Guide to the administration of anæsthetics / by Henry Davis.

Contributors

Davis, Henry, -1918.
University of Leeds. Library

Publication/Creation

London : H.K. Lewis, 1892.

Persistent URL

https://wellcomecollection.org/works/g667ahb9

Provider

Leeds University Archive

License and attribution

This material has been provided by This material has been provided by The University of Leeds Library. The original may be consulted at The University of Leeds Library. where the originals may be consulted.
This work has been identified as being free of known restrictions under copyright law, including all related and neighbouring rights and is being made available under the Creative Commons, Public Domain Mark.

You can copy, modify, distribute and perform the work, even for commercial purposes, without asking permission.

wellcome collection

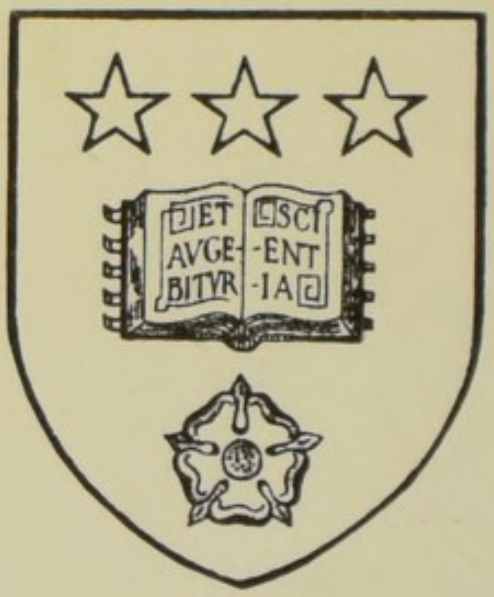
Wellcome Collection
183 Euston Road
London NW1 2BE UK
T +44 (0)20 7611 8722
E library@wellcomecollection.org
https://wellcomecollection.org

ANÆSTHETICS

DAVIS

SECOND EDITION

The University Library
Leeds



LEEDS UNIVERSITY LIBRARY

Classmark:

Special Collections

Health Sciences Historical Collection

Dental DAV

30106016125063

GUIDE

TO THE

ADMINISTRATION OF ANÆSTHETICS

ROY KENDALL,
163, ROUNDHAY ROAD
LEEDS.

GUIDE TO THE ADMINISTRATION

OF

ANÆSTHETICS

BY

HENRY DAVIS, M.R.C.S.

TEACHER AND ADMINISTRATOR OF ANÆSTHETICS AT ST. MARY'S HOSPITAL, AND ASSISTANT ANÆSTHETIST AT THE DENTAL HOSPITAL OF LONDON.

SECOND EDITION

LONDON
H. K. LEWIS, 136 GOWER STREET, W.C.
1892

PRINTED BY
H. K. LEWIS, 136 GOWER STREET
LONDON, W.C.

682377

PREFACE TO THE SECOND EDITION.

In this edition I have endeavoured to bring my little book up to date. To this end I have briefly discussed the conclusions of the celebrated Hyderabad Commission; and have added a chapter on the relative safety of anæsthetics. As in the first edition, it has been my object to make the book essentially a practical guide for students and medical practitioners.

HENRY DAVIS.

Queen Anne Street, W.
1892.

PREFACE TO THE FIRST EDITION.

THE object of this little work is to supply in a compact form the chief details which are requisite for the safe administration of the various anæsthetic agents now in use throughout the civilised world.

Only those special forms of apparatus have been described which my experience has taught me to regard as most useful.

In my position as teacher of anæsthetics at a large London Hospital, I have often felt the need of a book to put into the hands of students wherein they may find, in a concise manner, the rules and methods now employed in producing insensibility to pain.

Although this work is mainly intended for students studying a course of anæsthetics, nevertheless, I venture to hope that my efforts may be of use to others.

HENRY DAVIS.

1887.

CONTENTS.

CHAPTER VI.

CHAPTER VII.

CHAPTER VIII.

GUIDE

TO THE

ADMINISTRATION OF ANÆSTHETICS.

INTRODUCTION.

Anæsthetics are remedies usually employed for allaying sensibility to pain in surgical procedures. They may for convenience be divided into two classes :—*Local* and *General*.

Local anæsthetics are those which annul the sensibility of the peripheral nerves in a particular seat of the body; whereas **general anæsthetics** when carried to a certain point, abolish all functions except those reflex actions essential to life, viz., respiration and circulation, these remaining active even in the most profound artificial anæsthesia.

The chief **local** anæsthetics are :—

Extreme cold.

Ether, in the form of fine spray.
Cocaine.
Carbolic acid.

The most important **general** anæsthetics are :—

Nitrous oxide gas.
Ether.
Chloroform.
Hydrobromic ether.
Bichloride of methylene.
Bichloride of ethydene.

Although anæsthetics are chiefly used to lessen pain in surgical and dental operations, they are also invaluable for inducing muscular relaxation, thereby enabling the surgeon to reduce obstinate dislocations, to return herniæ, and overcome hysterical affections of joints. An anæsthetic is of the utmost value in enabling a diagnosis to be made in various affections of the abdomen, especially when the parts are too tender or painful to allow of the necessary manipulation. It affords a most effectual means of clearing up the diagnosis in those curious cases of phantom tumour.

Anæsthesia is also employed to lessen the anguish of labour, and the pains which accompany renal and biliary colic ; also to diminish the spasm in hydrophobia, tetanus, strychnine

poisoning, and to procure rest in severe cases of chorea.

Local anæsthesia has a very limited use, being for the most part employed in such simple procedures as paracentesis thoracis and abdominis, opening abscesses and the like. The introduction of cocaine has considerably superseded ether and chloroform in ophthalmic operations. To this we shall refer more particularly in a subsequent chapter.

The advantages of general anæsthesia in surgical practice are so obvious as to scarcely need pointing out. By its aid a patient can, in a few minutes, be rendered so unconscious and insensible to pain, that severe operations can be performed without undue haste. There is no interference with the operation by the struggles of the patient, and many surgical operations can now be undertaken which in pre-anæsthetic days could not be entertained. Not only is the patient spared intense pain, but the dangers arising from shock are directly averted. It is also far less difficult to induce patients to submit to operations, and as a consequence many more are performed than formerly.

Although as a rule the administration of these agents is attended with but little danger,

yet at times it is accompanied by risk and the life of the patient in inexperienced hands may be placed in great jeopardy. As every practitioner may be called upon at any moment to render a patient anæsthetic, it is of the utmost importance that he should make himself acquainted with the methods of administering these wonderful agents, and it is the object of the following pages to indicate the more important rules concerning their use.

