs prefer the eggs of lap-

wings to those of hens; and they are in great request among the *Dutch*. There are many of the last mentioned eggs among those our little country boys go and make collections of in the marshes, near our coasts of *Poitou*. The lapwings themselves are no despicable birds, and they would perhaps be in greater esteem, if they were served upon our tables when they are of the age of young pigeons. Thus one might have young water-fowl of a great many different kinds, if instead of eating the eggs that should have been collected, they were hatched in our ovens: among the birds that might be had out of them, those one would be obliged to give their food by bill-fulls, would not be so difficult to rear as canaries, goldfinches, linnets, and others: they generally are strong enough to resist the injuries of the air very early: they would be brought up as easily as magpies, jack-daws, and ravens are. Most of the water-fowls I have just mentioned are very easily tamed; the old ones taken in nets, and have been rendered unable to make any use of their wings, the largest pinions of which have been cut off, live very well in yards and gardens, especially when they have a little water there: those that should be hatched among us, cannot fail therefore of living very comfortably in our houses.

Might not the great facility we shall have of warming on the very moment of their arrival the eggs of birds of very rare kinds, that may be sent us from very remote countries, procure us the pleasure of seeing them hatched among us, and perhaps of naturalizing in our climate some of them that are either admirable for the beauty of their feathers, or of a very singular form? There are hardly any kinds of parrots that we might not make our own this way. It is a most certain matter of fact, and of which I am very well satisfied,

that

that parrots have laid eggs, and sat on them with success at *Luçon*, at the episcopal palace, whilst Mr. *De Barillon* was bishop there; that is, about sixty years ago: that prelate caused the father, the mother, and their children to be painted, and they are still to be seen in the buffet of the dining-hall there. And since a canon of *Angers* has had at his house a couple of parrots, which have made nests, laid eggs, and sat on them for three years successively: accidents hindered two of the broods from succeeding, but three little parrots were hatched out of the third, and one of them is now actually living at a country clergyman's near *Angers*, who had him as a present. We might perhaps accustom to our climate, if we could have hatched them in *France*, those birds which are so vastly pretty for their extreme smallness, whose feathers are all over bright with gold, and with the brightest colours which set off each other mutually, I mean, those humming birds whose body is less in bulk and weight than that of a great many beetles, and of some butter-flies. But something still more desirable as well as more easy to be brought about, would be the naturalizing among us those kinds of birds that would be an addition to the number of those designed to supply us with food to our liking. The class of the aquatick kinds, and chiefly that of geese and ducks, would probably supply our poultry-yards with several new species of fine good birds: many kinds of both very good and extremely beautiful hens are wanted; we are obliged to fetch them from *China*, and the *East-Indies*, from whence no more were transported to *Europe*, than what might raise in the mind of those who saw them, a passionate desire of seeing our continent fond of naturalizing them among us.

Sure,

Sure, no man need be a naturalist, to be fond of seeing hatched in our climates some of those birds whose feathers adorn the hats of our military-men, and which are applied to a great many other ornamental uses; of those birds which are as remarkable by their enormous size as the humming birds are for their prodigious smallness, which are among birds what the elephant is among the quadrupeds, and the whale among fishes. Who would not be enchanted to see such a huge bird as an ostridge come out of her egg? A great many strange facts have been related concerning the manner in which their eggs are sat on, which are, if not all, at least most of them false, since some of them are directly the reverse of each other. Many travellers pretend that the female is contented with burying her eggs in the sand, after which she forsakes them, and leaves to the heat of the sun the care of hatching the little ones: others, on the contrary, pretend that the male and the female sit very often on their eggs together, and that these are never forsaken by both at once; but they assert that they sit with their eyes only; and that the direction of their looks is so very important, that were it to cease but one instant, the eggs would be lost, and rot immediately. Among those who pretend that ostridges forsake their eggs, there are some who will have them lose all remembrance of their own eggs at the same time that they sit after the usual manner of birds on other eggs they meet with in their way and none of their own: some on the contrary, suppose they have so much memory as brings them back to their own eggs when the little ones are ready to be hatched: the female, according to them, out of ten or more eggs which the brood consists of, breaks four, which she chuses to sacrifice for the preservation of the little ones to be hatched out of the rest, and which are to supply them with food without which they would die for

for hunger : worms are ingendered in the said broken eggs, which the small ostridges newly hatched are to feed upon till they are able themselves to go abroad in quest of food. No body will believe that these facts, any more than others of the same nature which might be produced, were ever ascertained by any good observers. Those who pretended ostridges do not sit on their eggs, thought however they had found a good reason for it in the enormous weight of their body ; they both judged and asserted, that they would crush the eggs their body should rest on : but they would have entertained other thoughts had they duly reflected on the thickness and solidity of the shells of ostridges eggs, which are so considerable, that cups are made of them, which may be used as we do our *China* tea-cups.

We ought in this affair to be more ready to depend upon the testimony of Mr. *Kolbe*, than upon that of a crowd of authors, who are fond of the marvellous, and have not seen things with their own eyes : he plainly makes ostridges sit on their eggs in the same manner as hens and so many other kinds of birds do : nor is he one of those travellers who give us memoirs of countries which they have only run cursorily over. He resided nine or ten years together at the *Cape of Good-Hope*, and that purely to make observations. He assures us, that he had had even very frequent occasions to observe, that the male and the female of the ostridge-kind take alternately upon themselves the care of sitting on their eggs which lie on the sand ; he adds, that the little ones cannot walk till some days after their birth, and that both the father and the mother bring them grass till they are able to go and provide food for themselves.

However, the account of the travellers who contented themselves with saying that the eggs of
C c ostridges

Kolbe

ostridges are hatched, or warmed by the sun, might perhaps be reconciled with what Mr. *Kolbe* asserts as an eye-witness. There are in *Africa* regions much warmer than the parts adjacent to the *Cape of Good-Hope*: in those countries which are scorched by the excessive heat of the sun, the eggs deposited upon the sand need not be warmed by the mother during the day: they rather require to be sheltered from the action of a heat that might destroy them; which she possibly intends by burying them in the sand; did she cover them with her body at that time, it would be to cool them, or to hinder them from being too warm: ostridges seem then to be dispensed with very good ground, from sitting on their eggs during the day in such countries; but there are nights in those very countries where the heat of the day is intolerable, which are much too cold for eggs, and during which ostridges must needs be obliged to cover theirs. These are but conjectures: and we may now hope to see them soon ascertained or exploded by one of the most passionate lovers of natural history: Mr. *Adamson*, who tho' as yet at the age where it might almost be permitted to lanch into frivolous pleasures, yet knows no other but that of observing and studying animals and plants, set sail about five months ago for *Senegal*, with an ardent desire of completely informing us of the history of ostridges: he is to send me some of their eggs, with all the cautions that can possibly make them arrive in a condition fit to be sat on.

Nor shall we perhaps need waiting till we can warm the eggs sent over from *Africa*, to hatch ostridges in *France*. The king's kindness, so very favourable to whatever may encourage or improve our knowledge, has already enabled us, not later than last summer, to attempt that experiment. There

There remained at that time at his menagery only, a male ostridge and a female one; the latter laid eggs there every year, which she never sat on; this is very common with the females of other birds that have been transported into a climate different from that of their native country. His majesty was pleased to order, that the eggs that should be laid by the ostridge of the menagery should be brought to me: the two first she laid happened to be like those of our hens which we call rathe-eggs; they had no shell, and were covered with nothing but a membrane. They burst at their coming out of her body. She laid a third covered with a shell that was at least as solid as what is the common one with this sort of eggs, and had a few things peculiar to it besides: it was much whiter than that of any of the eggs of that kind I ever saw in my life: it had and has still the whiteness and lustre of *China* ware: but that shell is not smooth like those of all the ostridge-eggs I have hitherto seen: it is channelled above one half or nearly two thirds of its surface with furrows that bear some resemblance to those of melons, but are in a more oblique direction. Mr. *De la Roche*, took care to send me this egg the very day after it was laid. I had no sooner received it, but I put it into an oven which afforded me daily the number of chickens I had reason to expect from the eggs that were warmed in it: the precious egg was kept there in an equal heat fittest for the hatching of birds of all kinds: but the hope of seeing an ostridge come out of it was taken from me when five weeks were over; I shook it for the first time, and the noise which on that shaking I heard, informed me that it was at most but half full, and that of a very liquid matter too. I have had hen eggs (which is but very seldom the case) that rattled, I mean, that made a noise the very day they were laid, and

that were not good to be warmed : I don't know but the ostridge egg had been in the same case, for I did not so much as think of shaking it when I received it, I thought of nothing but of having it warmed and well taken care of ; not doubting but the inside of it was in good order. The ostridge that laid it died about the end of last year ; but she was replaced by a couple of other females that will perhaps supply us with eggs of better condition, on which we shall be able to repeat the experiment with more success.

Such as shall incline to contribute to the good success of the trials we may make towards naturalizing in *France* birds from the remotest countries, by sending us over some of their eggs, will stand in need of some cautions to procure their coming to us fit to be sat on or warmed, notwithstanding the long time they must be in the way ; and what the precautions necessary for the preservation of the germs are, will be explained in the following memoirs.

But, are not the new methods for hatching and rearing up birds, of which we have only mentioned the advantages hitherto, liable however to some inconveniencies ? People have pretended that chickens were more commonly hatched crooked and lame in ovens than under the hens. I don't conceive what could be the cause of such a thing, nor was I ever invited by any matter of fact to inquire into it ; they, as we saw in another place, are hatched much more comfortably there than under a mother who can afford them no manner of help. 'Tis true, chickens are sometimes hatched in our ovens, that have one leg, or even both their legs turned out to an excess ; my gardener calls them *Toads*, and the name fits them well enough, as they walk as it were upon their belly, their legs being too distant from each other ; but some of those toads are also hatched under the hens. Were it

it well proved that these accidents are more common in the chicken of the ovens than the others, the only cause which might be assigned for it would be the eggs not being so often turned in the ovens as under the hens: one might suspect that when the egg remains a long time in the same position the legs and thighs of the chicken contract a bad turn thereby; the remedy to this would be to turn up each egg every day, which is to be done with ease and in a short time.

But a number of people, more, indeed, than I ever could have suspected, have had a doubt, which would be of far greater consequence, had it any foundation: I have even heard many of those whom I saw rejoice most at the notion of being able to have by means of our ovens young chicks any time of the year, yet express some uneasiness concerning the quality of the meat: they asked me if chickens hatched and fed in a hot-bed, would not smell of dung. The same question was put to me by people of sense, who had indeed no concern, with regard to themselves, for the perfections of any nice dish whatever. *Egypt* has her dainty toothed people as well as other places, who pretend, according to *Thevenot* and Mr. *De Maillet*, that chickens hatched under hens have a better taste than those hatched in the mamals; but both authors add at the same time, that they never could find that difference. If I was to say barely that I found none at all between those which are born and have been reared in hot-beds and those hatched and brought up after the usual manner, there might be room to mistrust my testimony: an illusion like unto that which makes the owner of a garden to find the fruit of it, as well as the wine of his own growth, vastly superior to any other, might have prepossed me in favour of my chickens; but, those who had not the same induce-

ments to find them perfectly like the others, having tasted them, have all of them answered uniformly, that they could not find out the least difference between them, nor could any of them be persuaded that the doubt of the others had ever been serious.

If the smell of the place where a chicken is hatched could possibly affect the taste he is afterwards to have, those hatched under hens in hen-houses, would not certainly be preferred to those hatched in our hot-beds: the smell of the place where the hot-beds are, is not by much so unpleasant as that of a dirty hen-house as they generally are kept; but it is not the place where a bird is hatched that renders his flesh more or less delicate and fit to please our taste: it is indeed the things he has been fed with that produce this effect. The poultry that run freely about, whose flesh is preferred by the connoisseurs to that of the fowls that are fattened in coops, love to keep pretty constantly upon dunghills. Our chickens brought up in hot-beds, have much less communication with dung than these rambling fowls have: they never go to fetch any food out of it, it serves only to keep them warm. No smell of dung whatever can possibly reach those which are brought up in hot-rooms warmed with fire, nor those that live in chicken-houses intirely covered and glazed at top; if, in short, you except those that are killed very young, and condemned to appear upon our tables, the rest have lived for whole weeks and months together, after the manner of the chickens hatched under hens.

The imputation which we have just proved to have been unjustly thrown out against the chickens hatched in any other than the usual manner, is not the only one they have been charged with: another still of greater weight, but the falsity of which I have most easily proved by matters of fact much less

less dubious than those which depend on the judgment of taste, by facts within the reach of our eyes, is, that we are not to expect that they should ever contribute to the multiplication of their species: people have asserted that those chickens, when grown to be cocks, were incapable of fecundifying any eggs, and that, when grown hens, they could lay none but unfruitful eggs. The chickens hatched at my house during the greatest part of last year, and those I have hatched during the whole course of this, will supply here the most solid answer that can be made to this objection: they all of them came from the hens produced in my ovens, and rarely conversed with any other but cocks that were hatched in the very same place. In a word, I have locked up hens in lodges, where they had no other company but that of a cock hatched in an oven, and chickens as perfect as any other have been hatched from the eggs they laid.

It will perhaps be thought more difficult to guess what can have given room to this last imputation, than it has been to demonstrate its being ill-contrived: a ridiculous prepossession, which is but too generally established in our villages, has most likely been the foundation of it. It is generally thought by our country people that birds hatched by mothers of a species different from their own, have no inclination to sit on eggs, and think themselves exempted from giving to their species what they have not received from it: they pretend that chickens hatched under a duck, and ducklins under a hen will never undertake the slavery of sitting on eggs. The good old dames are not the only persons that will stand it out, I have seen inhabitants of the country of all ranks and classes, that were fully convinced of it; for instance, parsons, among whom I have found some, who, though men of

very good sense, thought it wrong I should doubt that fact. This notion is countenanced by an authority still greater than that of these persons; Mr. *Frisch*, who is famous by his works upon the insects of the neighbourhood of *Berlin*, and upon *German* birds, which he has drawn, ingraven and coloured with the utmost care and judgment, is not contented with asserting the truth of this odd fact, he will even have it to be undeniably proved by experiments. What could be the cause that should thus take from birds the will as well as the aptitude to contribute to the propagation of their species? Instead of looking for it, it will be properer to say, that such a fact required an explanation. I have, in order to qualify myself to deny it flatly, caused duck eggs to be sat on by a hen; some of the ducklins that were hatched out of them became ducks, and have sat on their eggs with as much affection and assiduity as any ducks hatched under mothers of their own species can possibly be expected to do. This prepossession is one of those it were to be wished men could be cured of; as it may put a stop to the attempts which might be made towards naturalizing in any country species of foreign birds by means of the eggs alone; it takes all hopes of succeeding in it from those who think that the little ones to be hatched from these eggs, would be absolutely unmindful of the propagation of their species.

Very probably people have not been inclined to consent that chickens hatched in ovens should be more favourably disposed for the multiplication of their species, than those hatched under a mother of a species different from their own might be thought: they have even been thought to be less capable of contributing to it: it was decided that the cocks that rise from such an origin, would be cocks only in name, and that the hens that should have

have the same, would be incapable of laying any fruitful eggs. This odd conceit has been refuted much beyond what it deserved, by the experiments made in large, and which have been mentioned before ; however, notwithstanding the small need I have to busy my hens about sitting on eggs, there have been some among the multitude of those hatched in the ovens, that shewed a desire to sit, to which I allowed eggs, purposely to be able to assure afterwards, as I am intitled to do, that hens hatched in ovens, are as good, as eager, and as fond fitters as any others.

I have also heard people say that chickens hatched otherwise than the usual way, never grew so large as the others : my poultry-yard is very fit to undeceive those who might think so : it will shew them a multitude of hens and cocks hatched all of them in my ovens, among which not one can be found to have in the least degenerated : the cocks and the hens are no way inferior both in bulk, size and appearance, to the cocks and hens of the species they belong to.