General Considerations.

There are certain preliminary precautions to be taken into consideration before administering an anæsthetic, more especially in reference to chloroform and ether. In the first place it is important that the patient should be properly prepared. This can be easily managed in all cases except where the agent has to be given in an emergency, or rendered imperative in consequence of an accident.

It is exceedingly desirable that the bowels shall have acted thoroughly, and this may be effected by a purgative the night previous, or preferably by an enema at least twelve hours before. No food should be taken for four hours

previous to the administration, the meal then being some good beef tea. The very best time to give an anæsthetic is in the early morning when the stomach is quite empty. Although this preliminary fast is well borne by children and young adults, it is apt to be prejudicial in aged and in debilitated patients. In such it is advisable to permit a cup of tea, coffee, milk or some good beef tea, to be taken two hours before the time fixed for the administration. The disadvantages of taking an anæsthetic on a full stomach are very great. The patient is not only sure to vomit and embarrass the administrator, but it is an annoyance and inconvenience to the operator, and a source of considerable risk to the patients, since they run a very great danger of getting solid pieces of food into the air-passages, for as the contents of the stomach are passed into the pharynx, they may at the next inspiration be drawn into the larynx. The advantage of abstinence from food is that it not only renders the production of anæsthesia safer, but diminishes the chance of vomiting afterwards, and that is a matter of great moment.

In addition to this source of danger, the exertion induced by the vomiting is apt to

produce faintness. Of course retching may, and often does occur, even when the stomach is empty, but then its effects are by no means so severe or dangerous. It happens that even in spite of the most precise instructions, patients will take food, sometimes even a good meal within the proscribed period. Should the anæsthetist be aware that the instructions have been neglected, he will be wise to postpone the administration. Many cases could easily be mentioned in which patients guilty of such disregard of advice have run serious risks in consequence.

Another precaution is that the anæsthetist should always look into the patient's mouth and satisfy himself that there are no false teeth, if any be present they must be removed. Finally, he should always be provided with a pair of forceps, furnished with a catch, wherewith to draw forward the tongue in moments of danger, and in addition he should have at hand a Fergusson's gag, ether and a hypodermic syringe. He should also make it a golden rule never to anæsthetise a patient save in the presence of a third person, and when ether or chloroform is used, some other qualified person should be in the room. In preparing the patient all articles of clothing,

that may restrict the breathing, should be removed or loosened, such as collars, ties, stays, and petticoats with bands encircling the waist.

Among preliminary measures some writers advocate the administration of alcohol and even of opiates.

The routine practice of giving alcoholic stimulants a short time before exhibiting an anæsthetic is to be deprecated save in greatly debilitated subjects; in very severe operations likely to produce great shock, or in those who have great dread of the operation. Sedatives in the form of morphine, or morphine combined with atropine, strychnine and chloral have been recommended in the belief that they shorten the stage of excitement, lessen the tendency to vomit, and diminish the amount of the agent necessary to produce anæsthesia. When morphine is employed, it is recommended to give $\frac{1}{6}$ to $\frac{1}{3}$ grain combined with $\frac{1}{100}$ grain of atropine hypodermically. The reason for combining atropine with the morphine is that atropine acts as a cardiac stimulant and therefore lessens the danger of cardiac syncope during chloroform narcosis. According to Koenig, in more than seven thousand cases treated with hypodermic injections of morphine before inhalations of chloroform, not a

single death was reported. In his experience the use of the narcotic was especially serviceable in the case of professional drunkards, chronic tipplers, the introduction of the drug considerably shortening the period of excitement under chloroform (Willard and Adler). Dr. Willard is of opinion that $\frac{1}{120}$ grain of strychnine given subcutaneously renders the administration of chloroform safer, and Dr. Wood asserts that a dose of chloral previous to inducing narcosis by ether causes the first stage to be quieter and prolongs the effects of the drug.

In this country the administration of drugs before anæsthetising a patient is rarely resorted to, indeed the practice is almost limited to operations upon the brain.

Dr. Hewitt states that respiration may readily become slow, feeble, or even arrested from the combined effects of a very small quantity of morphine and general anæsthetics, and recommends that whenever the patient is even slightly under the influence of an opiate, general anæsthesia must be induced with the greatest caution, and as a general rule it is best to administer the anæsthetic in very small quantities, and not to abolish reflex action. My own experience is in accord with this observation.

CHAPTER I.

The Choice of an Anæsthetic.

The choice of an anæsthetic depends upon :—

(*a*) The purpose for which anæsthesia is required.

(*b*) The condition of the patient.

Children under six years bear chloroform so well that for them it is practically universally employed. The sight of a handkerchief or a piece of folded linen is to them no novelty, whereas even the face-piece of the gas or ether apparatus is sufficient to terrify them, apart from the suffocating feeling all experience when it is used, and this causes them to scream and struggle, two conditions which should be avoided, as they always add to the alarm and anxiety of the parents and friends.

Gas.—It cannot be too strongly impressed upon practitioners and especially the junior residents in hospitals that in all trivial operations such as avulsion of the toe-nails, opening abscesses, slitting up sinuses and fistulæ, and even in paracentesis thoracis, gas may be

easily employed. It possesses many advantages; it is absolutely safe, does not cause unpleasant after effects, and above all, the patient can leave the surgery or out-patient room a few minutes after the administration. It is surprising what a number of minor operations, besides teeth extraction, can be performed during the brief period of unconsciousness induced by gas when the surgeon is apt with his fingers.

In teeth extraction gas is invariably used unless the number of teeth requiring removal is too many for one exhibition, under these conditions, the anæsthesia can be prolonged by means of ether in the way described in Chapter II.

Gas, whenever possible, should be used as a preliminary to ether; for instance, the patient should be first rendered unconscious with gas and the anæsthesia maintained by ether.

The advantages of this method are fourfold:—

(1.) It is more agreeable for the patient.

(2.) It obviates struggling.

(3.) Shortens the time required for producing anæsthesia.

(4.) Lessens the amount of ether it would be otherwise necessary to give.

Ether.—In all persons between the ages of 6 and 60, ether should be employed as the routine agent unless its use is contra-indicated by some one or other of the following conditions :—

(1.) It should not be administered to persons with a tendency to bronchitis, as the vapour has an irritating effect upon the respiratory mucous membrane, and this is one of the chief reasons for withholding it from elderly patients.