People went so far as to pretend, that the eggs of the hens hatched in ovens, were not near so good as others, and had not the same nice taste as they : this I can answer no otherwise than by defying the palate of those who are the best judges in point of eggs, to distinguish by their taste what kind of birth the hen had that laid them.

Finally, it has been alledged against our chickens (for what is it people have not been pleased to say against them) that it was impossible to fatten them. I own I never had any hopes of guessing upon what foundation this had been surmised ; but I know that to make them fat one need only be inclined to make them so. Why should they not have the same appetite as the others ? Why should they make a worse digestion ? You may have them either in good plight, or quite fat, according to the

the condition you like them in best, and in proportion to the trouble you take to feed them well; they are good at any age, and if they are multiplied in the very town of *Paris*, as one may very well do, they will supply the best tables with dishes with which it is not customary, and which it has even been in a manner impossible to serve them. Pigeons almost just hatched, which they call squab-pigeons, are served at *Paris* upon tables in many different shapes; but why do they not serve also squab chickens? The only reason for it I know, is, that they do not cause so many chickens to be hatched at *Paris* as they do pigeons; very few hens are made to sit there, and those who have brood-hens, seldom make them sit with an intention to sell their chickens: they have them purposely to multiply their hens, or replace those that have died. When people shall be able to buy new hatched chickens at *Paris*, I don't doubt but they will be dressed all the different ways squab-pigeons are dressed. Nor did I think so, till after the trials I have had made at my house several times. Experiments like these are not unpleasant to repeat and to vary, and the newly hatched chickens were no less to the liking of those palates I had gratified with them than to my own. Our new-fashioned cooks, who are so well skilled in the art of contriving very expensive kickshaws, will perhaps give us chickens still more in miniature; possibly they will not stay till they are hatched to make very nice dishes of them; when they can find a considerable quantity of them to work upon, they will perhaps dress chickens which ought to have been hatched two or three days after: these chickens will deserve the name of-egg-chickens better than those that now go by it; for each chicken will, in that case, be still attended with good part of the yolk of the egg, which is as good as that of an egg new laid.

I don't fear the reproach I have just now given room for, I am not afraid of being accused to aim at the multiplication of superfluous dainties; those to whom I offer them ought to thank me for them a great deal less than the persons to whom I would fain procure greater success in the cares they shall take towards hatching a very great quantity of chickens. The same thing ought to be done in all states where the favours of fortune are too unequally distributed; it is a means of getting out of the hands of those who have much above what the greatest ease can possibly require, and who have very little concern for the narrow circumstances of others, what is necessary to supply the most craving and indispensable exigencies of the latter. It is matter of sorrow that there should be men able to give, for one single dish (even without the least diminution in their superfluities) a sum that would maintain a whole family for a year together: but so long as there are men so very rich, one ought to be pleased to hear that a dish of young green peas has been sold for an excessive price: it would be a piece of humanity to wish that the premature part of all vegetables and fruits was never sold but at that rate: it were to be wished that proud gluttons would always impose on themselves this sort of taxes, which can never be too considerable whenever they contribute to alleviate the misery of those to whom hard and constant labour can scarcely procure wherewithal to subsist.

But ought we not to fear, I have been asked, that by thus endeavouring to render chickens extremely common and cheap, we should render eggs scarce and dear? The plenty of eggs seems no less desirable to me, says one, than that of chickens; but what better means can there be to procure it than the multiplying of hens, or (which is the same thing) the hatching a great many chickens? They will

will not be killed all of them, some will be suffered to live, grow up to be hens, and all the eggs supplied by the new hatched hens will not be warmed in the ovens. It is most certain that if all the inhabitants of a country should at once take the resolution of having all the eggs of their hens fat on, eggs would become very dear there; and that an egg wanted for a sick person, would be sold as dear as any chicken; but, from that moment the necessity of having eggs fat on would soon cease to be general; those who should find it more profitable to sell their eggs than to see them converted to chickens, would give over this last scheme, and the proportion which ought to be preserved between the price of eggs and that of chickens would soon be restored: the bad consequence of a practice, if spread, would not have been of long duration, since after all, the whole sum total of the evil would have been to make men eat fewer eggs and more chickens.

Another apprehension of an evil which one might suspect would result from too great a luxuriance of our poultry, deserves better to be removed. Is it very certain that the multiplication of poultry carried as far as we seem to wish it was, or as it may indeed be by the methods we have proposed for it, would be advantageous to any state, and to all mankind? Would not the consumption of corn be too much increased by it? Shall we not take the bread from those to the labour of whom we owe it, or shall we not render that bread too dear to them, and that barely to procure the plenty of a sort of food, the quantity of which has been found sufficient till now? Nothing indeed can be more directly opposite to my intentions than such a consequence: I should think myself happy, were I able to contribute to procure to the people of the country that ease which one
of

of our greatest kings wished he could procure them. One of the most earnest desires of that king, who was as tenderly fond of his subjects as a father is of his children, I say one of the most ardent wishes of *Henry IV*, was, that each peasant was able to put a good fowl in his pot every *Sunday*: all country-people would be able to do this, if they bestowed their cares upon rendering fowls more common. The particular examinations into which we entered in the foregoing memoir, concerning what the feeding of a fowl may cost during a whole year, ought to remove all apprehensions that a very great increase of their number would consume too much corn, which is the first and most essential ground of the nourishment of men. Fowls cost almost nothing for their food in the country; the expence is not in keeping them alive, but in the fattening them; and one might very well do without fat fowls in such years when crops were but small, one might be extremely well contented with chickens that should be in good plight and fleshy.

After having convinced ourselves, that there is no inconvenience able to counterbalance these advantages of the chicken-ovens, which are of a nature generally evident; we ought not indeed to leave the subject without having given the reader some idea of another kind of benefit to be expected from these ovens, though they cannot be so generally wished for as the former; we ought not to part with them without having observed to our readers, that they may procure a new stock of learning to our naturalists, and improve some of the branches of the knowledge they are already in possession of. There are no fitter observations to inform us of the wonderful manner in which nature brings on the unfolding of the sperms of animals, and by degrees leads them to the state of embryos,

embrios, and then makes them grow till they are become animals strong enough to come to light, than the observations of what is daily brought to pass in the eggs of birds from the beginning to the very end of the incubation. Every egg you break during that time affords you a sight which can never be sufficiently admired, and which one is never tired of considering. *Harvey, Malpighi,* and more lately *Antony Maître-jan*, have described, and the two last have figured the daily progressions of which they were not able to see the whole complete series till three weeks end; they must needs have had every day a new drawing made the day before, to be able to find out what an egg sat on for four and twenty or even sometimes for only twelve hours more, would exhibit, not visible in an egg which had been sat on for four and twenty or only twelve hours less. The whole chain of the successive unfoldings and increasings which are operated in hen-eggs in less than twenty one days, may, by means of the ovens, be exposed to view in one hour, and even in a shorter time: one single oven will be able to afford us eggs of any term, and the term of each of them will be known, if care has been, as it always ought to be, to write upon every one the day when it began to be warmed, and even the hour, when the egg is designed for very exact observations. You will then be able to break at one and the same instant eggs that shall contain the compleat series of the several progresses of the incubation: you will be able directly and at once to compare all these progresses among them: and in order to make yourself very sure of their mutual and respective differences, many eggs of the very same term may be broken at once: the comparison made in this manner will be far more exact than that which could be made by drawings only, examining

examining what those of one day have over what was seen in those of the foregoing.

If the several tastes, inclinations, industries, ways and whole behaviour of chickens in general and of other birds hatched in ovens, brought up without mothers, and even without having had any the least communication with those of their species, are perfectly like those of the birds hatched and brought up in a manner more conformable to the general rules of nature, as we probably shall find they are; we shall conclude from thence, that birds stand in no need whatever of being instructed by mothers; that they have been instructed by a master who never fails to teach animate beings all it is either necessary or proper they should know. If the chickens hatched and brought up after the new manner, shew us by their cries that they are frightened when they see a kite, a buzzard, or any other bird of prey in the air; we shall be certain that it is the author of nature himself that made them to know the enemies they ought to dread. If the chaffinches, the sparrows, and other the like little birds that have been hatched and brought up in an oven without having had any communication with those of their species, yet make each of them their nests with the art which is peculiar to their respective species, it must and will be acknowledged that that art is as natural to them as their manner of breaking and picking off the husk of their corn and of digesting it, and as the circulation of their blood through their veins and arteries.

It may even be tried whether there is any education can remove the fear which all weak small birds are hatched with of those that are stronger than they and fond of killing them. You may, together with chickens, hatch in the same oven birds of prey of different kinds, as falcons, hawks, and others, of these kinds, in short, of which you shall

shall have been able to find out the eggs, and bring them up together in the same chicken and weaning-houses. You will see, if, notwithstanding their destructive inclination, the birds of prey will live at peace with the chickens with whom they shall have been brought up, which may be probable enough, and whether they will shew the same regard for chickens quite strangers to them, which is a point more questionable. You will see, whether the chickens familiarized with the birds of prey will not skriek out of fear, as all hens and cocks never fail to do, when they shall spy out any bird of prey of the very same kind in the air.

Chymistry will be able to borrow some help from our ovens made of hot-beds, it will be able to make much use of them for digestions, and for such other operations as require a gentle and constant heat that remains the same for a great while. Those who have sought a long while after the philosopher's stone, have spoken much of the heat of dung without ever determining the degree of it. Had they known our ovens, and been able to substitute them to the fire of a lamp; they would have been masters of working more at large, and of making a greater number of experiments at once, as they would have been able to put a greater number of different preparations into the same oven; whereas there can be but one at a time warmed by the fire of a lamp. They would not have convinced us a whit the better for this, of the possibility of the philosopher's stone that transmutes all metals, or at least the major part of metals, into gold, of that stone which would procure naturalists the finest branches of learning, tho' contrary to the good of the societies throughout the world; they would not have convinced us the better for this of the reality of another philosopher's stone infinitely superior to the former,

former, I mean of that which affords the universal medicine; but, they would much more frequently have met in their way some of those curious facts which are very fit to enlarge our stock of physicks, of which they have nevertheless found a great many which they did not investigate or look for.

An *Explanation* of the head-piece of the ninth Memoir.

The head-piece of this memoir exhibits a yard in which there are two sorts of cages, under which the chickens are made to take the air during the fine days.

a, is one of those wicker-cages well known in all our country places under which chickens are put; the size of the cage allows not to put a great many under it, unless they are very small.

b. is a cage more spacious than the foregoing, which can, on that account, hold larger chickens, and in a greater quantity.



M E M O I R X.

*Containing a view of the philosophical amusements
the birds of a poultry-yard may afford.*



THE man is happy who has an inborn taste for soft and quiet amusements which he may resort to at any time of day: he is still happier when he has good ground to expect from the said amusements curious branches of knowledge, that may become of use to mankind. These may indeed be very properly called philosophical amusements. The birds of a poultry-yard will afford diversions of this kind to any that shall be fond enough of seeing and observing them. If he is obliged to pass a part of his life in the country, he must be very well pleased to experience within himself an inclination that will daily insure a very laudable pastime to him. We ought perhaps, in the last memoir, to have added to the advantages that may result from the new methods of hatching and bringing up chickens, their being very fit to inspire

inspire us with that kind of taste : it is natural to be tempted to try whether they answer all the effects we pretended they would produce ; and whoever takes upon him to warm eggs, cannot fail of growing fond of the birds hatched from them : so long as they owe their life to the care we have taken, we see them grow with pleasure ; we follow them in every stage of their lives ; we love to see them arrive to the age when the females lay eggs ; we compare the number of their eggs with that of the eggs laid by other hens ; we make some of them sit, to try whether they will prove as fruitful as others, and whether the chickens hatched from them will be like their mothers. Thus are we invited to make a great many other observations : we insensibly contract an inquisitive disposition, which will make us acquire a pleasing, satisfactory and useful knowledge : this spirit of curiosity will lead us to inquiries which ought to have been made long ago, and which have not been as yet attempted. We are now going to point out a few of those which deserve to become the employment of such among good observers as dwell in the country.

The inquiries I intend are not all of them so easy as they at first appear to be. The experiments and observations they engage us in are very plain indeed, but most of them require a care, an attention, an assiduity, and a constancy, which very few people are capable of : It is on this account, that the very rudiments of what we ought to know concerning the product of all the birds of a poultry-yard are yet wanting. The first thing we, indeed, ought to know is the proportion of the product to the expence : *viz.* What a hen costs and what benefit she yields to her master yearly. Experiments mentioned in the eighth memoir enable us to make a pretty exact estimate of the yearly expence of the hen ; but the benefit

with which that expence ought to be compared, is not as yet sufficiently known: however, the whole of what ought to be done in this consists in becoming sure of the number of the eggs laid by a dozen, a score, or more hens of a particular kind, for a few years together, to know what the number, at a medium, of the eggs laid by a single hen of the same kind, ought to be rated at: that estimate will be the exacter the greater the number of the hens is. All to be done is, to reckon your hens in the first place, to require the eggs laid by them every day to be brought to you every night, and to keep an account of them: this is no great flavery for a day: however, it becomes such to the majority of men, since it is to last a whole year or better: for there is a necessity to follow, with constancy, the laying of a great many hens, during the course of a whole year at least: there are among laying hens some much better than the rest; some yield but one egg in three days, others lay one every day; and I have had one who laid two eggs in one day: but they all of them have times during which they intirely cease to lay, and the time is not the same in all, nor probably of the same duration, which might procure compensations. If, for instance, the hen that gave but one egg in two days was to lay twice the number of days that another hen that gives daily but one single egg, the product of both hens would be perfectly equal.

It would not be enough to have made these observations upon the number of eggs laid by the hens of one sort; it would be of importance to make the same upon the number of the eggs of hens of all the other species, and in every country; in order to know the species which one would be fonder of multiplying there, on account of the greater benefit to be expected from it. It will be from that time
 2 only

only that we shall be able to decide whether it would be right or wrong, to people the poultry-yards of a great many parts of this kingdom with that large and excellent species of fowls which has been rendered common in the province of *Caux*, or with another species almost as large which is fed in the province of *Mirrebalais*, or with the kind of fowls which affords those capons of *Bruges*, so very famous for their bigness; it will be then only that we shall positively know, whether the curled hens, the short-legged hens, called short-footed in some provinces, and the hens without tails and even without rumps, whose size is little inferior to that of our common hens, do not lay a greater number of eggs than those of the largest species. It is not always a reason for a hen's laying a less number of eggs, to have been transported and naturalized in a climate very different from that which her species came originally from. The hens we have from *Guinea* and *Segal*, lay a great many eggs in *France*. Notwithstanding their black combs, their flesh is white, and is judged very nice by such whose imagination is not shocked by the black colour of the bones it covers.

The quantity of the eggs is not the only thing which ought to enter into the comparisons I propose to make; their bigness ought to be reckoned besides. The egg of a hen that weighs double of another, is equivalent to two of the latter. It happens most frequently that hens of a large kind lay eggs, two of which weigh more than three of those of the common species, and a great deal more than double those of very small hens.

But the expence ought moreover to be compared with the product in eggs: If the hen which affords in one year a number of eggs, the sum total of the weight of which is by one third larger than the sum total of the weight of the eggs laid du-

ring the same time by another, costs one half more for her food ; the species of the second hen will deserve to be multiplied preferably to the first. Although the eggs of those hens which are called dwarf-hens, be very little bigger than large pigeon-eggs, one may come to find at last, that it would be more profitable to bring up hens of that dwarfish kind, which are so very pretty, and whose limbs are all of them so well proportioned, than other hens of a larger species, if any experiment should teach us that the dwarf-hens cost less in proportion in keeping.

However, to be able to decide with certainty, whether the hens of any kind afford a greater produce in eggs than those of another species, and above all, whether they give the biggest eggs, the comparison ought to be made between hens very nearly of an age. Every one knows that the first eggs of hens are small ; but people may be ignorant that some hens lay the second, the third, and the fourth year, eggs much bigger than those they afforded during the first year.

Let those to whom the inquiries we have just proposed may appear trifling as to their object, call to their mind again, in what proportion eggs become the food of the inhabitants of the country, and even of towns, and they will be of quite another opinion, they, as well as we will wish that hens might be far more fruitful than they are. People pretend, nor is it without some foundation, that hens that are well fed lay more eggs than those that are not, and that nevertheless those which are excessive fat lay but very few : but these assertions are not as yet grounded upon needful experiments. A certain class of foods and grains are much extol'd in many places, as being very favourable to make hens desire to lay ; other grains and foods are no less reputed for the promoting

moting of the same effect in other countries ; but nothing is as yet sufficiently ascertained on that head ; a point which would require a very great number of trials : if the object of these is not of eminence in itself, it is certainly useful.

The laying time of hens would be infinitely more beneficial than it is, if the periods of it were determined by our choice ; by that means, the sum of the eggs laid by the hens of a poultry-yard, would be distributed in a far more equal manner during the several months of the year : and if they have each of them but a certain determined number of eggs to produce us, we would be glad that some of them would pay us in winter that annual rent. The necessity we are under of keeping eggs in the season when hens lay them in great plenty, against the times when they debar us totally of them, is the reason why a great many eggs are forced to be thrown away every year : they are spoil'd for having been kept too long, or for want of using proper cautions for their preservation. Is it then impossible to inspire hens with a desire of laying eggs during the winter ? I have made a few slight attempts towards it, which had no sort of success : I prevented every way their being influenced by the hardness of the season, by keeping them in a place where the air was warmed by the hot-beds that served to communicate a sufficient degree of heat to the ovens wherein the eggs were warmed, and to the chicken-houses where the birds newly hatched out of them were brought up : I have fed some of them a whole month together with hemp-feed, which people pretend to be fitter than any other grain to make them lay, without having been able to procure so much as one single egg from them. However, I do not think myself intitled to conclude from thence, that the heat of the air is an indifferent thing toward

promoting their laying, and that there is no food whatever able to contribute to it; I have seen the laying of eggs stopt at once in hens which I had fed with nothing but spinach: it is probable that there are foods capable of producing a quite contrary effect; but they must be administered in the proper time, that is, when a hen is in a certain way and condition. Hens moult or cast their feathers once every year: it is the approach, the duration, and the consequences of that time which put a stop to their laying: that season is very critical to all birds: all the time it lasts, even to that when the lost feathers are replaced by others that have got to their full growth, the wasting of the nutritive juice which is made by and for the unfolding and increase of the new feathers is considerable, and it is no wonder that there should not remain enough of it at that time within the body of the hen to cause eggs to grow within her. It is not then, critically speaking, the cold of winter, that hinders hens from laying: this is a fact very well proved, because there are hens that give eggs in the months of *January* and *February*, months much colder than those of *October*, *November* and *December*, during which the same hens laid none. It is however a matter of fact, that when very severe colds come upon them, they stop, or at least abate in their laying; the hen that gave before that time an egg every day, will give it now only every second, or every third day. If any hens happen to lay eggs again very early, it is those that have cast their feathers sooner, and are sooner recovered of that critical indisposition. It seems then, that the means of causing hens to moult soon enough, would also be a means of causing them to lay eggs during the winter. Would not this secret consist in robbing them of their feathers in the spring or the beginning of the summer: could the forced premature

premature moulting, hinder that which nature would infallibly have required later, from becoming necessary? It is never necessary except when the quills of the feathers cease to borrow any nourishment from the body, and dry away: when they are come to that period, the nutritive juices which they no longer appropriate to themselves are bestowed on the sprouting feather rising under every one of them: it grows, and in process of time forces off the old feather, at the end of which it is to fall off, to make room for it. This experiment is one among a great many others that I have neglected, although they are very plain and easy, and I have judged them deserving to be tried; the good opinion I have beforehand of the success of this premature moulting, will not hinder me, I hope, from trying it this year upon a good many hens: I invite the lovers of useful experiments, to please to try it as well as myself: but I don't know whether it is very necessary I should forewarn them of my being of opinion, that in the robbing a hen of her feathers, nature is to be imitated by taking them from her gradually. Her life would be exposed, if she was intirely stripped of them at once; or even in but a few days; it will not perhaps be too much to make that operation be a fortnight or three weeks about. You will indeed lose at that time and during some of the following months, the eggs which she otherwise would have laid; but it is probable that you will have the same made up to you in a season when they shall be very scarce.

However, it will always be in the power of country folks to put a stop to the desire we might have that hens could be made to lay eggs at the end of autumn and in the beginning of winter; it will even be in their power to make us cease to wish that the laying-times of hens were otherwise distributed

distributed than they actually are, because it will be intirely in their power, to have eggs to sell in every season, among which there will never be a single bad one, however long they may be kept, and even to sell them to us as fresh as they were the very day they were laid. Those who have read in the second volume of the memoirs intended for the history of insects, or elsewhere, the methods I have observed to preserve for several months and even for many years together, eggs as fresh as though they were but just laid, will think that I have a mind here to mention the same methods again ; and that my actual wishes are that the people of the country may not continue to overlook the use that may be made of them. It is my intention in reality, to propose to them means towards preserving eggs from spoiling, which are; as to the ground of them, the very same I have proposed several years ago, but which are now rendered so very easy to be practised, that they require no skill whatever, very little time, and almost no kind of expence. No body needs borrow from any other book than this the experiments that demonstrate that a perspiration is undergone by every egg through the pores of its shell : I thought a great many years ago, that if that perspiration could be stopt, and the egg remain always as full as it is when just come out of the hen's body, the cause which alters and corrupts the matters of the egg would not exist, because the fermentation which causes their corruption could not be therein effected. It can never so much as begin in matters that have not a sufficient communication with the air. Now, any varnish impenetrable to water, and spread over the shell of the egg, appeared to me fit to hinder what was in it from perspiring, and consequently to preserve it in the state of a new-laid-egg. I caused several of them to be
done

done over with varnish made with spirit of wine : the success of this experiment fully answered my expectation : Weeks and months passed away, and my varnished eggs were ever in the state of new-laid-eggs ; those that were boiled at the year's end were full of the finest white milk, and had no manner of bad taste whatever. The varnish had then the full effect I expected from it, but my hopes were balked with regard to the principal object of the experiment : my intention was not to make a curious experiment : it was to make a useful one, that might procure at all times and at a very cheap rate a considerable quantity of eggs sound and perfectly fresh ; I expected that all who make long voyages by sea, would for the future enjoy the pleasure of having exquisite eggs to eat during the whole voyage ; it delighted me to think that no ship would set sail without making a large provision of them.

But, nothing of that happened ; a curious disposition indeed inclined many a private person to verify the experiment, but I have seen but a very few of them, that carried it so far as to varnish a sufficient quantity of eggs to supply them with them during the whole winter. It is the people of the country whom it was most essential to inform of this practice : when country-women spin, knit stockings, or sew, they do a more difficult thing than the spreading of varnish over an egg with a little brush : however the spreading and drying of varnish, are small operations which require to be taught. Knowing where to find and how to come at varnish ready made, is a difficulty capable of stopping the country-people, who besides, see an expence certain in the buying of the varnish, without being sure of the benefit it will bring in.

In process of time, I freed them of the trouble of providing themselves with varnish, by teaching them how to apply tallow and mutton fat in general to the same use. Layers of a solid unctuous matter appeared to me as fit as those of the best varnish to stop all manner of evaporation: which the experiments afterwards confirmed. In short, I failed not to observe to them likewise, that if after having filled pots with new-laid eggs, the interstices they left between them were directly filled with fat, they would keep perfectly fresh there.

These last processes, much more easy to be practised than the former by the people from whom we are to expect eggs in any quantities, have moreover the inconvenience of requiring from them a few trifling expences which they may be afraid of venturing on. 'Tis true, the fat which a pot has been filled with, is again found there in a very great part, when the eggs have been taken out of it, and the same may be applied to the same use several times over: but this requires a stock of fat which is an expence to be made: besides, how can one carry to the market eggs done all over with a thick covering of fat? That layer becomes then a small inconvenience to both feller and buyer.

Observations which offered to me naturally when I tried to hatch chickens out of eggs which had been done over with either varnish or fat, have led me so far at last as to see that a considerable part of the apparatus I had hitherto used for the preservation of eggs, might be suppressed. I had been afraid, it would be impossible to stop with success the whole evaporation of the matters within the egg, any otherwise than by means of a coat of matter sufficiently thick, of a layer consisting of many others when it was to be of varnish, but I have had since that time reasons to think that the
same

same effect might be as safely produced by the thinnest as by the thickest layer. The experiments I have made in conformity to this notion have more than barely confirmed it: they have moreover taught me that the pores of the shell of an egg might be sufficiently stopped by a fat matter of which no sensible layer or vestige should remain on the outward surface of that shell: they have informed me likewise, that all fat matters of any kind whatever were equally fit to preserve eggs: at least all those I have used for my experiments, have succeeded so equally well, that I know not any that ought to be preferred to the rest. I have used butter, hogs-lard, dripping, and olive-oil, and have by means of these matters employed in the smallest quantity, had eggs which though laid eight or nine months before, were nevertheless as fresh as they would have been the first day.

If we are made perfectly easy as to the choice of the matter, we are no less so with regard to the manner of employing it: you need but take on the end of your finger the bigness of a pea of either butter or any other fat whatsoever, rub the shell with that fat, and pass and repass your finger over the whole surface of the shell, so as that you may be sure that no part of it was left untouched: when this is done, the egg is perfectly secure against the evaporation, or, which is the same thing, against corruption. Oil is employed for this use with the same facility and parsimony: you dip the end of your finger into oil put in a small saucer or in any other vessel, you rub the shell with the tip of that oily finger, and if the quantity of oil you have taken at first is not sufficient to anoint the shell all over, you dip your finger a second time into the oil, and rub it as before. However, here is a proof that neither the butter, nor the fat, nor the oil need be put over the egg in a quantity sufficient

sufficient to leave a visible coat of it on the outward surface of the shell ; I have many a time wiped with a clean towell eggs after they had been anointed with oil or fat, and they nevertheless remained always fresh.

Would it be asking too difficult a thing of country-women, to desire them to amuse themselves every night, or at any other time, with rubbing over with grease or oil the eggs their hens have laid them in the course of the day ? such a work will never take up much of their time, it will cost them hardly any thing, especially if they will use common fat, or butter not over delicate. It will be just, in order to encourage them to take that trouble, to give them more for anointed eggs than for others ; but let the increase of the price of the dozen of eggs thus prepared be ever so small, were it even but the quarter part of a *sous*, it will more than enough repay the expence that shall have occasioned it.

If the people of the country after having been taught such easy methods for preserving new laid eggs, should nevertheless happen to sell any not perfectly fresh, this could proceed from nothing but downright ill-will, or from an indolence which would be no less blameable, and both of them contrary to their own interest : but they must be taught however, and that may appear the most difficult task of all. A paragraph that should contain but five or six lines from the foregoing page, would include whatever is necessary they should know : two or three copies of that print might be sent to the minister of each parish, who would distribute them to the most understanding of his parishioners, if he was not himself willing to take the care upon him of giving them short instructions.

However,

However, it will be a long time before old eggs, I mean, those of but a middling quality, among which there are often very bad ones, can be proscribed, unless the government is pleased to extend to eggs the care it takes to maintain the abundance of foods, and to hinder the ill conditioned from being sold; unless they would command, none but eggs of the utmost freshness should be seen at *Paris*. The several places that supply such an immense quantity of them for the consumption of that large town, are known; and the above-mentioned prints that should teach how to anoint eggs with oil or fat, ought above all things to be distributed there, together with a strict inhibition of bringing any other eggs to market after a certain time limited. A prohibition should also be made to those who bring eggs to *Paris*, never to bring any after the limited time, that had not been prepared in this manner, which is easy to be known: the apprehension of being searched at the gates, would hinder them from bringing eggs not anointed, which would be deemed counterband; these ought to be proscribed from all markets, where they would be in danger of being confiscated. The same precautions used for the towns of the several provinces of the kingdom, would make them as well as *Paris* sure of never having any but eggs perfectly fresh.

It may be apprehended that the shells of very old eggs might be besmeared purposely to make a surer and a quicker sale of them: this may indeed happen at first, but it will be never or very seldom done afterwards. The trouble of smearing eggs is the same for both the best and the worst of them; so that tricks of this kind cannot be play'd for a longer time than what will be necessary to take off the latter; but the merchants who go and stock themselves with eggs afar off, to transport them to
Paris,

Paris, will not fail to declare that they never will buy any more eggs of such as shall have deceived them: they will know that they have been imposed upon, from the reproaches they will be exposed to on the part of those they shall have sold them to at *Paris*: in short, as there will be nothing to be got by deceiving them, they will be cheated this way but very seldom. Possibly it may happen, through neglect, that the fat may not be spread over the eggs the same day they shall have been laid, and that their shell will not be penetrated with it but a day or two later: all that will then happen is, that they will appear in the condition of eggs a very small matter staler, but they never will be for all that in the condition of stale eggs.

The multiplication of the chickens will not perhaps, and ought not indeed to appear to be a more important object than the preservation of the eggs, which we have so much insisted upon, if the reader be pleased to observe that it is very probable that hens contribute more to the actual supply of man's food by the latter than by the former. It is very easy to surmise, that if all the eggs consumed in one year were put into the scale of a balance and weighed, and all the chickens, fowls and capons eaten in the same year, were weighed likewise; the weight of the eggs would be superior to that of the latter. To be convinced of it, we need but observe that the number of the hens whence we have nothing but eggs, is eight or ten times greater than that of the hens from whom we have both eggs and chickens, and that what each of the latter affords us in weight of flesh of fowl, does not exceed eight or ten times the weight of what she herself supplied us in eggs. There has been but twelve or fifteen eggs subtracted from the sum total of those she laid during the whole year, towards the chickens we are indebted to her
for;

for ; if we knew with sufficient exactness the said sum total, we should be better able to make a just estimate : were it of but 75 eggs, that would make 60 eggs to be weighed against the product of the 15 eggs in fowls : the hen that shall have been able to rear up no more than three or four chickens, will hardly afford in meat the same weight she afforded in eggs ; and those that shall have succeeded best in rearing a good number of chickens, will never by much supply a weight of meat superior enough to the weight of what they would have supplied in eggs, to make a compensation of the weight of the eggs that came from hens that did nothing but lay eggs and never fat on any.

There is a method for having eggs preserved a great while without corruption, which I ought not to forget mentioning, although the method just explained of preserving them makes this a matter of meer curiosity. It is very odd that there should be among the eggs laid by the same hens, some that remain sound and contract no ill taste whatever, though laid a great while before, and kept in a warm dry air five or six times longer than what would be necessary to rot any other eggs placed by them. This is an observation which I had occasion to make a great many times, even when I knew not how to have eggs hatched otherwise than by hens, and which I have repeated pretty much in great, since I tried methods for causing chickens to be hatched in ovens. It was at the very time I had least skill to hatch them there, that I took notice of those eggs which are so little liable to corruption. After eggs had been warmed for some days together, more or less, in my first ovens made with dung, there were some that spread the most offensive smell in the place, after they had been burst by the infectious matter which had fermented within them, others whose shells were

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covered

covered all over the surface with a liquor of the like foetid smell which had transfused from within; and others, in short, whose shell was neither cracked nor wet, that stunk most intolerably the instant they were broken. Among these very corrupt eggs, I found some, which, when broken, not only had no ill-smell, but which were no otherwise altered than the old eggs we daily feed upon, and were really very good to eat. They differed from new-laid-eggs only by their being emptier, but their yolk was not dissolved at all, it was in an entire ball like that of the best eggs.