(2.) In operations on the mouth, ether presents one or two disadvantages, *e.g.*, in such an operation as cleft palate, a copious secretion of saliva hinders the operator. In other cases the surgeon may require to use the cautery, then ether would be dangerous.

(3.) In ligaturing arteries at the root of the neck, ether presents the disadvantage of rendering the great veins turgid and increasing the difficulties of these operations.

(4.) In reducing dislocations and fractures the rigidity which occurs with the inhalation of ether is a disadvantage, the relaxation produced by chloroform being a great advantage.

(5.) Many are of opinion that in ophthalmic operations ether presents disadvantages as compared with chloroform, in that it causes

congestion and hæmorrhage, but against this we must set the fact, that the vomiting so often induced by anæsthetics lasts longer after chloroform than ether. However, cocaine being used now so frequently, ophthalmic surgeons rarely resort either to chloroform or ether in delicate manipulations.

(6.) In advanced kidney disease inhalation of ether should be avoided, as it is said there is considerable danger of inducing suppression of urine. It is also urged that the alterations of the walls of the arteries, *arterio-capillary fibrosis*, which so frequently accompanies chronic interstitial nephritis, and senile changes to which arteries are subject, contra-indicate the use of pure ether, as increased blood pressure which follows its inhalation adds to the work of the heart, and by imposing additional strain upon the cerebral arteries may cause them to give way.

(7.) In patients over sixty there is a middle course which may be followed by using a mixture of ether and chloroform or the A.C.E. mixture. The latter finds favour with many. In brain surgery ether is inadmissible as it causes too much congestion, not only of the meninges, but also of the cerebral vessels.

(8.) In abdominal operations chloroform is

preferred by the most experienced operators to ether, in consequence of the greater relaxation of the abdominal parietes which the former produces.

The objections to ether are few in number and a long experience in its administration has served to convince me that it is by far the safest anæsthetic we possess.

Even in operations upon the nose and mouth, unsuitable for ether, anæsthesia may be induced by this agent and then maintained by chloroform.

In the case of drunkards trouble arises even with the most experienced. With this class of patient, I find it useful to begin with gas and ether, so as to stimulate the cardiac mechanism. This manœuvre produces a certain amount of excitement, which is then gradually reduced by the cautious use of chloroform until the patient is unconscious and relaxed, I then maintain the anæsthesia with ether. This method has given me the greatest possible satisfaction.

Chloroform.—The cases for which chloroform is best suited, are the following :—

1. *Children.*—They take chloroform admirably up to six years of age.

2. Old persons after sixty, or before, if there

is the least tendency to chronic bronchitis or emphysema.

3. In abdominal operations, in empyema, and in the phthisical.

4. In operations about the mouth, and in cases where the anæsthetic has to be administered through an opening in the trachea or larynx with Junker's inhaler.

5. It is the agent chosen to diminish the pangs of labour. In these cases it is not necessary to produce complete anæsthesia, but only to dull the pains. If complete unconsciousness is produced there is reason to believe that labour is retarded, and that the patient will be predisposed to post-partum hæmorrhage.

But even in labour ether may be employed and Dr. Dudley Buxton writes :—"I have met with cases of women who after trying chloroform preferred to take ether in their confinements, stating that it produced more exhilaration and general feeling of well-being, while it assuaged their pangs more efficiently than chloroform."

In operations within the skull chloroform alone should be used; Mr. Victor Horsley recommends that morphine, $\frac{1}{4}$ or $\frac{1}{3}$ grain, should be injected subcutaneously 15 minutes

before the administration of the chloroform. This procedure lessens the capillary oozing and reduces the amount of chloroform necessary to maintain the anæsthesia.

The patients for whom it is difficult to select the anæsthetic are those with organic disease of the heart. Valvular diseases do not appear to be very prejudicial, but it is structural change in the muscular substance of the heart, such as fatty degeneration and fibroid disease, which renders the inhalation of chloroform particularly hazardous. In such cases it is preferable to employ a mixture of chloroform and ether.

In aortic regurgitation it is important to prevent undue struggling, it is therefore advisable to commence with chloroform, and if the patient's condition demands it, then ether may be substituted or used as an adjuvant to the chloroform.

CHAPTER II.

Nitrous Oxide Gas.

This agent is now extensively used as an anæsthetic in operations, such as extracting teeth, which in the majority of instances require only a brief period for their performance.

The gas is prepared by boiling nitrate of ammonia in a glass retort, the resulting vapour—gas and steam—is passed through water to remove any of the higher oxides of nitrogen which may be formed, and the gas is collected in a gasometer. Nitrous oxide when pure is without smell but possesses a sweet taste. It is usually obtained for anæsthetic purposes in a liquid form in specially prepared iron, and more recently in steel bottles of various sizes. Each bottle is labelled so that the weight when full and empty can be at once known, hence on weighing the bottle the amount of gas it at any time contains is readily ascertained.

Physiological effects.—The inhalation of

a moderate quantity of nitrous oxide as long as the lungs contain atmospheric air, causes excitement. When this is replaced by the gas, the functions of the nervous system fail, and if air be not quickly supplied, death results. Nitrous oxide abolishes the functions of the cerebrum, before those of the medulla oblongata, hence unconsciousness is produced before respiration ceases. As the heart's action continues when respiration is in abeyance, it is fair to conclude that the functions of the medulla are suspended before the intrinsic cardiac ganglia are paralysed.

Clover was of opinion that this gas prevented the oxidation in the nerve centres and thus excited its anæsthetic influence. It has been shown that during the administration of nitrous oxide, the amount of carbonic acid eliminated is diminished by two-thirds, whilst at its close the amount is reduced to one-third.

It must be confessed, however, that we are not fully acquainted with its *modus operandi* as various opinions are held by competent investigators.

Method of administration.—The apparatus commonly used for administering nitrous oxide consists of a portable gas bottle made of iron or steel (the latter is preferred on account

of its lightness, for a steel bottle capable of holding 100 gallons of gas will weigh less than an iron bottle containing only 50 gallons). These gas bottles are provided at one end with a foot-key which can be loosened at will so as to allow the gas to escape through a nozzle connected with the inhaling apparatus. This consists of a protected India-rubber tube connected with a bag, from this bag a tube leads to the face-piece and is furnished with a stop-cock just before it joins the latter.