In some of the eggs that were corrupt enough to spread the most offensive smell, I found a chicken very well formed, in some of the same eggs I found only the remains of one, and in others I could not perceive the least vestiges of any: in this last case the infection had more efficaciously acted upon the solid parts of the chicken, it had perfectly dissolved them where it had exerted its influence soonest: the Germ had perished in those eggs, and rotted as soon as it had begun to unfold itself. The Germ, or at least a Germ able to unfold, is wanting in the eggs of hens that live without a cock, those of the hens that are not deprived of cocks, are not even all of them fruitful, or provided with a well conditioned Germ: now, since the eggs that have Germs in them are liable to corruption, it was very probable and very natural to think that those which keep sound a longer time, are the unfruitful ones. The experiments fit to remove all doubt on that head were too plain not to be attempted, and they were necessary to me on some other accounts.

I kept four hens without a cock in a large cage, where they had every thing besides in plenty; they laid eggs there, the first of which I caused to
be

be fat on: chickens were hatched from them some weeks, or else they died in the shell. There came a time at last when the eggs, which had been fecundify'd before the confinement of the hens under the cage, were intirely exhausted: all those they laid afterwards, remained sound eggs in the oven where they were warmed, no chicken was unfolded in them, nor did they contract any corruption in the oven: although they were in an air warm to the degree that causes chickens to be hatched, they remained sound there for above thirty, and sometimes for forty and fifty days together.

Thirty or forty days in an air that has the degree of the heat of a hen's body towards corrupting eggs must be equivalent to a great many months of an air which has only the temperature of that in which we keep the eggs we would preserve: I must then have concluded from it, that eggs destitute of a Germ might be kept a considerable time without being spoiled. Instead therefore of continuing to introduce into the chicken-oven the eggs which my hens destitute of cocks continued to lay, I deposited them in one of the coolest places of my house on the ground floor, after having written upon each of them both the month and day it had been laid. It was only on the third of *January* that I made the trial of those whose date was of the beginning the month of *May*: I, indeed, did not expect to find them new-laid-eggs, but I found them, as I had expected, very good old ones. A very great vacancy had been made within them. They had had a principle of corruption less than the others, but they had kept whatever could be in them the freest perspiration, the pores of their shells having remained as open as they naturally are. The yolk, far from coming to a dissolution by becoming fluid, and by ceasing to remain in a ball,

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ball, as happens in the yolk of eggs that are rotten, was rather grown thick in some of them; and I found a number, in which the yolk stuck to the shell by a place of very small compass where it adhered to it. In short, I have had those eggs dressed many different ways, and none of those who eat them with me had the least suspicion that they were eggs of eight months old.

In order, then, to have eggs that would keep fresh from spring to the middle or even the end of winter, we need only to deprive hens of all manner of communication with cocks. People without knowing this, must often have owed that peculiar circumstance, or some other equivalent to it, the advantage of finding a lesser number of spoiled eggs among those they bought, and to find a number of better among other eggs that were not as yet spoiled. Hens are not furnished in every farm with as many and as good cocks as would be necessary to render all their eggs fit to be sat on: I have made with those eggs trials that I did not like of buying eggs to hatch chickens with in my ovens, and which have made me resolve never to warm in them any but those of my own hens: being willing to have large broods, I have bought eggs of one of my farmer's wives, whom I knew to be incapable of deceiving me and of selling me stale eggs: and two thirds, and sometimes three quarters of the eggs proved to be unfruitful ones: the good woman was equally ignorant that her eggs were not only unfit to be sat on, but excellent to be kept. A long, and indeed much too long a time before vacation, the peasants about *Reaumur* keep their eggs to sell them at my house when I am there: it happened very often that of those they had sold, my cook was obliged to fling away two thirds or three fourths, the remaining third

or

or fourth part, probably consisted of none but those which had no Germ in them.

Whilst *Harvey* was making his observations on the incubation of the egg, chance seemed to have taken pleasure in offering him none but fruitful eggs even to an egg: had he met with any that had been preserved sound for one and twenty days together, he would not have marked out, as he did, the fourth day, as that on which addle-eggs begin to corrupt; he would have past a quite different judgment upon those he should have seen decaying from that day; he would have considered them as eggs whose Germ had perished before it had been able to increase in any perceptible degree. The day which he calls the critical day, may be fatal to weak Germs; his

very words are these * *Ova hypenemia sive infæcunda, hoc ipso tempore (quasi die critico) mutari incipiunt, atque indolem suam ostendere; nam ut ova fecunda, in colliquamentum (quod postea in sanguinem transit) ab insitâ vi plasticâ mutantur, ita subventanea ova eodem tempore corrumpuntur, & putredinem induunt.* * *Tertia ovi inspecti, exercitatio 16. pag. 53. London- edit. in 4to.*

M. Antony Maître-Jan, a surgeon at *Méri sur seine*, who besides a large volume of excellent observations upon the diseases of the eyes, gave us a small book which contains the chain of his accurate and curious observations on the formation of the chicken, has used the precautions neglected by *Harvey*, that were necessary to compare the effects of the incubation both on fruitful and unfruitful eggs: he observed accordingly that the latter preserve their goodness † much longer, and that † *Pag. 8.*
 “ though warmed by the hen, they remain several days together without any greater alteration than a diminution of the bulk of the
 “ white.”

Dainty people find differences in the taste of eggs, according to the things the hens that laid them have been fed with. However, I am not very certain, as the connoisseurs will have it, that those of the hens which feed upon grass and eat corn also, are better than those of the hens that feed upon corn intirely: these comparisons are easy to be made, and they may become an amusement in the country. But it is an acknowledged fact, that when years abundant in cock-chafers supply our hens so as that they may eat bellyfulls of them for some weeks together, their eggs are of an unpleasant taste on that account, which is sufficient to prove that the quality of the foods is no indifferent thing as to the taste of eggs.

What belongs to the feeding of poultry in its different stages, is in general as yet a large field open to experiments. Notwithstanding the length of our second memoir, we have not by much exhausted all the experiments which deserve to be made towards being certain of the kind of foods that suits poultry best: we have only pointed out the foods which are most to their liking. We ought to have tried to bring up chickens, by making them feed intirely upon each of these foods; we ought, for instance, to have given to forty or fifty chickens nothing but millet, to forty or fifty others, nothing but crums of bread, and to a like number nothing but paste made of crumbed bread and meat: another such a set might be fed with boil'd herbs, &c. The use which is made with success of raw, and much more still of boiled nettles to feed young turkys, is an invitation to try what herbs are most to the liking of chickens, and what are those that will promote their growth most of any.

When chickens begin to be nearly of the age when we make them pay dear for the care we have
taken

taken of them, they then afford us new matter for experiments on the manner of feeding them. Our greedy or dainty mouthed people, for these are many years since become synonymous words, would be very well pleased with any one that should procure them chickens whose flesh should have a superior flavour to that of the chickens they have hitherto been served with, I mean that flavour which the *French* call *fumet*. The profuse manner in which they pay for novelties in point of eating, deserves that we should strive to procure them some, especially when they may in time be shared in common, by those who are least desirous of them. The trials that may be made in favour of these dainty people, are fully hinted to us by the well known alterations which are procured by certain foods in the taste of the flesh of several birds. It is an unquestionable matter of fact, that fieldfares, which are exquisite whilst they feed upon grapes, have oftentimes a bitter-tasted flesh, when they are obliged to feed upon juniper-berries. Black birds are tolerable good eating during the times of vintage, and their flesh is really bitter whilst they feed upon ivy-feed. No body is ignorant of the difference which is between the flesh of rabbits fed with cabbage-leaves, and the flesh of those that feed upon wild thyme. It would be needless here to multiply instances that prove the quality of the flesh of an animal partakes of that of the things he has been fed with. However, it seems that, if aromattick plants were made one of the ingredients of the food of chickens, their flesh ought to contract a small flavour or *fumet* by it. If any seemed to be to their liking, it ought to be offered them in preference to any other and in great plenty. But if they refuse them all, one may try to introduce successively a variety of them into the lumps of paste which are forced down the throat of

those designed to be fattened. Balm-mint, tarragon, hyssop, rosemary, sage, lavender, creeping-thyme and other aromatick plants, might be introduced one after another into the paste, cut small. Those trials might indeed cost many a chicken his life; but, it is probable, that any aromatick plant that should have been found proper to mix with the paste without causing the chicken to fall off, would also be the means found out to produce an agreeable alteration in the quality of his flesh. This trial might be made upon the very *Indian* sweet-scenting spices, such as cinnamon, nutmeg, and cloves.

I have not as yet attempted any of these experiments, but I have one to offer that was made by meer chance, and which gives very good hopes for the rest. Mr. *Bouvard* of the academy of sciences, told me that a couple of turkeys having once stolen into a garden of his father's, that was not over and above well guarded, and where there was a border of onions, they found the green part of them very palatable; they were suffered to feed on them for some days together, after which they were killed. Their flesh was found of an exquisite taste, which had never been perceived in that of turkeys, a flavour like that of pheasants and venison: their flesh had been intimately seasoned by the onion. People say, on the other hand, that the turkeys that pass, in their way to *Paris*, through the forest of *Fontainebleau*, and make a stop there, have a flesh which the juniper berries they eat upon the road have rendered very unpleasant to the taste. The above-mentioned experiment of Mr. *Bouvard*, is then an invitation to us to feed not only turkeys, but also chickens, with onions, leaks, and garlick.

Although people are very well skilled in the art of fattening fowls, although it be a part of the business

business of the poulterer, although the several provinces of this kingdom succeed very well in procuring fat fowls, capons, turkys, gossins, and geese, and a prodigious multitude of these fattened things be yearly conveyed to *Paris*; there remain very probably a great many things to be known with regard to the most speedy method of fattening them, with regard to the cheapest way of bringing it about, and with regard to the practice that procures both the fat and the flesh of the nicest quality. What we already know on that matter is as yet but superficial, it having not been told us with sufficient exactness and particularity by those who have treated that subject in the books intitled *prædium rusticum*, and other works of the same kind. In short, this matter deserves to be sifted by those who are fond of occupations useful to the publick, who think them noble on that very account, and who are capable of pursuing, combining, and varying experiments in a judicious manner.

A poultry-yard is not so necessarily dirty as one might be apt to think; uncleanness is very far from being essential to it: if great care be taken to sweep up the dung very well on a heap, and to suffer none to be scattered about, and all proper means shall be taken to convey the water out of poultry-yards, our very ladies need have nothing to fear, whenever they have a mind to go and enjoy there the amusing sights they yield every hour of the day. If people are affected by that kind of pleasure which is but transitory to our fondest florists, who procure it to themselves but for a few days by a world of toils and cares taken for a whole year together; if they are affected by the variety and singular combinations of colours; the hen-kind, which ought always to make the basis of a poultry-yard, will offer to the eyes of our virtuoso's,

oso's, objects very fit to satisfy them. Most cocks, even those of the commonest species, being considered, when exposed to the light of the sun, shine with the brightest colours, with the beauty and odd mixture of which we are the more struck as we are more intent in looking at them. The hens themselves, if we have been mindful of having them of the finest kinds, are adorned in a manner no less worthy to be admired. Some of them have spots distributed with a kind of regularity, and so brightly white that they have been called silvered hens on that account. Others go by the name of gilt hens, because they are deck'd with spots which look like gold when viewed in the sun. The more common colours are distributed with innumerable varieties on the ordinary hens. This class of birds, designed to be for ever under our eyes, offer a multitude of colours, the several shades of which would be very difficultly found, if they were sought for among the birds of the forest, the river and the sea, of a great many species. If we see not in their feathers colours as fixed as those that strike us in certain birds, it is not for want of their having been granted to some of their species, but only because we neglected to naturalise those singularly beautiful kinds among us. We have accustomed to our climate hens of the *East-Indies* and of *Africa*, although their native country be much warmer than that of the provinces of *China*, where live those hens and cocks so excellently gilt, whose feathers exhibit at once to our eyes that true beautiful blue which we find in none of our European hens, the red that seems to us so great an ornament in those birds which we call cardinals, and the finest yellow of the yellowhammer.

Nor must I omit mentioning, with regard to their colours, that among the hens or cocks of a poultry-yard, there are some which offer an annual phenomenon

phenomenon worthy to be remarked. Birds moult every year, they yearly cast off their old coat, and put on a new one, which is commonly much like that they have left off, at least after the second moulting and the following; the hen that was quite black before the moult, is again quite black after it; and the hen white all over most generally assumes none but white feathers. One of the singularities of those very small and charming sparrows which we have from the coast of *Bengall*, and which are called *Bengalis*, is, that after having cast their feathers, they frequently are of a colour different from what they were of before; you see with a blue belly the bird which had a red one; and the very reverse: that of some others becomes yellow, and that of others becomes grey. Whether there be an order according to which the colours of one year succeed those of another, I indeed do not know; all I know is, that the fact of the annual, or nearly annual change of the colours of these little birds ought to be looked upon as certain, it being attested by all who have had some of them in cages for above a year together. Notwithstanding the vast resemblance between all rams and ewes, the shepherd distinguishes one from another the whole numerous flock he daily leads to the field: so, let the number of your hens be ever so great, if you are fond of seeing them flock together when their food is given them, you know them all by differences which you observe without being sensible of it; you may at those times take notice, that there are some among them whose feathers experience a change of colours like those which are looked upon as a singularity in the feathers of the *Bengalis*. I am going now to give a few instances of it. The first of them was in one of my hens, that the woman that looked after them distinguished from the rest by a crooked claw like
that

that of a fore swollen hand ; this fowl had, when her coat began to be taken notice of, feathers of that ruddy colour mixt with brown, which is most generally seen in the hens of the commonest kind : it was observed the year after, and I observed it myself, the creature was become almost quite black, having here and there large white spots ; after a second moulting black was predominant in every part of her body ; the white predominated after another moult, and to such a degree, that the black was no longer found but in a very few places, and only in spots the biggest of which were not quite so wide as half a crown. Finally, after the moult of the year 1748, that hen was become perfectly white, as white as a hen can possibly be, that is, of the whiteness of a swan.

As she is actually old, ten years at least, one would think that old age, which whitens our hair, whitens likewise the feathers of certain birds ; but in that case the transition from the ruddy to the white, ought not, one would think, have been made as it really was, through the black. If that hen lives a few years more, as her present vigour seems to promise, 'tis probable that she will not stop at the white, but will reassume some black and brown, and perhaps return to her primitive ruddy colour. A cock I have now at my house, and whose alterations, as to his colours, have been observed more readily than those of the hen before mentioned, has given me proofs that the whiteness of the feathers does not proceed from old age, having shewed retransitions from that colour to darker ones. The owner of that cock was struck, the first time he moulted, with the colour of his new coat ; nor has he failed ever since to take notice of the new colours which his feathers had constantly assumed after five successive moultings. The prior of *Bury near Clermont in Beauvoisis*, has an affection

for me, grounded on that I have for him ; judging that I should be curious of seeing that bird assume every year feathers in colour different from that of the year preceding ; he had him conveyed to my house about the beginning of the month of *December* 1746. informing me, at the same time, that in his first year, he had nearly the same colours in which he would appear before me for the first time, *viz.* some of the ruddy colour mixt with white ; that in his second year, he had been clothed with none but feathers perfectly ruddy ; that in the third he had had none but black ones, and none but white in the fourth year : in his fifth year, when I received him, he had white feathers, mixt with a great deal of the ruddy colour, or with brown bordering upon chesnut ; ruddy feathers covered his neck, his back, wings and belly : the ruddy feathers were predominant, and even the white feathers were mixt with some of the ruddy colour. I was two months of the vacation without seeing him : he had disguised himself to such a degree during my absence, that I could never have known him again at my return, had I not been forewarned that he must have assumed feathers quite different from those he had had the rest of the same year. His coat was all white, and of the finest white that could be. During the vacation of the year 1748. he cast his fine white feathers ; those that came in their stead, and which he will wear to the month of *October* 1749. are partly white at the most, but the majority of them are very ruddy, or rather fair red. This is then a retransition from the white to a light brown colour, of which I am actually an eye witness : therefore the whiteness of his feathers is not owing to the number of his years : I cannot help wishing him to live beyond the term of the oldest cocks, and having reasons to think that he will continue to appear under new colours every

every year, I shall be able to observe if there be any regularity in the course of these alterations.

Facts like those just related, will perhaps cease to be rare, when every person shall be pleased to examine whether the hens of his poultry-yard have any such changes to exhibit. Since I was forewarned by my hen, that others, as well as she, might not be constantly clothed with feathers of the same colour, I observed a cock of the curled kind that was of the most perfect black, had acquired in both wings several feathers of the green colour which we call duck-green. The next year, the number of those feathers increased on his wings, and a few of the same colour grew on the lowest part of his neck and under his belly. Death deprived me of this cock about the middle of winter, so that I could not know whether he was to lose all his black feathers in time.

These sorts of observations, if they were repeated, might lead us to a surer method of making experiments that would be judged curious by naturalists, and be much to the liking of those who are passionately fond of the beauty of the feathers in fowls.

The *Indians* of *Guiana* busy themselves already for those who love fine parrots; they know how to make red and yellow feathers grow on wings where there was none, or where they were scant. That fact, which Mr. *De la Condamine* has mentioned in his curious and interesting relation of the river of the *Amazons*, is attested by all that have lived at *La Cayenne*: there is even a word to distinguish those parrots which owe to art one part of their fine feathers, they are called *Perroquets tapirés*. We have been assured that the *Indians* pluck the feathers off the places where they know they can, instead of the green, cause some red or yellow feathers to grow, and that they rub the flesh they

they have laid bare with the blood of a certain kind of frog. If a longer sojourn at *La Cayenne*, and a greater leisure had permitted Mr. *De la Condamine* to cause some parrots to be *tapires* in his presence, we should know much better what ought to be thought of the use of the blood of frogs. The whole art of the *Indians* amounts perhaps to no more than the procuring a premature growth of the feathers which the moult would have brought on later; and the blood of frogs is possibly nothing more here than a balsam on the little wounds thus given to the parrots. The *Indians*, they say, know what parrots are fit to be *tapires*. Possibly they know with regard to their parrots what we should know with regard to those of our hens whose feathers change their colour after each moulting, if constant observations had taught us which are the hens whose feathers are to undergo that change, and of what nature it is to be. When parrots are known to have been *tapires*, they are bought cheaper than the others, and the *Indians* take great care never to give them for such on that account. Of what importance can it be that their red colour should be owing to nature alone? Is it not because the red colour perhaps, in which art has had any share, is the effect of an operation equivalent to the moult, and because experience taught them that the red and yellow feathers that fell off at the next moulting, were not always replaced by feathers of the same hue; just as the feathers of the above-mentioned cock and hen are not replaced by feathers of the same colour till after a great many years?

Turkys, ducks and geese are so many fortments almost necessary and seldom wanting in a poultry-yard: they help to adorn and render it more lively. These last kinds of birds, together with the several kinds of hens, are sufficient to supply us with very ample

ample matter for observations and comparisons on the genius of many different kinds, of birds, upon the principal differences of their form, and upon their inclinations, considered with regard to that form which is the principle of them. The gravity of the gate of the geese there makes a contrast with the less studied behaviour of some, and the blunt giddy ways of others. The sociable behaviour and familiarity of those of one and the same kind among themselves, their different ways of making love, the feuds and fights both among birds of different classes and among these of the same kind, are sometimes pictures of what passes among mankind, which nevertheless does not afford us instances of any mother so tenderly fond of her children as a hen is of her chickens: she knows no danger when their preservation is the question; she, in that case, rushes upon a dog, whom she would run away from at any other time, she is then bold enough to attack him with fury. A spectator that shall have any notion of anatomy, will admire the motions of the bill of these birds, which take but one grain at a time, but who repeat the strokes of their bill with so much exactness and rapidity, that they are able to fill their craw in a very short time, be the grains they eat ever so small. He will observe how several grains are taken up at once from the ground, by those whose wider and flatter bill is moreover designed to help them to pick up food in water. Such a spectator will not content himself with barely considering the turkey-cock spreading his tail with a proud mien, he will be curious to find out by what mechanism, by what disposition of his flesh and muscles he is enabled to make the feathers of his tail stand up on end, and at the same time to set the tops of them at a distance from each other, so as to dispose them in one and the same vertical plan like the rays of a circle,

circle, and by what disposition of his flesh he, at the very same time, makes the feathers that cover the greatest part of his body stand erected, so as to be bristly with them : he will judge it remarkable, that there should be but a few other kinds of birds able to communicate such motions to their feathers. He will consider with attention another singularity which the turkey-cock shews at the same time, and which no other of the birds we know has yet exhibited to us, I mean that long flabby reddish or purple piece of flesh, that has its root above his head, and hangs in that case several inches below his bill, whereas, at any other time, it only stands to him in stead of a conical comb six or seven times shorter ; whilst other birds, not excepting the turkey-hens themselves, have combs whose form is as constant as that of bones ; the turkey-cock, therefore, has a comb which it is in his choice to lengthen to an enormous degree ; curious eyes will find in poultry a world of extraordinary things which have been offered to their view thousands of times before, without so much as being taken notice of. The feathers that compose the tails of birds of almost every class, are ranged one under or by the side of each other in a plane either parallel or inclined to the horizon. There is but one single kind of birds that I know of, having their tail in a vertical plan, and so folded into two equal portions that the under part of one half of its feathers is close to the under-part of the feathers of the other half. That kind of bird whose tail would appear very odd to us on account of its situation, if we were to see it for the first time, is the hen-kind. The facts I have just mentioned, have nothing in them that could make me observe them preferably to a prodigious multitude of others, which birds are for ever exposing to our eyes, they offered first to my remembrance, and that was all.

If a common poultry-yard has so many objects capable of engaging the attention of an inquisitive genius, how much will the number of interesting objects be multiplied for him in a poultry-yard that shall have been purposely peopled with all the different kinds of birds that deserve to be admitted therein? He will have there a great many different kinds of ducks and geese, and if he will not content himself with a useless stock of knowledge, he shall have besides their several products to compare with each other. Turkey-cocks will no longer be the only birds that spread their tails before him; he shall see proud peacocks, with their tails standing up on end and even bristling to their very head, notwithstanding the prodigious length of their feathers, whose lively bright colours and gold may vie with the most beautiful productions of nature in that kind: next to the gilt peacocks, he will also see the white ones with pleasure, notwithstanding the almost total uniformity of their colour. The *Indian* hens will shew him colours still more modest, but which cannot fail of pleasing his eye very much by the regularity of their distribution; there is no pencil that can make any thing of an exacter symmetry. The pheasants, which we should admire much more if they were more rare in our woods and parks, may be ranked in the number of the inhabitants of our poultry-yards; it is utterly needless to imprison them in lodges; they live very well with the hens, and we have in that case the pleasure of seeing them: we may, in order to make ourselves certain of this, cut the feathers of one of their wings: their beauty will be diminished very little by it, the male will not be less fond of his hens, nor will their eggs be a whit less fruitful for this. The bustards, whose value is equal at least to that of turkeys, may, as well as the latter, be accustomed

customed to the living in a poultry-yard : It is only a thousand pities that we cannot expect as many eggs from them as from the turkeys, for the birds which we ought to be fonder of feeding in our poultry-yards, are chiefly those that may become useful to us by their multiplication. Nor shall I ever be tired with repeating, that the classes and kinds of birds which are wanting in a country, are those which we ought to make it our business to naturalize and convey into it, when it is a known fact, that other countries find advantage in the rearing of them.

Too few navigators are disposed to take, during a long voyage, the care that would be necessary to bring us alive the birds we should be glad of : we shall therefore content ourselves with desiring from these persons the eggs, whose transportation can be no great trouble : buried in bran, or in any other powder, like saw-dust, they make the longest voyages even by land, without running any risk of being broken. The only farther precaution we shall require is, that care should be taken to smear over with varnish, or to rub slightly with oil or with any fat whatever, the eggs designed us, if possible on the very same day they have been laid. This very plain operation has been sufficiently explained in the beginning of this memoir ; and we have given proofs of its perfect security towards preserving eggs in the state of new laid ones.

We shall be able, by means of our chicken-ovens, to have these eggs warmed as soon as they arrive : but we must, in order to be able to warm them with success, previously divest them of that varnish or fat matter with which they have been done over. They have been preserved sound, because the perspiration was stopped ; experiments repeated over and over have taught me that if the perspiration is not restored, and rendered free again, the germ will not

not unfold itself, and the embrio will sooner or later be destroyed. Among the methods I have tried to the end that the shell might be supplied again with a sufficient number of open pores, that which seemed to me the surest was to scrape it with a sharp blade; that of a pen-knife is very fit for it. This small operation requires a deal of patience, though not so very great as one might be apt to think. It would be much more convenient to have nothing more to do than rubbing with sand or with ashes the eggs that have been oiled or besmeared: but the trials I have made shewed me that we cannot arrive by that means at sufficiently taking off the fat matter that has penetrated through the pores. I tried in vain to take it off with chalk: nor did I succeed better by washing the eggs with soap, or in a lixivium made with an alkaline salt. The scraping, that takes off a thin stratum of the shell, may still leave some pores stopped by the fat matter, I mean by the part of it which had penetrated lower than the stratum that has been scraped off; but it opens pores that were obstructed by the very substance of the shell; and this makes a compensation: it breaks grains of it which, when intire, yielded no passage to the matter of the perspiration; whereas they yield that passage when they are broken and have lost their continuity. The whole surface of the shell of the egg must then be carefully scraped all over with a pen-knife or with a blade equivalent to that. The places it shall have past over will be easy to be known by their whiter colour, and by a drier look: you must not cease scraping, before you have made the whole surface of the egg of the same bright colour: You must scrape off the shell as thick a stratum of its substance as possibly you can without breaking the shell. Commonly the shells of the biggest eggs are the most solid, and of course the

the most easy to have this operation done upon them. If eggs of the biggest birds of *Asia*, *America*, and *Africa*, as, for instance, of the casouar, the ostridge, the condor, &c. were sent over to us besmeared with oil or with any other unctuous matter, we might entertain some hopes of hatching in *Europe* some of those birds which are giants with regard to its native ones: nothing would be easier than to scrape off the shells of such eggs as these a stratum thick enough to render the perspiration as free as it was before they were smeared. I have tried the effect of a smooth file, by substituting it to the blade of the pen-knife, towards a greater expedition in the scraping of the shell, but I found there was no time saved by it as I had expected. The file grows greasy, and the interstices which ought to remain empty between the small teeth, are soon filled up with what has been scraped off.

We cannot enjoy for many years together, the pleasure we should have procured to ourselves of seeing several species of the same genus assembled in one and the same poultry-yard; for instance, a great many sorts of hens, which are the more important class of birds on account of their vast utility, if we do not take care to perpetuate the same among us: the feeding them well, and causing a sufficient quantity of the eggs laid by the females of each individual species to be set on, or warmed every year, would not be enough for this purpose; ill-sorted matches of them, would, by little and little, cause all these different species to degenerate; the individual birds that should go off, would no longer be replaced by others perfectly like them; we should no longer find among them those species that were distinguished from the others by the elegance or by the largeness of their topplings or tufts, those that were distinguished by

their enormous size, those that were remarkable for their long shanks, or that were short-legged so as to touch the ground almost with their belly, no more than those whose extremely smallness of body rendered them very pretty. The cocks of the largest species do not despise the hens of the smallest, and the cocks of the smallest kinds dare to make their addressees to the biggest hens, that are not cruel to them. If then we have a mind to procure the preservation of the species, we are under the necessity of never allowing to the male of each sort to converse with any but the hens of his own kind. We are obliged to keep a set of hens prisoners and a cock of each species, to reside together night and day in a small place. The cock will not be a whit less fond of the hens, nor did they seem to me to render fruitful a lesser number of eggs for this confinement. It is then almost indispensibly necessary to prepare a row of lodgings, in number equal to that of the species you have a mind to preserve. These lodgings will be an ornament to your poultry-yard, and will cost but very little, if you will content yourself with making them like those I apply to the same use. A bower * of lattice work, thicker wrought than those of gardens, and made like them, either with hoops or with small pantile laths, is the principal and most remarkable part of the edifice. This bower is but five feet high, it is above three feet broad, and its length is determined by that of the ground you have at your disposal. It is divided by means of partitions also of lattice-work, as thick wrought as the rest, into a number of portions, each whereof forms a lodge. I make the smallest lodges but four feet long, and the biggest but six feet and a half. The least of them is sufficient to harbour a cock with two or three hens, and I put but three or four and a cock into the largest.

* See the
head-piece
of this Memoir,
and
Plat. VI.

largest. Each lodge has its door which is not very high, but a man may enter stooping. I had all the doors garnished with grates made of iron wire, because they left more room to see what passed in the lodges, than a wooden one would do.

However, each of the lodges which are under the bower is but one part of the habitation of a cock and his hens: it is their day-room as it were, behind which they have a night-room, a bed-chamber. The disposition and construction of the night-rooms are easily imagined, when you are told that the lower lies at the distance of two feet from the wall, to which it is parallel, and the side of the bower which is nearest to the wall, is only a partition of boards. There is no lattice work between the partition that constitutes the back-part of the bower, and the wall; there remains therefore a narrow gallery in that place. Which gallery is divided by partitions into as many parts as is the whole length of the bower, and into portions corresponding: each of these parts is the bed-room of one cock and his hens. The intention is that they should be warmer there than under the bower, and not exposed to the rain: therefore the gallery must be covered from one end to the other with a roof *, which consists, in its breadth, of a *Plat. IV, couple of boards so joined as to make a gutter that VXD. conveys the water to one end of the gallery. No doubt the reader has already suggested to himself, that there is a door of communication from each lodge under the bower to the corresponding room behind: it suffices not that the aperture of that door be adapted to the shape of the biggest fowl; it must besides, on many occasions, receive the head and one arm of a man, and even permit a man creeping on his belly to enter into the second room. A plain board † cut square will close that †Plat. VI. gap; Q, Z.

gap; it is a door that requires no lock, as it moves up and down in two grooves: care is taken every night to let it down, to shut the door, and to open it every morning. It is raised or kept open, by a small pack-thread fastened to its upper-edge, and having a ring to be hooked on a nail.

* L.

It is in the fore-room *, which is the larger of the two, that the cock and his hens remain the greatest part of the day at least; it is there they find their meat and drink: they breath there an air which is not stagnant, and they besides enjoy the influence of the rays of the sun, when care has been taken to place the row of lodges in a south exposition. In the night, they are warmer behind † than the hens that roost upon trees, and almost as warm as those that lie in a hen-house, provided you forget not to shut the door at night: that door is also a security against pole-cats and weasels.

† Plat. VI.
C, C.

A small window grated with iron wire and placed on the partition that shuts up each end of the gallery, is no indifferent conveniency: at the one as well as at the other, your eye is able to look into the whole row of the hinder rooms, to see what eggs have been laid in the nests, and the hens that are actually laying. However, the hens of each lodge are not always deprived of all manner of society. They communicate in some measure with those of the lodges from which their own is separated only with a grate. Nor is that communication always friendly; I have more than once been present at a fight between the cock of one lodge, and that of the next to it, and sometimes between hens of two contiguous lodges, fought with so much cruelty and obstinacy, that the scene became bloody, and the comb of one and sometimes of both the antagonists, was all over blood.