The face-piece is furnished with two valves of sufficient size to allow of the passage of the inspired and expired gas. The valve attached to the supply pipe allows free entrance to the gas but prevents its return. The second valve allows the expired gas to escape but prevents the entrance of air. The margin of the face-piece is fitted with an India-rubber air cushion so that it readily adapts itself to the patient's face and prevents egress of gas or what is more important *ingress of air*, during the inhalation. For to insure success, it is important that the face-piece, which must cover the mouth and nose, fits well and absolutely excludes all air.

When about to administer the gas, a prop or gag is placed between the teeth to keep the

mouth open and give the dentist room to operate ; (these gags consist of pieces of hard wood united with string, lipped so as to fit between the teeth ; sound teeth should be selected as far away from the teeth to be removed as possible). All air is then pressed out of the bag and the stop-cock closed and the face-piece adjusted to suit the individual. By pressing the foot on the key of the gas bottle the liberated gas rushes over and distends the bag. Here a few precautions are necessary, for if the supply tube connecting the bottle and bag is not large enough it is liable to burst, or the tube may be blown off the nozzle. If the gas escapes too rapidly, sufficient cold will be produced to freeze the gas and stop the supply.

When the bag is filled with gas and the apparatus properly acting and the face-piece accurately applied, the stop-cock is turned and the gas admitted to the face-piece. The patient is advised to breathe freely and to empty the chest at each respiration. In about fifteen or twenty seconds the face becomes livid, then the eyes become fixed, and the pupils remain of normal size : the conjunctival reflex may be lost at this stage, or only slightly manifest. Convulsive twitching of the hands

and oscillations of the eyeballs are next noticed and the respiration becomes slower and snoring. The pupils are now widely dilated, and anæsthesia is complete. The pulse is carefully watched at this stage, and if syncope occurs the patient should at once be placed in a recumbent position and allowed a free supply of air. If, during the administration, the breathing intermits and the pupils suddenly and widely dilate the gas should be immediately withdrawn. In dental cases, as a rule, the anæsthesia only lasts for a brief period, but an expert operator has time to extract several teeth before sensation returns.

The after-effect of nitrous oxide inhalation is occasionally a slight degree of headache.

In one administration of nitrous oxide for dental purposes a patient will require from seven to eight gallons of gas. This will make a difference of nearly three ounces in the weight of the gas bottle.

Gas and Ether.

Although the administration of nitrous oxide is chiefly used for operative purposes in dental work, it has, nevertheless, an important appli-

cation to the requirements of the surgeon. The long time required in some cases to produce anæsthesia by ether alone, is often annoying, independently of the quantity of ether respired by the patient, its suffocative odour, and the probability of its being followed by sickness and struggling. To obviate this most anæsthetists now commence by producing unconsciousness with nitrous oxide which usually requires about forty seconds, and then maintaining it with ether, with but little initial discomfort to the patient. The late Mr. Clover endeavoured to effect this by a most ingenious apparatus, so constructed that it could be used for gas alone, or ether, or the two methods in combination. The arrangement is represented in fig. 1.

In this apparatus the ether is stored in the vessel E; connected with this is an india-rubber bag G. This bag transmits a tube, as indicated by the dotted line, which is in communication with the ether vessel and the face-piece. The communication between the ether vessel and bag may be opened or closed by means of the stop-cock. The communication between the face-piece, bag and tube is regulated by means of a dial-regulator Re, this is so arranged that when the face-piece is in

communication with the tube, its relation with the bag is closed. The regulator is furnished with two letters, G and E.

When the indicator rests on the letter E, the face-piece and tube communicate, and by means of the expiratory valve in the side of the face-piece with the outer air. When the indicator rests on the letter G, the face-piece and bag are in relation, and when the stop-cock is turned on, with the ether vessel. The expired air now passes through the ether vessel, and during inspiration the air passes from the bag and from the ether vessel by way of the tube to the face-piece.

When used for gas alone the regulator is turned to G, the face-piece must now fit firmly for reasons explained on page 18, and the stop-cock of the ether vessel turned off. By means of the foot the gas is turned in from the gas bottle K and allowed to distend moderately the bag and so reach the face-piece, during expiration the gas will pass out through the exit valve before mentioned in the side of the face-piece.

When the apparatus is to be used for ether, but the administration to be preceded by nitrous oxide, about four ounces of ether are poured into the vessel which must be heated to

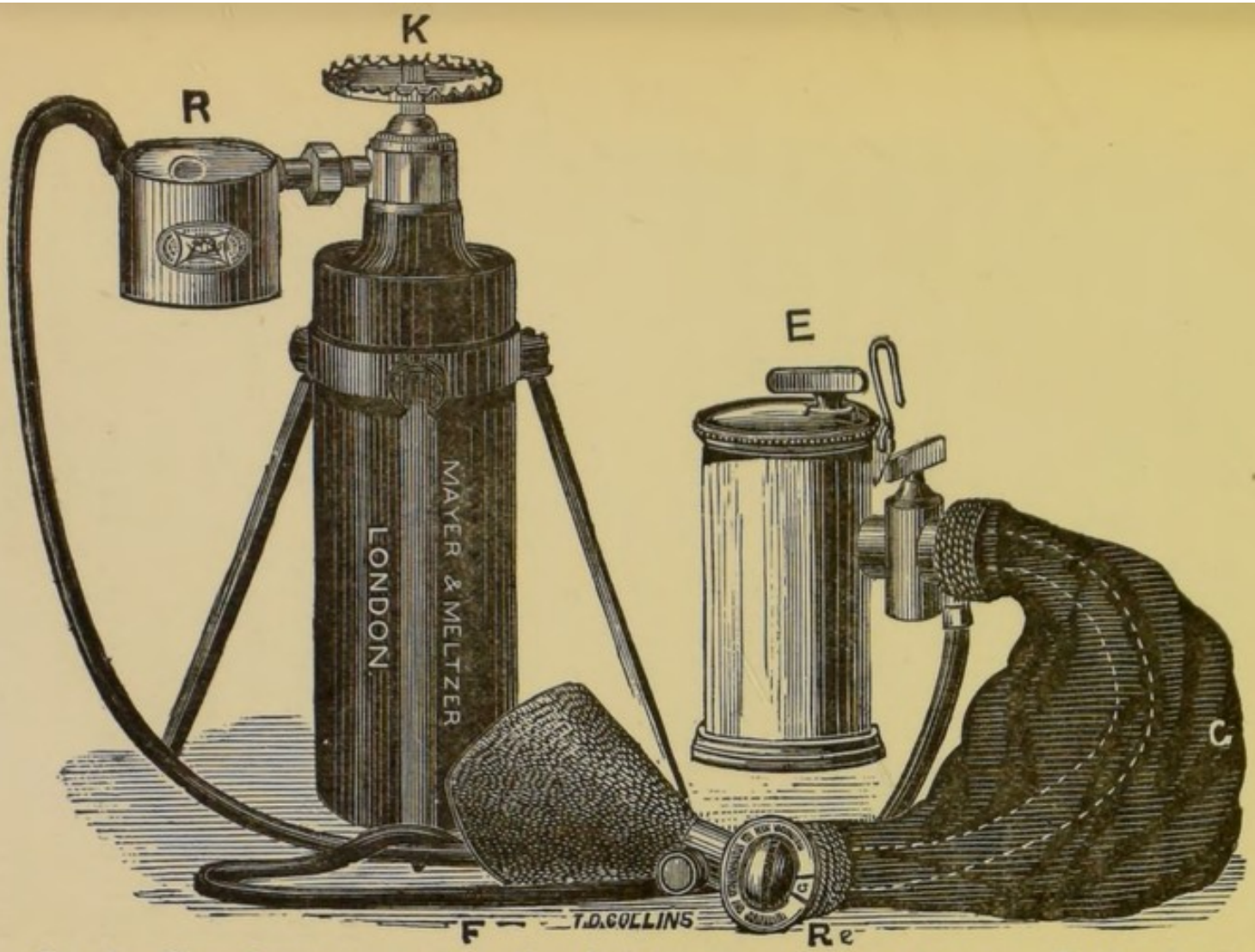


FIG. 1.—Clover's arrangement for the administration of gas and ether. K. Gas bottle. R. Quieter. F. Tube conveying the gas to the bag G. E. Ether vessel. Re. Dial regulator.

about 70° F. The inhalation is commenced by allowing the patient to take about a dozen inspirations of gas, then the stop-cock of the ether vessel is turned on, and the regulator gradually rotated towards E. When midway between G and E the tube will be partially opened and the bag partly closed. The gas must now be turned off with the foot. Having reached this stage, air should be admitted from time to time. If the ether be turned on too rapidly, reflex movements of coughing and swallowing are caused. On the other hand the too free admission of air leads to partial recovery and struggling.

Nitrous Oxide and Oxygen.

When a patient is under the influence of nitrous oxide the face and neck are intensely livid, as if asphyxiated. Dr. F. Hewitt* has recently stated that he has "conducted about 500 administrations of nitrous oxide with varying percentages of oxygen, and finds that it is possible with 10 to 12 per cent. of oxygen to secure perfect anæsthesia without the occurrence of any asphyxial phenomena,"

* "Med. Chir. Trans.," vol. lxxiv., p. 121.

and he recommends the employment of such a mixture when "it is necessary to secure a brief period of anæsthesia in anæmic and feeble individuals, or in those suffering from any serious cardiac or pulmonary affection."

My own experiences with nitrous oxide and oxygen are not satisfactory, it is difficult to decide when the patient is unconscious, and the return to consciousness is accompanied by great exaltation and screaming.

CHAPTER III

Ether.

Properties.—Pure ethylic ether (and none other should be used for inhalation) is a colourless transparent fragrant liquid. It has a sp. gr. 0·720, boils at 35·6° C. (96° F.), and bears without freezing the severest cold.

It is very volatile and combustible, and produces when burning, water and carbon dioxide. Its vapour mixed with oxygen and ignited explodes with great violence. Ether is miscible with alcohol and chloroform but not with water.

It is obtained by acting upon strong alcohol by means of sulphuric acid and heating the mixture to 140° C. The chemical changes are of great interest and are fully described in works on organic chemistry.

Physiological effects.—Ether acts directly upon the respiratory centre of the medulla. The experiments of Flourens and Longet appear to show that the cerebrum and sensory centres of the spinal cord are first affected,

then the motor centres of the spinal cord, then the sensory centres of the medulla, and finally the motor centres of this part of the brain are affected. During the inhalation of ether the blood-pressure in the arteries is increased and the heart stimulated to vigorous and rapid action. The flushing and perspiration produced by this anæsthetic are due to stimulation of the vaso-motor centres. If the administration is prolonged, a depression follows, causing coldness of the skin. The secretion of saliva and mucus is also greatly increased.

Although this agent may be given on a folded towel, or flannel inhaler, nevertheless, it is a very disagreeable mode of exhibiting it, not only to the patient, who requires by this method a very long time to become unconscious, but it is exceedingly unpleasant to the operator, and indeed to all concerned. To remedy this defect various kinds of apparatus have been devised.

The various inhalers used for the administration of ether are so constructed as to induce anæsthesia, by allowing the patient to inspire a diminished volume of air and a regulated amount of ether vapour, accompanied by a minimum amount of discomfort to the patient.

In Clover's inhaler, fig. 2, the face-piece is

furnished with an indicator, which by rotation points to certain figures, 0, 1, 2, 3, F, on the neck of the receiver. In relation with this is a metallic vessel containing the fluid ether and an india-rubber bag into which the patient breathes.

When the indicator is at 0, the inspired and

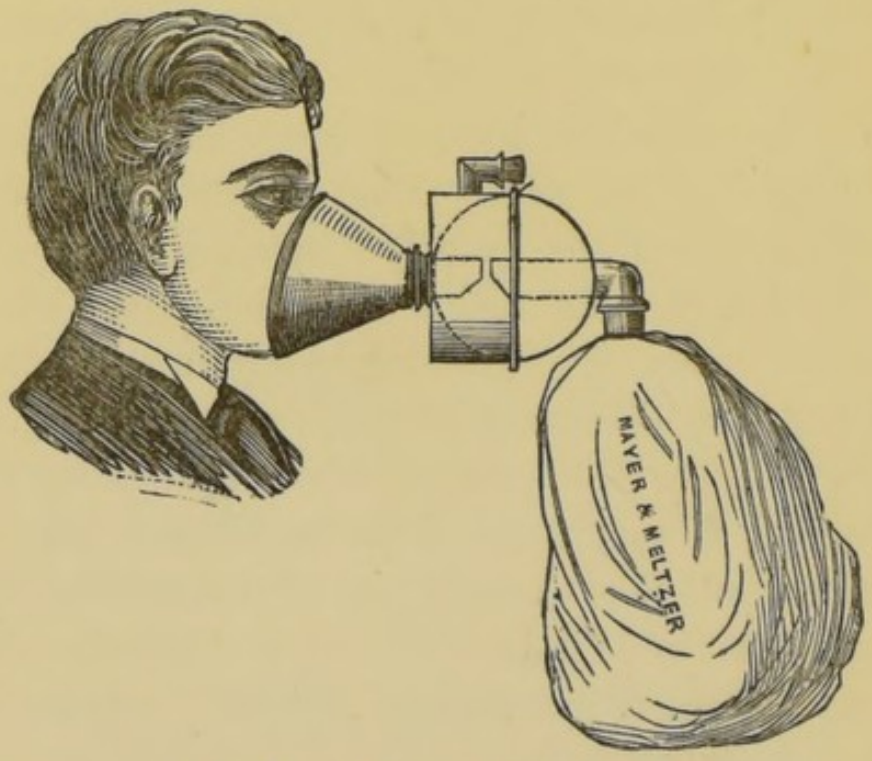


FIG. 2.—Clover's ether inhaler.

expired air passes to and from the bag without communicating with the ether chamber.