Although union is commonly preserved in the same lodge, I, nevertheless, have seen there instances

instance of battles still more odd and more bloody than those just mentioned: the two hens of one lodge, after having lived in very good understanding with the cock allotted them, after having laid eggs which he had rendered fruitful, took an aversion to him, and never gave over pecking him with their bills from morning till night: they soon came to strip his head of feathers and make it bleed: he made no kind of use of his strength against them, and hardly strove to avoid their bills: his mildness did not appease their fury; they went on with their rage against him; they tore his head and neck to pieces, and killed him at last in five or six days time. It is a general maxim among fowls, and a maxim very fit to give us a bad opinion of their disposition and manners, and that birds in good health fall foul upon the drooping one: they no sooner see one of them suffer, and chiefly if bloody, but they are directly disposed to rush upon him. I changed the cock which my hens had killed for one very sound, strong and beautiful; they soon shewed themselves the same furies to him as they had been to his predecessor; after he had been a day and a half with them, he was put in a condition that made me in fear for his life, which his beauty required I should take care to preserve: I took him from these two harpies and gave him his liberty. I tried successively to make them accept of two other cocks; they used these as unmercifully as they had done the first: I took one from them after two days, and the other after three, that is, when they seemed to me in so bad a condition, that they must necessarily have perished, if they had been left any longer at the discretion of the two hens. I declined offering any other new cocks to them, they would have killed all those of my poultry-yards one by one, if I had pleased to deliver them into their hands: these

hens were *Guiney-hens*, and pretty large hens of the common sort.

Let not the adventures I have just recited, make the reader be afraid he shall not find as much utility as could be desired in the lodges. These catastrophes have never been repeated for the four or five years together that I have kept hens in my lodges; and I have related them, to the end only that no body should persist in offering fresh cocks to be killed by hens of so bad a disposition if they should ever be met with. It will then be easy, by means of these lodges, to preserve all the different kinds of hens genuine in their purity (if I may be allowed the expression) they will be in no danger of being altered, and the same lodges will facilitate the making of several other curious and useful experiments. Nor were those very hens who had such aversion to cocks even needless to me for an experiment which it was proper to repeat: I wanted to know by my own experience how long a hen may continue to lay fruitful eggs after she has refused the cock for the last time. I warmed the eggs that were daily laid by the two hens who were no longer disposed to suffer any cocks to come near them: those that were laid by one of them almost five weeks after her total separation from the male yielded me chickens, but those she laid afterwards none: therefore, the company of a cock may fertilise the eggs that shall be laid for above a month. When I had made myself certain that these hens laid none but addle eggs, I let them go and live at liberty in the poultry-yard, where they shewed no signs of cruelty, nor any manner of aversion for cocks.

Three other hens which I separated from the males with whom they had lived, ceased sooner to lay fruitful eggs, that is, after 25 or 26 days; but there are perhaps circumstances when the

the number of the fruitful eggs which are once in the body of a hen is still greater than the number of those given me by the two first hens, and that number is perhaps sometimes smaller still than that after which the three other hens ceased to lay fruitful eggs. This experiment requires to be repeated many times more, and in different seasons of the year, to make us sure of the limits beyond which the fertilising of the eggs of hens cannot be extended.

If we had a mind to have a number of lodges sufficient to make at once all the experiments which they would be wanting for, we ought to have a great many indeed: seven or eight at least would be necessary to preserve without alteration the several species of hens which are actually in the kingdom, although no lodge should be granted to the most common kind of them, to which it would be needless to grant any. I shall not here make the description nor even the enumeration of those different kinds of hens; because I shall have an occasion to speak of them in another work: however, I think I ought not to defer till then to warn the curious to procure to themselves two of those species, which have many odd proprieties hitherto unknown to all ornithologers. You will find in a large and noble work written by one of the most famous of them, *viz.* in *Willoughby's* book upon birds, two general rules laid down, one of which is contradicted by one of the two species of hens I mean, and the other by the other. One of those rules is, that there is no kind of birds provided with more than four claws. The hens of one of the two species I mean have five, *viz.* three fore and two hinder ones; the second of the two hinder-claws, which is the supernumerary, is much larger than the other; it seems not however to be the most useful to the foot, as it keeps frequently off the ground. As for the rest,
this

this kind of hens is one of the largest, and deserves on account only of their considerable bulk, that we should endeavour to multiply them: they are of foreign extraction, I suspect them originally to have come from the *East-Indies*: I had them in *Poitou*, whither people pretend they were brought by a sea officer. They thrive very well in *France*, they lay very large eggs, and seemed to me to lay as many as our most common hens: but we shall infallibly lose them, if we are not more mindful of preserving them than we have hitherto been: I was obliged, in order to have a cock and a hen of the kind, to apply to two different families many leagues distant from each other, and I was assured at that time, that none could be now found in places where there had formerly been a great many.

The hens of the other species I am speaking of are not so scarce and are smaller than the foregoing; they are even something smaller than the hens of the most common kind: they are easily found in several parts of *Poitou* and *Normandy*: they look as if their tail had been pulled off, but they naturally have none, and it makes them look not so pleasing in our eyes; they are in some places called *tailless* hens, and in others *naked-arses*. They have not been unknown to the writers of birds; but if they had been better known to *Ray* and *Willoughby*, they would not have laid it down as a rule without exception, that if there are any species of birds without tails, there are none without rumps. Altho' the name of rump is frequently extended to the bony substance, or frame that supports the flesh of the whole hinder-part of the body of a bird, every one knows what that name is, strictly and properly speaking, the appellation of a pyramidal eminence situated upon the back side of the fowl: that small body, that real rump, has also its bony frame

frame that supports the flesh covering kernels that make the rump of some birds a dainty bit, and give a strong perfumed taste, not unlike musk to that of some others, as for instance to that of ducks. The kernels that rump consists of, in great measure, are designed to make the secretion of an unctuous liquor: it is in order to bring away that liquor, that the rump of many birds has a very perceptible excretory canal, and that of a few others has two. Hens, and many species of birds both of the hen-kind and other classes have but one of these canals: the excretory canal of the hens is a fleshy pipe situated almost perpendicularly upon the rump; its figure is conical. It is easy to convince ourselves that that pipe is the excretory duct of the glands of the rump: you need only press with your fingers the places about the basis of that fleshy canal, and you immediately cause a thick fluid to ascend the canal and issue out at its extremity. The pipe seems to be organised so as to produce the same effect as the pressure of the fingers; it seems to consist of a number of rings placed one above the other.

The remarkable singularity of our hens without tails, is, that they have not the least appearance of a rump: the place where it ought to grow and rise, if they had any, is more depressed than the rest, the flesh is smooth there, and it would be in vain to look for the kernels and the excretory canal that serves to convey the unctuous liquor before said.

Were I tempted to explain why the hinder-part of the hens without tails has not a secretion performed in it like that which is observed in other hens and in other kinds of birds, in many of which I have found a rump notwithstanding their want of tail, were I tempted, I say, to explain it, I should be aware of the danger I should be in of committing mistakes, by the very obligation I think myself
under

under of exposing as an error the notion which the naturalists and philosophers have framed to themselves concerning the utility of the unctuous liquor that issues through the one or the two excretory canals of the rump of birds. All the works of nature being lavishly filled with wondrous characteristics fit to raise in us a most just admiration, those who from the best intentions expose them to our eyes in order to force us to acknowledge the author of them, are on account of the multitude of those wonders liable to some reproach, when they happen to mention among them some that are not of the utmost certainty. They all of them have been of opinion, that the feathers of birds, in order to be sheltered against rain, wanted to be done over with a kind of oil or grease, that might cause the water to run off them without penetrating them, and that this unction wanted to be repeated from to time : we shall prove in a memoir that shall treat on nothing but feathers, that they have been wrong to entertain that notion. In consequence of it, they have pretended to make us admire a reservoir of unctuous matter placed on the hinder part of each bird, out of which he expresses and takes it with the end of his bill, to convey and spread it all over the feathers that want it.

I shall not here undertake to shew how little the quantity of liquor that may be daily supplied by this reservoir, is in proportion to the extent of the surfaces resulting from the assemblage of the numberless feathers with which a hen or a duck are covered, nor what long time would be necessary to enable the reservoir to supply a quantity of the said liquor sufficient to besmear the surface of only one of those feathers. In order to explode a notion that must needs have been pleasing, since it was universally espoused, I need only say that the feathers

thers of our tail-less, or, as I call them, rumpless hens, are as much proof against rain as those of the other hens, and of many other birds that are provided with a rump, in which the secretion of an unctuous liquor is made.

It is, however, a real fact, that birds are at times seen pecking their rump: this imposed upon the observers; they thence concluded that they squeezed from their rump an unctuous liquor, with which they took upon the end of their bill, to stroke it afterwards over their feathers; they did not consider, that the extremity of the bill could never fetch out a quantity of that matter sufficient to make itself greasy. All that might have been concluded from it, is, that some slight pain, or barely an itching perhaps, caused the bird to squeeze his rump, or the reservoir, or the extraordinary canal of the unctuous matter, to force it out of the place where it caused an obstruction being grown too thick. Our very school-boys know that this obstruction may take place and occasion illnesses in birds: when their sparrows look poorly and are in a drooping condition, they examine the state of the rump, and when they think they perceive any glands more swelled than they naturally are, they press and even sometimes tap them, to force their contained fluid out of them. I don't know whether the success of this last operation is very certain, but it would be better in my opinion, to endeavour to cure the obstruction of the excretory canal whose orifice is sometimes stopped by the liquor inspissated, and in order to this, to moisten it, or to introduce into it some small solid body. So long as we shall be ignorant why a secretion is made in our ears of a certain matter, though in a very small quantity, we shall not think ourselves obliged to give an account why a secretion of a certain matter is in a particular manner effected

effected in a very small quantity on the rump of birds.

The eggs we shall have of the hens kept in lodges with a cock of their own kind, being duly warmed in our ovens, will afford us chickens, which being free to run about in the poultry-yard, when arrived at the age when they may be left to themselves, will preserve that variety of objects which results from a multitude of birds of different kinds living indiscriminately together. That sight will become from year to year more and more various, by the alliances that will be had from cocks and hens of the sorts that differ most from each other. If we are fond of making experiments fit to give us new branches of knowledge, the above-mentioned trials may not all of them be made at random, a great many different experiments may be attempted, to see what will result from them with regard to the forms and colours of hens, or with regard to their quality as good laying hens, and to the number as well as the bigness of their eggs. There are among these experiments some which we shall speak of before we conclude this memoir, that cannot fail appearing to be of the utmost importance to naturalists.

Curiosity may lead us to the making of mixtures more disproportioned than those of birds that differ only in the species; it may prompt us to match birds of a different genus tho' not very distant from each other. We may try upon large birds what has been done with success by the virtuoso's, who love to make the smallest kinds to sit on eggs. The male of the goldfinch renders fertile the eggs of the hen of the canary, a middle bird is hatched from them, whose note is neither that of the goldfinch nor that of the canary, and which is found more agreeable than the song of either. Very successful matches are made of many other species
of

of little birds ; probably the same may be procured among birds of the largest species of different genus's, that would not prove unfruitful. It is a known fact that cock-pheasants will take a fancy to hens, and great praises are bestowed on the birds that come from the hens they have rendered fruitful, their flesh being esteemed more delicate than that of our common chickens.

Conjunctions more contrary to the common rules of nature, are sometimes contracted in the poultry-yard : I have had an opportunity of seeing daily a duck of the most common kind that squatted to receive the careffes of a cock, and that not always the same, and which she received as readily as she would have done those of a drake ; and the cock on his part seemed as eager for the duck as he could have been for any hen. However, this ill conduct of hers was downright lewdness, for she lived with a drake whom she did not refuse, and who had but two other ducks besides herself : but whenever he was absent and she inclined to have had him near her, she invited the cock to do for her the functions of a drake, which in appearance he very well performed. Accidents that happened to the eggs she laid, deprived me of the pleasure of seeing the birds that would have been hatched from them : they would perhaps have been something different from common ducks. Death deprived me of that duck, and the hope I had entertained of having other eggs from her, which would never have been rendered fruitful by any other than a cock with whom I would have confined her in a lodge, and which would have given me a particular kind of birds. This is an experiment that deserves to be made upon some other duck, and which will not be difficult, I having been assured that ducks as disorderly as mine are no rarity.

The whole town of *Paris* was some years ago full of amours far more strange than those of a duck and a cock, viz. of the amours of a hen and a rabbit. The *Abbe de Fontenu*, whom his continual labours for the academy of the inscriptions and Belles-lettres, of which he is a member, hinder not from loving physicks, and from making experiments and curious observations, informed the academy of sciences of what passed in the house of his brother where he lives, between a hen and a rabbit: he informed them of the strong inclination which this ill-sorted couple of animals had contracted for each other, and which was such that the rabbit behaved with the hen as he would have done with his doe, and the hen let him take as much liberty with her as she would have allowed to a cock. The academy judged this fact to be one of those which ought never to be credited, but when it is certain that they have been seen by a discerning eye. The *Abbe de Fontenu* is one of that sort: but he did not assert the copulation of the rabbit with the hen upon the testimony of his own eyes, he only attested it upon the report of all the servants in the house; as the coachman, the footmen, the cook, and others, all of them not much used to make observations, who pretended they daily saw in a yard where the rabbit and the hen lived together, things which the *Abbe de Fontenu* was not near enough to observe from the window of his study. I no sooner had hinted to him that I should be very curious to have the hen and the rabbit in my possession, to assure myself with my own eyes of the reality and the degree of the liking they had taken to one another, but his kind disposition towards me, of which I am very proud, and of which he has given me many proofs, made him promise me without the least hesitation, that the two animals would be at my house the very next day.

The rabbit and the hen were accordingly brought to me the day after, which was the twenty fourth of *June*: I lodged them in a place where I could conveniently often observe them without interrupting them: it was in a wardrobe which is behind my study, and in which I could see all what passed without entering into it. This wardrobe has a large pretty low window which looks into my garden. They seemed to me perfectly indifferent to each other to the twenty eighth of *June*: and it is likely the change of place had disconcerted them and taken up all their thoughts: on that very day at about half an hour after five in the morning, I saw the rabbit draw near the hen, placing his body along one of her sides, a moment after, having his hinder paws on the ground, he jumped with the agility of a rabbit, and put the fore-part of his body on the back of the hen, whom he laid hold of with his fore-paws, at the root of both her wings; he next drew the lower part of his belly as near as possibly he could to the hens hinder parts, and gave that part of his body small quick motions, the intention of which was plain enough. He was not allowed to remain in that posture but a very short time. The hen was not disposed to answer his careffes: his fore-legs were but a little folded, she went forward and escaped from him.

On the twenty ninth, I observed no courting on the part of the rabbit, I say of the rabbit, for the hen always behaved like a modest hen; but on the thirtieth, and at half an hour after five in the morning as before, I began to observe the same scene I had beheld on the twenty eighth, which was repeated several times. The rabbit had just eat a lettice leaf: after having rubbed his paws one against the other, and wiped his chops with them, he went to his hen, and was no sooner by her, but

he swiftly jumped with the fore-part of his body on her back ; but before he could have time enough to hook himself upon it, the hen escaped the embrace : she was just then in the middle of the small room, and ran under a chair. The amorous rabbit followed her thither, and notwithstanding the cross-bars of the chair-frame, which rendered the compass which the hen was within very narrow, he found means to lay his fore-paws on her back ; she escaped a second time from him, and kept quite close to the wall of the window clapping one of her sides against it. The rabbit directly took advantage of a position in which it was become more difficult for the hen to escape him, he quickly jumped upon her : she shewing the same desire to resist him, and the projection of the window not leaving her liberty enough to fly away, she had recourse to force, she turned her head to peck the lips of the rabbit three or four times, which he indeed took not for caresses, it having quite another aspect, so that he directly quitted his hold and went off : he nevertheless paid a little more for his coaxing, and the hen pecked his forehead three or four times more. Her attacks calmed his passion, he remained quiet by the hen, and even let her go from him without following her, and went himself about the room. About half an hour after, the rabbit having eat a lettice leaf, seemed to have forgot the ill-usage he had met with ; he drew near the hen again, and repeated his tender pursuits, which she seemed not more disposed to comply with than before. He in vain was able to mount her three times running, she never would permit his continuance in that position : to get rid of him she got upon a pretty low stool, he was there almost as soon as herself, and made new attempts that were not more successful

cessful than those he had made when she was on the ground.