If the indicator is at F, the whole of the air expired passes through the ether vessel into the bag and at inspiration returns from the bag through the ether vessel. When the indi-

cator is at 2, half the respired air passes to and from the bag direct; the other half traverses the ether vessel. In this way by turning the indicator, air, or air with one, two, or three parts of ether passes to the bag, or by turning the indicator to F, ether vapour only.

The air does not pass through the ether, but only through the vessel containing it, and thus becomes charged with the vapour.

To use the apparatus. — About two ounces of ether are poured into the vessel, this being about half its capacity, the various parts are adjusted and the indicator standing at 0, the face-piece is applied lightly to the patient's mouth. At first it should be slightly raised during each inspiration until the bag is moderately distended. The indicator should now be rotated to 1.

The rotation is effected every few seconds, gradually accustoming the patient to the vapour without causing him discomfort, until it gets to 3. Occasionally the face-piece should be removed for a few inspirations of fresh air. When we remember that so long as the face-piece of the inhaler is accurately adjusted to the patient's face, the air contained in the bag is respired again and again, the precaution of removing the inhaler to allow

the patient to take in fresh air is sufficiently obvious.

The amount of fresh air required during an administration of ether varies with different cases, especially as the tolerance of ether varies greatly in individuals.

Ormsby's inhaler. Although Clover's inhaler is preferred by many, yet it has certain inconveniences which are not present in the useful instrument introduced by Dr. Ormsby represented in fig. 2. In this inhaler the metallic receptacle for the ether is replaced by a sponge, the indicator is absent and the supply of air is regulated by a valve which rotates over a slit, at the will of the administrator. In this respect Clover's inhaler has the advantage in that the amount of ether and air is accurately regulated, but this objection is more than counterbalanced by the extreme lightness and portability of Ormsby's apparatus.

Messrs. Coxeter at my suggestion have modified this instrument by making the bag larger; this is a distinct advantage with patients of large vital capacity. Further, in order to increase the space within the face-piece, I have it constructed without the valve and tubes leading to the sponge. The instrument

is charged by pouring the ether straight upon

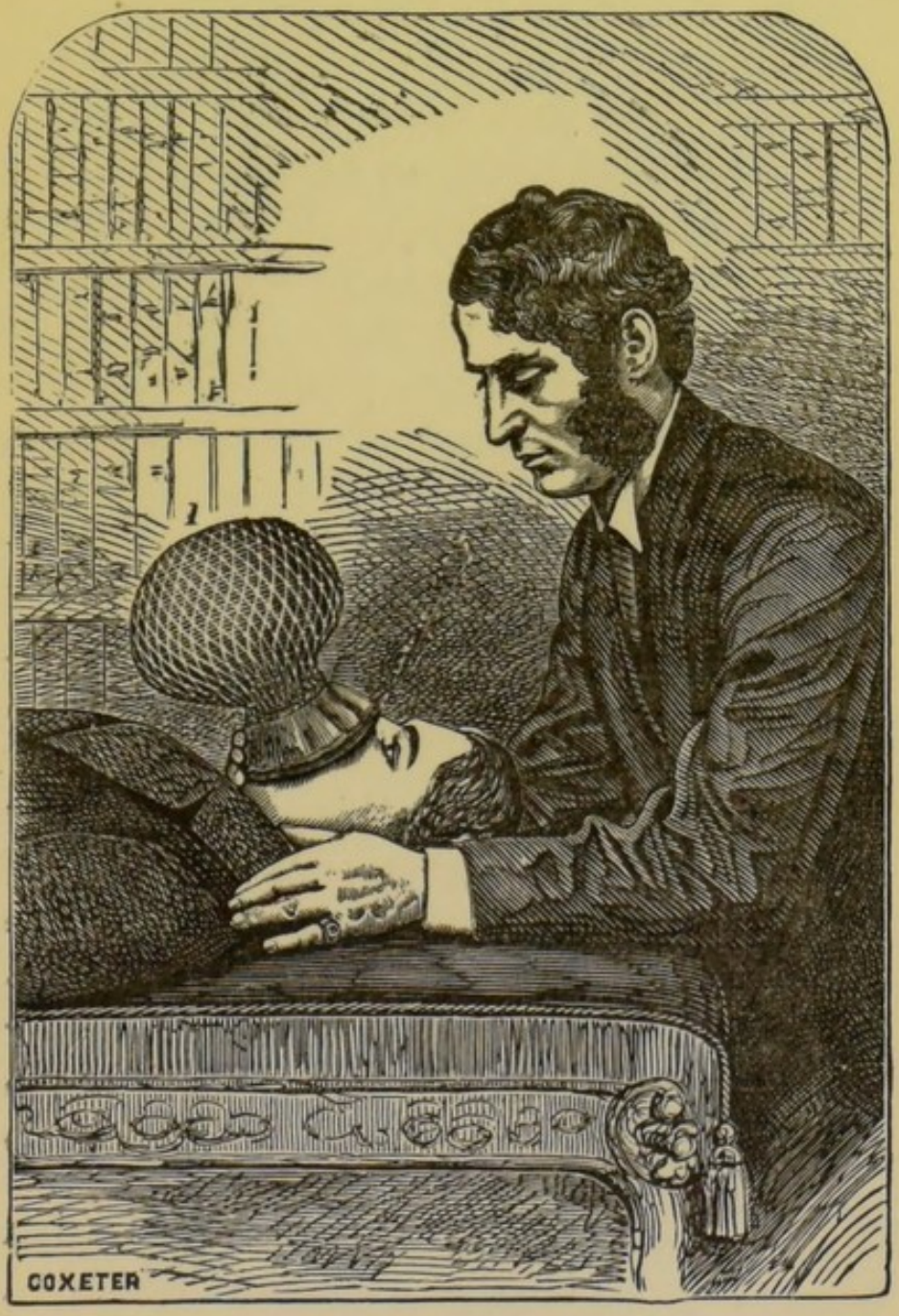


FIG. 3.—Ormsby's inhaler.

the sponge. I invariably use this inhaler and recommend it to my pupils.

During the administration of ether the patient is placed in a recumbent position, all constricting portions of the clothing being loosened. The first effects of the inhalation is to cause a sensation as of suffocation and the patient struggles freely. If the vapour be not sufficiently diluted at first it causes the patient to cough. In the course of some thirty seconds the mucous membrane becomes accustomed to the ether vapour and the proportion may be increased. The various stages which the patient passes through are as follows :—

At first there is a sensation as of suffocation, and if the proportion of ether be too great, coughing is excited.

Gradually the patient breathes more fully and becomes exhilarated. As the respirations increase in frequency the pulse becomes quicker and softer, the pupils contract, the excitement passes into delirium and the patient struggles, often violently and in some cases seems as though suffering from hallucinations.

Gradually this delirium subsides, but the muscles remain very rigid and a rash of transient character (known as the ether rash) breaks out upon the chest and neck.

The skin perspires freely. The pupils dilate, the breathing becomes slower and shallower, whilst the pulse beats with proper frequency. The muscular rigidity yields and the patient is now completely anæsthetic.

If the administration of ether is pushed beyond this point cyanosis begins to manifest itself, usually appearing first on the lips and ears.

The inhaler should now be removed so as to allow the patient to inspire some fresh air, these symptoms will then disappear. Some patients present cyanosis to a greater degree than others. When once the patient is rendered profoundly anæsthetic it is only necessary to administer air containing ether to the extent of about 40 per cent., unless the operation concerns such sensitive parts as the vagina, rectum, or eye.

It will be perceived from the foregoing account that two stages of anæsthesia occur in the course of an administration of ether. In the first there is a temporary period immediately succeeding the stage of exhilaration, during which a tooth may be extracted, an abscess opened, or a sinus examined. The second stage commences when the conjunctiva is insensible to the touch. This may be termed the stage of complete anæsthesia.

Ether excites salivary and bronchial secretion, which often gives rise to noisy râles and an abundant flow of buccal and bronchial mucus.

Caution during administration. The dangers of ether inhalation are: (1) Spasm of glottis; (2) Paralysis of respiratory centres; (3) Failure of heart. The first is caused by the inhalation of a too concentrated atmosphere of ether. This condition is sometimes brought about by nervous patients, who voluntarily hold their breath. The inhaler should be removed, and if breathing is not at once resumed, then artificial respiration should be commenced. First the mouth should be opened, the tongue drawn forward, the mucus cleared from the fauces, and manipulation as recommended on p. 63 at once proceeded with.

In the second danger—paralysis of the respiratory centres—timely warning is as a rule present, such as shallow breathing, with diminished force and frequency of the pulse. In these cases artificial respiration should at once be started. This I have always found effectual.

With regard to cardiac failure. The chances of it occurring under ether are so remote, that I need not spend time in discussing it.

There is one sequel to the administration of ether which it is necessary to bear in mind. That is a tendency it has in delicate children and elderly persons (especially those subject to chronic bronchitis and emphysema) to cause an attack of bronchitis after an incautious administration. Ether is, however, not always to blame in this respect, for indeed unheeded exposure of a patient by the operator may have been the real cause, but the ether has been blamed.

The after effects of ether vary considerably in different people. In some cases, headache, nausea, and thirst supervene, and last for a considerable time, in others all unpleasant symptoms disappear in an hour or two.

CHAPTER IV.

Chloroform.

Properties. Chloroform is a thin colourless liquid of agreeable odour. Its density is 1·48 and it boils at 61° C. It is difficult to kindle and burns with a green flame. It is very slightly soluble in water. It is obtained by distilling together chloride of lime, water, and alcohol. The chloroform constitutes the oily portion of the distillate. It is purified by agitation with water, dessication with calcium chloride, and distillation in a water bath.

It has long been known that the administration of chloroform in gas-lighted rooms causes decomposition of the chloroform vapour, and that the persons present suffer from irritation of the respiratory passages, with coughing, sneezing and lachrymation. Professor Kunkel ("Therap. Monatshefte") introduced chloroform vapour into a glass chamber in which gas was burning, and then drew off the products and analysed them. As a result, he found that the chloroform was chiefly decom-

posed into hydrochloric and carbonic acids, a small quantity of free chlorine being also present. As one-tenth per 1,000 of hydrochloric acid in air is sufficient to cause severe respiratory irritation, it is evident that this amount can be produced by comparatively little chloroform. Kunkel explains that irritating effects are comparatively infrequent, owing to the moisture in the air absorbing the free hydrochloric acid and combining with it.* As soon as the irritation of the larynx is felt, the room should be ventilated by opening the windows and doors.

Physiological action.—Chloroform applied locally has very slight anæsthetic action, but acts as an irritant producing redness, burning, and when evaporation is hindered, actual blistering. Evidence of this local action is often seen around the mouth and on the nose of patients when inhalations have been clumsily administered.

In the mouth, chloroform produces a burning sensation, and when swallowed in small quantities induces a sensation of warmth in the stomach. When inhaled in sufficient quantity the vapour of chloroform produces unconsciousness and death. Before the stage

* "Brit. Med. Jour. Sup.," 1890, p. 6.

of unconsciousness is reached, the inhalation induces certain physiological effects which follow in such fairly regular sequence as to be spoken of as stages or degrees of chloroform narcosis.

In the first stage the symptoms exhibited by the patient are similar to those of intoxication from alcohol; this stage of excitement is usually brief, but in intemperate and athletic persons it often persists for a few minutes. In drunkards and patients with cardiac disease, this excitement is attended with grave danger.

During this first stage, although the patient is not unconscious, his tactile sensibility is somewhat blunted.

In the second stage, the patient is quite unconscious, and save the movements of respiration absolutely motionless and the muscles quite relaxed. In this condition operations may be performed.

In the third stage, narcosis is more profound, the breathing is stertorous and all the reflexes are abolished, and the patient lies on the verge of death.

In the first stage, the pulse may be quickened; in the second stage it is as a rule of normal frequency; but in the third stage it is variable.