The rabbit gave over pursuits which had availed him so little, and remained quiet for about an hour, after which his tender fits came on him again; about seven o'clock, he went up again to the hen who had clucked a little before but not very loud: she was in the middle of the room, when he placed the fore-part of his body upon her back with a new ardour; he perhaps found means then to hook himself better there than he had done hitherto, or perhaps the hen had no longer the same disposition to run from him: she nevertheless made a few steps forward, but slowly and with her legs some what bent. The amorous rabbit kept his hold and remained where he was, but then the moment of her being conquered was come; she squatted herself as all hens do, which after having run away from the cock, consent at last to admit his caresses: she let the rabbit put himself in what position he pleased; he left his two hinder-paws on the ground, and laid his body all along the back of the hen, whose tail was removed to the left side by the pressure of the thighs of the rabbit; the hen in short became a perfect doe to him; he remained active upon her four or five times longer than a cock would have done.

But, was the copulation as complete as that of a hen with a cock or of a rabbit with a doe? This I indeed know not: all I know is, that what passed between them proved sufficient to cool the rabbit: he not only let the hen alone for above two hours together, but he even seemed to want nothing but rest. He passed these two hours upon the above-mentioned low stool, perfectly motionless, and without changing his place.

The hen having carried her complaisance for the rabbit so far under my eye, I could no longer doubt of what I was told had passed between them in their first habitation; nor did I think it so necessary as before to follow their actions with assiduity. Besides, if I could not well decide whether the hen had, in my absence, been as tractable as the rabbit had desired, I was able at least to judge whether he had let her alone or teased her. If a hen could be capable of any shame, and ours had known the condition in which the caresses of the rabbit left her; she never would have had the assurance to shew herself to any cock; she was much more ruffled than it seemed decent for a hen to be. We said that the rabbit began by laying his fore-paws upon the back of the hen at the root of her wings; each paw pushed upwards and towards the head the feathers it met in its way; it forced them to turn up and to leave a place where the flesh was almost seen: there remained then two impressions of the embraces of the rabbit on the back of the hen, and these impressions were more remarkable and of greater extent, in proportion as the embraces had been more frequent and of longer duration. Another impression of the caresses of the rabbit was likewise very remarkable on the feathers that were nearest to the hen's rump, but it was generally on one particular side; the feathers instead of having been turned upwards in that place as those we have just mentioned were, had on the contrary been depressed, and formed a hollow: the extremities of the last feathers of the wing being more pliant than the rest of the stalks, had yielded to the pressure of the body and thighs of the rabbit, and even to that of his fore-paws, which had rubbed against them, when the rabbit was withdrawn either of his own accord, or by compulsion.

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There were times, then, when the hen was in great disorder; she did her best endeavours to put herself to rights again by adjusting her feathers with her bill, but this was not a work of a few moments, a whole day was hardly sufficient for it, because the feathers wanted to be brought again to their first position by the spring of that portion of them which was in the flesh, and which had sometimes been over-strained. These so very odd amours seemed to me to deserve that I should keep a kind of journal of them during almost two months together; they were not constantly of the same degree of ardour, and had their fits distant from each other by intervals, sometimes of one day, and sometimes of several days together. I was almost certain there had been no solicitations on the part of the rabbit during the time I had not observed him, when I found at night no discomposure in the feathers of the hen. From the seventh of *July* to the fifteenth, the rabbit seemed to me to become quite indifferent; and the œconomy of the feathers of the wings of the hen during that time confirmed me in my opinion; but in the afternoon of the fifteenth, I had a proof of the renewal of his attacks, because I found the feathers near the origin of each wing prodigiously ruffled and turned up, and that those near the tail had been sunk on one side.

He not only continued to be very loving on the sixteenth, but I saw him more gallant in his amours than I had ever seen him before; I saw him leap over the hen from side to side, and in order to get at top of her, give a sudden jerk, and in a trice put his fore-paws near the origin of her wings. The hen having hindered him from continuing in that position, he that moment did the most gallant things that could possibly be expected from an animal of his kind; he capered about her

with great agility, and five or six times described a circle of which she was the center, jumping and capering always the same way ; this done he drew near the hen, who not having been conquered by these charming pretty vagaries, jumped upon a low stool on which he followed her, with a seeming desire of trying his chance again. He could not very easily detain the hen in such a narrow place ; she, in order to be securer still, went and perched upon the edge of a box that was partly full of herbs designed for the rabbit. He was forced to let the hen alone there ; I myself grew tired with observing them, and when I went to look at them again a quarter of an hour after, the lover seemed to me sunk again into an indifference that seemed to intimate that the moment of his greatest favour had escaped my inspection, I saw him pass by the hen without so much as looking at her. She had squatted herself upon the ground, and he, in turn, remained quietly upon the low stool : he was a full hour and a half without shewing the least gaiety or mettle, and assumed rather a kind of surly tired countenance.

I should have nothing to mention but alternatives of passion and indifference like these, were I to tell how he behaved himself for the two months during which I kept him in my wardrobe : I did not turn him out of it before I had room to think he had nothing new to shew me : it was even not till after I had put his constancy to a trial fit to inform me whether he had a peculiar inclination for the hen with whom he had always lived, or whether he was capable of contracting a like fondness for another. I chose one for him that was vastly tame, who came to the call of every body, and chiefly of ladies, and offered herself of her own accord when you had a mind to take her up in your hands ; but that hen, so very familiar
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with human figures, seemed to be frightened with that of the rabbit. I have had reasons to think that it was not the fault of the latter, if they did not live together in the utmost intimacy; but whenever he offered to come near her, she flew away clucking after the manner of a hen in a fright: she shewed no disposition to accustom herself to see him. I parted them after they had lived four days together, during which the rabbit made no manner of progress in her favour: I own that separation was very sudden; it is likely that whole months might have effected what a few days could not bring about; time being the greatest master in cases like this.

I should reproach myself for having expatiated too much upon what passed in my sight between the first hen and the rabbit, if I did not remember the time when the whole town of *Paris* was so desirous to be informed of it, when I met with no body that did not desire me to tell him the whole truth of their amours, when, in short, the curiosity of seeing them both drew to my house so many people of all conditions and classes. But what they all of them were equally desirous to know was, what productions would result from so odd a copulation. It was the general wish, as well as my own, that it might have procured us chickens covered with hair, or rabbits cloathed with feathers. The hen had laid eggs when the *Abbe de Fontenu* sent her to me, and he sent me two of her eggs along with her: the first thing I did was to put them under a hen that was sitting on eggs. I knew not at that time how to hatch chickens in ovens, and had I known it, I should not have been exposed to the mortification I had two days after to find the two eggs broken: their shell might very well be too tender, and had not perhaps been able to resist the frictions and pressure they had undergone

gone on the part of the hen, when she had ranged them after her own manner. I am the more persuaded to think that the shell of those eggs was thin, because the hen they came from had laid at my house and on different days a couple of eggs whose shell was so utterly incapable of resistance, that they were broken either at coming out of her body or a minute after. Those she laid afterwards had shells of a much better consistence; but the number of them was very small, they were but six that were sat on without any accident by three different hens among whom they were distributed: the time after which they must needs have been sufficiently sat on, came, without any thing hatched out of them. I broke them one after another, and found five of them rathe ones, that is (as we have sufficiently explained it) five of those eggs that have not been rendered fruitful, and which may be kept a long while, and even sat on without turning rotten: the five eggs I am now mentioning were accordingly very sound.

The sixth egg different from the others on account of its infectious smell, and because the yolk and the white were mixt together: this difference, which had offended my smell, will be thought a very important point by those whom the experiments we have mentioned in the beginning of this memoir have convinced, that the germ destroyed in an egg becomes a principle of corruption in it: it will incline them to think that the sixth egg had had a germ that was rendered fruitful; so that there would have been room to expect that an animal would have been nourished and unfolded in that egg, unless some of the circumstances that cause the chicken to die in the egg at a greater or lesser distance from his time, had been fatal to a germ resulting from the copulation of two animals so little suited to each other. If I had been sufficiently

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ently informed at that time, that the eggs which grow rotten are not the addle-ones, I would have wished for a greater number of eggs of the same hen with which the rabbit had lived in the matrimonial way; nor would I have sent back in so much hurry the two creatures with a thousand thanks to *Mr. de Fontenu*, who had been polite enough to desire me to accept of them as a present. But, it is probable one might succeed in having eggs of some other hen that should happen to be liked by a rabbit whom she should like herself, by making them live together with no other creatures in one and the same lodge for several months; but chiefly by putting them together very young: for our hen and her rabbit were already advanced when they first got acquainted.

But our lodges may serve to bring about marriages that will not be quite so ill-sorted as this, that is, between hens and cocks whose production will be more sure, and fit besides to cast some light upon one of the most obscure and most interesting matters in point of physicks, I mean on the generation of animals. Are the germs by means of which their species are perpetuated, in the eggs of the females, where they do but wait for the male who is to vivify them, and to be rendered capable of growing by either the fluid or the spirits which he is to supply them with? Or do these germs reside in the males, till they are brought by them within the reach of the eggs of the females, wherein they are to find whatever is necessary for their unfolding? Or, in short, are these germs a new production resulting from the copulation of the male and the female? This last opinion is the most ancient, and although it has been espoused by some moderns that have a great name in the world; those who have contracted the habit of always endeavouring to find some seeming proportion and
analogy

analogy between effects and their causes, have refused their assent to a notion which supposes that there may result from a liquor, or from several liquors blended together and kept in a certain degree of heat, a machine composed of so many organs, being themselves an assemblage of a prodigious multitude of different machines wonderfully united to concur to one and the same end.

The great *Descartes* did not presume so much upon the strength of his genius, when he tried to explain the formation of the universe, as he did when he attempted to explain the formation of man; nor was he perhaps himself over and above satisfied with his essays on the last subject, which were not printed till after his death. A much greater apparatus is introduced into the composition of the minutest animal, than in the disposition of those globes both luminous and opaque, which surprize us by the enormous magnitude of their mass, but which nevertheless shew us but a small number of regular motions of which the causes are to be investigated: the cause that is to fetch an animal out of one single liquor or out of many fluids combined together, seems not to be a cause that can by any means be supposed to act blindly; the gentle and even heat to the action of which those fluids are exposed, can never be an agent capable of forming any thing so perfectly well organized. Let us not suppose that the prolific fluids are as simple as those that serve to repair the losses that are daily made within us: let us give a loose to our imagination, even farther than we may be allowed to do it: and in order to render those fluids capable of producing a work like this, let us suppose that they contain all the materials which are necessary for the construction of the little animated machine, which is going to be formed within a great one, from which it shall

not differ on any account but that of its smallness : let us endeavour to think with some of the learned, that the prolifick liquors of either the male or the female, are composed of parts similar to those which all the organs of either the one or the other are made up of ; that is, that there are in those fluids parts similar to those which compose the heart, to those which compose the stomach, to those which compose the intestines, to those which compose the brains, to those which compose the eyes, the ears, the tongue, the nose ; in short, that there are particles similar to those which compose each bone, and muscle, each vessel, each valve, and even each individual fibre, in a word, let us suppose that each portion of the great machine has supplied from its own stock wherewithal to make in little something like itself : let us suppose that extracts, as it were, of all the different organs have been conveyed into a fleshy cavity, that shall be, if you will, the ovarium ; neither let us cavil upon the manner in which those extracts may have been made, any more than upon the manner in which they may have been preserved pure and sound in the long winding meanders (so very apt to produce alterations in them) through which they have been carried. Let us grant that the said extracts are all of them arrived at last at some place of the ovarium : but we cannot at the same time avoid perceiving that they are all in a confused state in that ovarium, that the materials proper for the making of the eyes will be there mingled with those which are to serve for the constructing of the stomach, and those of the heart with those of the ear or of the brains : there will certainly be in that cavity more irregular medleys than it is in our power to imagine. Who is the agent which is to disintangle and clear this chaos, to sort the several parts which are to come together, to construct

construct organs with them, to join the several organs with those they are to adhere to, in short, to finish that germ which, notwithstanding its being so very small that even the best microscope cannot render it sufficiently perceptible to our eyes, is not a whit less admirable? We must not expect, as we have already said, that the bare action of a gentle heat, can ever be capable of producing such a work, a work infinitely more complicated than any repeating watch can possibly be.

Every thing has its fashions, nor is philosophy itself an exception to it: those occult qualities, those sympathies and antipathies which no body would have dared to name in physicks fifty years ago, have, since that time, shewed themselves again with splendor under the name of attraction: although we never were taught what this attraction consisted in, very noble uses have been made of it with regard to the motions of the celestial bodies; great efforts have been made likewise to make it serve in general to explain all the phenomena in nature. People thought it might be usefully employed to disintangle all the materials which are to enter into the prolifick liquors; it was deemed capable of operating the miracle of the formation of the foetus; in order to which people judged it sufficient to suppose that the similar parts of one and the same kind had the propriety of mutually attracting one another, and that there were different laws of attraction for similar parts of different kinds: by virtue of those laws, all the similar parts fit to make a heart, all those fit to make a stomach, a brain, &c. will seek for those of their own kind, draw near and unite with them: the chaos is now clearing apace, and innumerable masses composed of the most analogous parts are going to be formed. We are nevertheless as yet very far from seeing any thing that resembles any of the

the organizations which are to concur towards the formation of our great work : how will attractions be able to give to such and such a mass the form and structure of a heart, to another that of a stomach, to a third one that of an eye, and to another that of an ear ? How will they frame other masses into vessels, valves, &c. all their tendency will amount barely to the reunion of the similar parts into solid masses. What law of attraction shall one imagine for the making of that small bone of the ear, whose figure makes it to be called the stirup ? How shall so many different organs be placed and assembled in their proper order ? We see with the most glaring evidence, that in order to arrive at the formation of so complicated a piece of work, it is not enough to have multiplied and varied the laws of attraction at pleasure, and that one must besides attribute the most compleat stock of knowledge to that attraction.

Those who will have all the germs of the animals to be produced by so many plastical forms are under the necessity of granting the most extensive intelligence to those beings, which we have not the least notion of. Some philosophers have pretended that the whole of nature was animated, and that no portion of the extent of the universe could be assigned, that had not a soul of its own. The author of a memoir, which, I think, has remained a manuscript, and which was sent to the academy to stand in competition for the prize, the subject-matter whereof was, *the nature of motion*, has pretended that each great animal was nothing but an assemblage of an amazing multitude of animalcula of an indefinite smallness : he made a very comical use of those minute animals towards explaining the sensations : he pretended that there issued from all the outward parts of the body chains of those little creatures hooked to one another by
their

their paws, that reached to and terminated at the place of the brain where the seat of the soul is : when the tip of the finger happened to be too near the fire, notice was directly sent of it from one little animal to another quite to that which was nearest to the soul, and which did not fail to inform her of it. Our author might have had occasion of employing a great many animalcula about the making of germs ; he might have had among them some makers of fibres, and others that should have had the talent of constructing veins, arteries, valves, nerves and bones : he might have had others capable of assembling the parts which an organ, as for instance, a heart, a stomach, a tongue, &c. are composed of : but the animalculum to which he would have been obliged to grant the superintendency of the whole fabrick, ought indeed to have been an architect much superior in point of extent of judgment to those who build our most lofty palaces. The architect who presides over the construction of the living edifice, needs to know every whit as much as the architect who produced the whole universe. Let us not, therefore, entertain any hopes of ever explaining the primitive formation of an animal. If it has been the good will and pleasure of the supreme Being, that germs should be daily produced, which there is room to doubt of, we ought to despair of ever knowing the means he makes use of towards it.

I am very far from pretending to infer from what has been said, that we cannot reasonably promise ourselves a greater knowledge concerning the generation of animals, than what we are actually possessed of : it only follows, that whosoever shall have enough considered what a germ or an animal is, will never attempt explaining the formation of it : we have not been allowed to dive
thus

thus deeply into things. But, setting out from the germs already formed, there remain still with regard to the generation a great many interesting facts to be known concerning which naturalists are divided: some pretend, as I said, that the germs are naturally in the female, and others that the females have no other germs but those that have been conveyed into them by the males during copulation. Several sorts of mules might have procured us a much greater insight into this curious question than the microscopical observations of *Lecurwenhoek* and *Hartsoeker*, if sufficient attention had been given to the things in which they each of them resemble their fathers and mothers: our common mules, I mean those which proceed from a mare rendered fruitful by an ass, might have already procured us some light upon that subject, and much more might have been borrowed from the animals born of a father and a mother of a very different genus; as for instance, of a cow and an ass, of a she ass, and a bull. But I have observed with great pleasure, that among the kinds of hens I have had, there were two that seemed to be very fit to inform us, by conjunctions much more within the order of nature than those that give birth to the mules, in which of the two sexes the germ resides before copulation: I thought it very lucky that we had hens of a kind different from all the others, on account of their having one part more than the rest, *viz.* a large claw, and hens of another kind also different from all the rest, by the want of a very considerable and very remarkable part, even of a rump. Let us match common hens with cocks that have five claws, and hens having five claws with common cocks: let us likewise ally common hens with a cock that has no rump, and hens that have no rump with a common cock: if chickens shall result from al-

liances contracted between hens and cocks combined in that manner, and it is a fact that chickens, and what is more chickens very fit to perpetuate their own species, will be produced by them; one would think that we may fairly expect from them matters of fact that will decide the question in hand; for if we suppose, as we have done, that the germ exists before the copulation, and that all we want to know is whether it existed in the male or in the female before their junction, the chickens we are now speaking of, must needs shew us by some parts they shall have, or by the want of some other parts, whether it is to the male or to the female that the germ belonged to originally. If the germs are in the hen, she that has five claws, has germs also with five claws, and although she has been rendered fruitful by a common cock, she will produce chickens with five claws. Those she shall bring forth, will, on the contrary, have but four claws like the cock she lived with, if the germs were originally in the cock. In like manner the common hen which owes the fertilizing her eggs to a cock that has five claws, will bring chickens with only four claws, if the germs of the chickens were in her, and she will produce chickens with five claws, if the germs were communicated by the cock. So from the common hen fertilized by a cock without a rump, will proceed chickens that shall have a rump, if the hen had germs independent from her copulation with the cock; and there will come from the same hen chickens without rumps, if the germs that shall be unfolded in her eggs are owing to a cock that has no rump.

I have, for a good many years, made some of these alliances among hens and cocks, from which chickens ought to be expected fit to decide whether the germ was in the male or in the female before

fore copulation: I have used all proper cautions to prevent all manner of commerce between the hens and any other males than those I had a mind they should live with. I have varied the said associations much beyond what I just now mentioned: In order then to give a particular account of all those I have made, and to inform the reader of the several products that have resulted from them, as well as to mention the many remarks and reflections they have been the occasion of, I should render this memoir, which is already too long, twice as voluminous as it now is: It will then be the matter of another memoir. Before it comes out, the experiments on which it is founded, shall have been confirmed by experiments of the same kind, that shall have been tried by those who love to find in their poultry-yard amusements conducive to the progress of natural knowledge. I here invite them not to overlook that I have just pointed out to them. It will not perhaps be easy for them to make experiments and observations upon hens of the kind of those that have five claws, they being very rare: but they will easily make some upon hens without rumps, which are to be found in great plenty in several provinces of the kingdom, as for instance in *Poitou* and *Normandy*, and even in the neighbourhood of *Paris*.

An *Explanation* of the figures of the *tenth* Memoir.

The Head-piece.

The head-piece represents a yard wherein a bower of lattice-work, is built, divided into several lodgings, where hens are kept, and where those of each lodging can have no communication

with those in any of the rest. When you have a great many different species of hens, and are desirous to preserve those species from being altered by ill-sorted matches, you must have a great many of those small habitations; but you must have a still greater number of them, if you have a mind to make all the experiments that can be tried by the association of cocks of one species with hens of another, *abb*, the under part of the bower: the disposition of the lodges it is divided into, and their construction are exhibited (*Plat. VI.*) in a manner in which it was impossible to expose them in the small figure.

a f, the part where are the lodgings in which the hens pass the night. *a*, a roof of boards.

f, the window through which you see what passes in the lodgings by means of holes in the same line with the window.

The three figures of women placed here only under a kind of pent-house, might and would indeed have been placed in a room, had not our intention been that they should be in view.

The first fig. brings eggs to the other two, that these may smear them with butter, oil, or any other unctuous matter, to make them keep in the state of new-laid eggs: this is the kind of work in which these two last figures are employ'd.

T, is a chafing-dish in which there is a little fire, that may be applied, if you think proper, to render the unctuous matter fluid.

PLATE VI.

This plate represents one of those lodges of which a great number will be necessary, when you have a mind to hinder a great many different kinds of hens from having any communication with those of another species, and when you intend to make experiments

experiments upon hens of one species allied with cocks of another. Nothing is wanting here to one of those lodges, where two or three hens and a cock live together without being crowded. There is hard by this well-conditioned lodge, another that has been destroyed in great part, to expose to the eye what remains hidden in the other. This row of lodges is prolonged according as the ground will allow, and according to the number of the experiments you propose to make.

ABCDE, the fore-part of a lodge the upper-part of which is a bower of lattice-work.

FF, a wall the lodge stands against.

ABH, the fore-part of that lodge which is grated.

IK, a door, which, when open like this, permits a man to enter stooping into the lodge; this door is about four feet high: but this measure and all the others are arbitrary. The height of the door is a scale for all the measures of the other parts; on which account it was thought needless to have a real scale ingraved.

L, the fore-room of the lodge, that has a couple of hens in it.

M, a drawer or box, in which the food of the hens is put.

N, N, cross-bars fastened under the drawer, which are to it a support that hinders the hens from overturning it.

O, a vessel wherein the hens drink.

P, a door of communication from the fore to the back-room, in which the hens lay eggs, and roost, there is a hen seen at the aperture of that door.

Q, a board sliding between two grooves, which when let down shuts the door P. The security of the hens requires that this door be shut during the night.

RSTVX,

RSTVX, a second lodge destroyed in part, purposely to set its back part in view.

VX, a roof that covers the second or back-room of the lodge.

Y, a door of communication from the fore to the back-room.

Z, a board with which this door of communication is shut.

aa, a partition that separates the first or fore from the second or back-room.

b, the first room.

cc, the second room.

d,d,d, sticks for the hens to pearch upon.

e, a stick with a hen roosting upon it.

f, a basket into which the hens go to lay their eggs; it is placed here somewhat too high, it ought to be lower than the grated window g, to the end that, when you look through the window of the lodge of each end, you may look into the baskets of that lodge and into some of those of the next: I say into the baskets, because there ought to be two at least in each lodge.

F I N I S.



J. Mynde Sc.

this treatise
of the French
style, because
of the
not to them
to observe
being twelve
which are each
a Winchester
one with our
four bullocks;
are nearly e

for eight four, and
from the top, for
the bottom, for two

N. B. The translator of this treatise has every where retained the *French* terms of measure and price, because there are no *English* measures, or monies, that exactly answer to them. It may be proper however to observe here, that the septies, containing twelve of the *French* bushels, which are each equal to only one third of a *Winchester* bushel, is nearly the same with our comb, or measure of four bushels; and that the *French* sous are nearly equal to *English* halfpence.

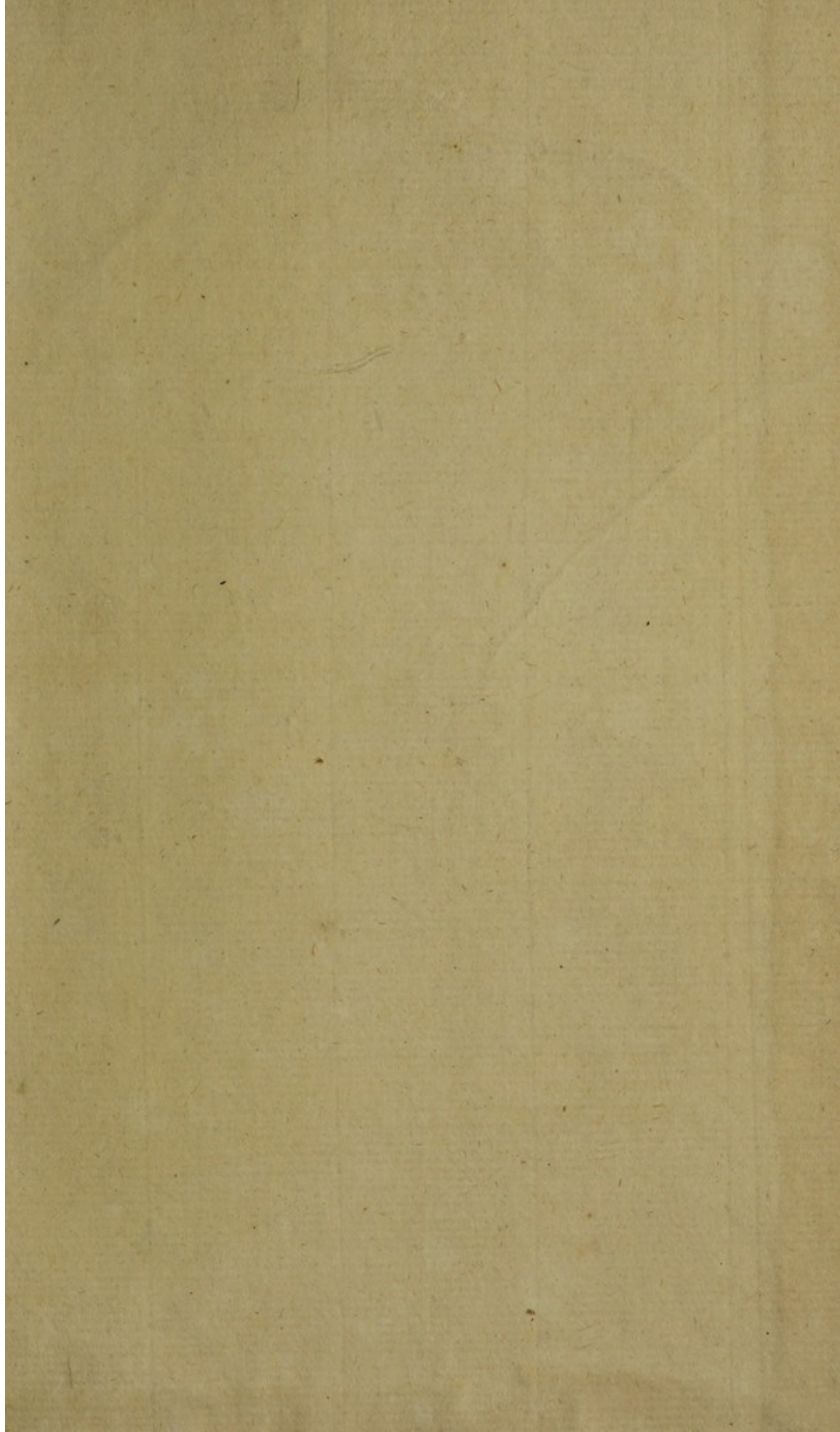
E R R A T A.

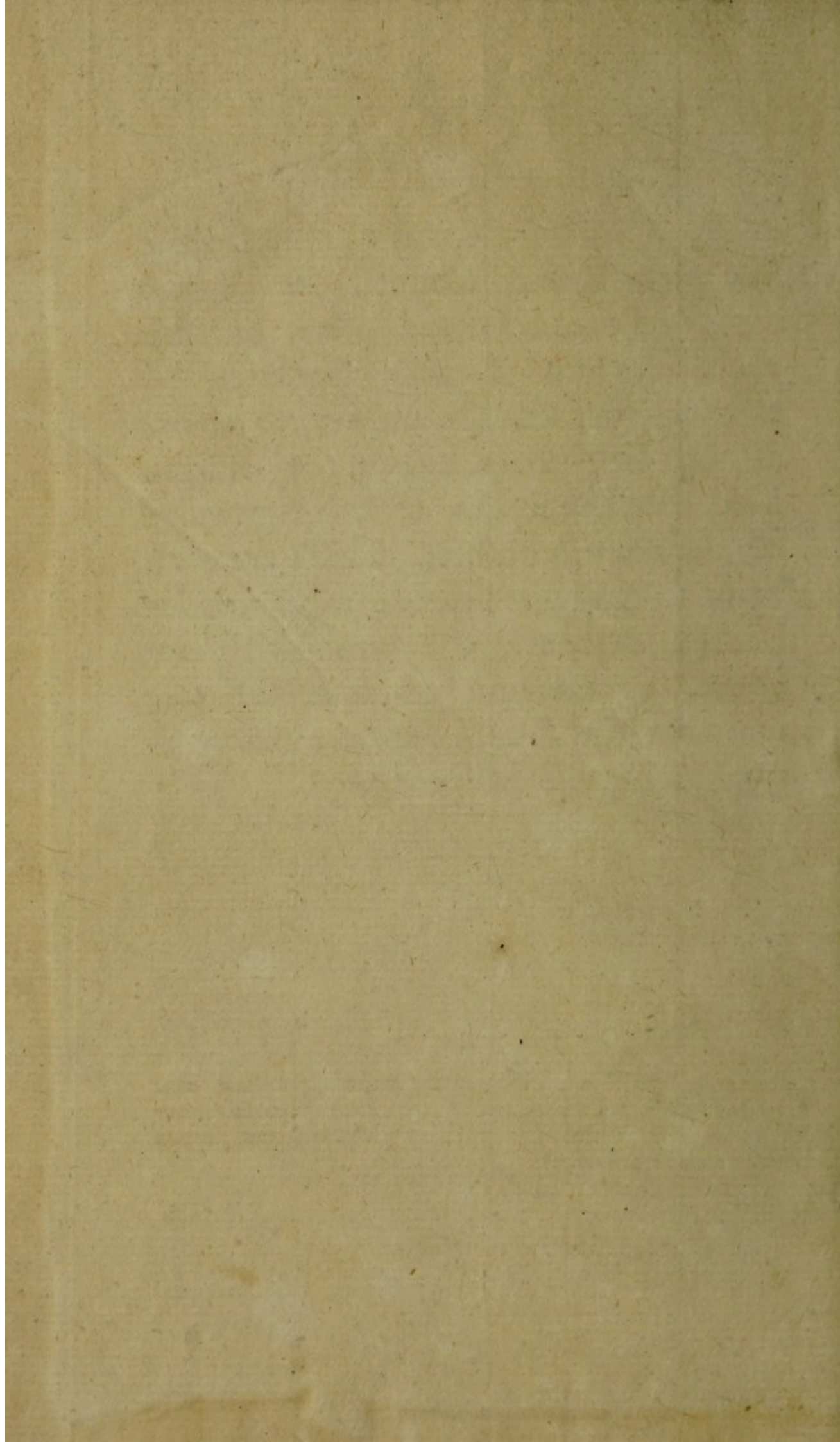
Page 340. l. 7. from the bottom, for under eight sous, read under twelve sous six deniers. P. 341. l. 15. from the top, for $\frac{3}{4}$ read $\frac{3}{5}$ of a settier. P. 343. l. 15. from the bottom, for two sous read three sous.

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R. P. A. T. A.

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Pauline
A