When chloroform is carefully administered these stages follow with great regularity, but if the drug is freely applied and the patient gets an overdose of the vapour, death may supervene even during the first period or stage of excitement. Chloroform like ether acts chiefly on the centres in the brain and spinal cord, but has very little, if any, influence on the peripheral nerves.

It also exerts under certain conditions a very powerful effect upon respiration and on the action of the heart. It is important to determine whether in fatal cases of chloroform inhalation death is due to primary arrest of the circulation or of the respiration, and unfortunately there is much difference of opinion on this question. Experimental observations, carried out of course upon the lower animals, especially dogs, furnish facts totally opposed to clinical observations on the human subject. Most anæsthetists are of opinion that in the human subject, the circulation is primarily arrested in fatal cases from chloroform. In some cases the respiration and circulation stop simultaneously, and occasionally respiration is the first to cease. Wood in dealing with this matter writes :—" When death is produced by chloroform in man, it is generally by cardiac

arrest, sometimes by asphyxia. That syncope occurs proportionately more frequently in man than in animals, is simply because this form of death is sudden and unexpected. Asphyxia comes on gradually, so that in man the threatening symptoms are perceived and death is averted by prompt measures. In animals, however, the object being to kill, nature is allowed to take its course." The last research on this question is that undertaken by the famous *Hyderabad Commission*, the conclusions of which are discussed in Chapter VII.

Methods of administration.—For the administration of this agent no inhaler is needed but a piece of lint folded two or three times, a cambric handkerchief or piece of linen will answer every purpose. A convenient form of inhaler, and one which has the advantage of economising the chloroform is represented in figs. 4 and 5. It consists simply of a piece of flannel stretched across a wire frame, supporting a small piece of sponge.

Chloroform prepared by Duncan and Flockhart is that most generally preferred.

In a special class of operations, such as operations upon the mouth, and in cases where the pharynx is plugged, and the anæsthetic

administered through a temporary opening in the larynx, the form of inhaler known as

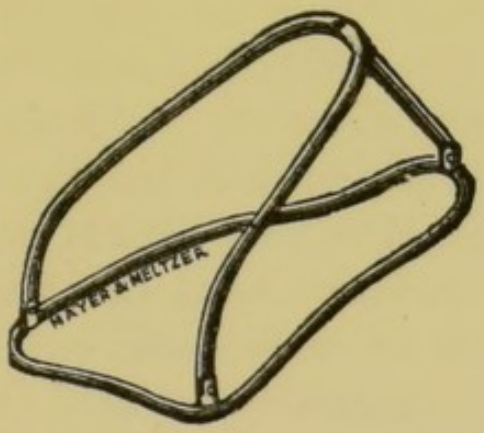


FIG. 4.—The wire frame of the simple inhaler, represented in fig. 5.

Junker's is necessary. This is fully described on page 46.

The open method of administration.

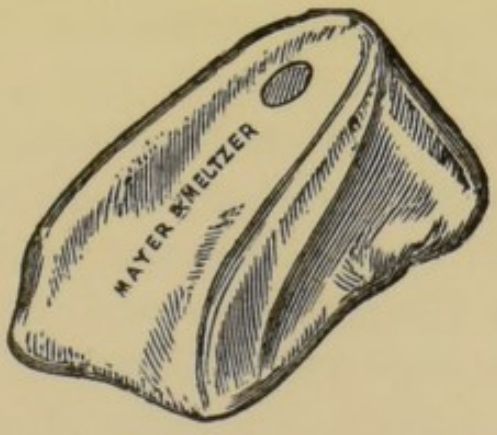


FIG. 5.—A simple form of chloroform inhaler. It consists of a piece of flannel stretched over a wire frame.

The anæsthetist should provide himself with a drop-bottle, holding at least an ounce, and

should have a supply of three or four ounces in reserve if necessary.

The patient should lie on his back, clothed only with light garments, and these should be loose especially about the neck and abdomen so that the breathing is in no way hampered. The head should be only slightly raised.

It is also well to anoint the lips and nose with vaseline or some such bland substance, for if the chloroform should accidentally moisten these parts blistering will be produced.

Having sprinkled the lint or inhaler with a small amount of chloroform, it is turned moist-side downwards towards the patient's mouth. At first it should be held about two inches away, and as the chloroform evaporates, should gradually approach the mouth. As the moisture disappears fresh chloroform must be added. The aim of the administrator is to allow air to freely enter the patient's lungs, mixed with about five per cent. of chloroform vapour. As soon as the agent begins to take effect, the patient, especially if addicted to alcoholism, begins to struggle. It is not wise to forcibly restrain him, except to prevent damage being done, either to himself or to those around. It is well to remember that

the more continuously the drug is administered at this stage, the less the patient struggles. Children usually cry, and in the deep inspirations which ensue, a large amount of the vapour is taken in.

Gradually the muscular excitement yields and the patient falls as it were to sleep, accompanied with snoring, and muscular relaxation. The administration should not be pushed at this stage, for during the struggling a large amount of the vapour is inspired, and this accumulates in the lungs, to be gradually absorbed.

Usually when this stage is reached the conjunctival reflex is lost, and the patient is now ready for the operator. Care should be taken that the eye used as a beacon is not an artificial one.

During the administration of chloroform it is necessary to watch the respiration and the eye, and to be fully acquainted with the condition of the pulse.

1. The **respiration** serves as an excellent guide to the patient's condition; should it become shallow and slow, the inhalation must for a few moments be suspended. It must be borne in mind that when the breathing is very shallow, watching the chest does not always

furnish full information about the respiration, *it is necessary to listen to and feel the breathing with your hand at the mouth and nose.* A not infrequent cause of retarded respiration during chloroform narcosis is the falling backward of the tongue, pushing the epiglottis over the larynx. This is easily remedied by elevating the chin and drawing the tongue forwards with forceps.

2. The **eye** furnishes valuable information. So long as the conjunctival reflex can be excited, there is no danger, but it is also an infallible sign that the patient is not fully anæsthetic. When thoroughly insensible, no danger need be apprehended so long as the pupil is contracted, but should the iris suddenly dilate then there is peril; exception must be made here in cases where the patient is about to vomit, when, as I have frequently noticed, the pupils suddenly dilate.

3. The **pulse** should be most carefully noted from the beginning to the end of a chloroform administration, for it may warn us of the approach of danger. In some cases, fortunately rare, the first indication is the sudden simultaneous arrest of both pulse and respiration. As a rule these cases rarely, if ever, respond to artificial respiration. In the

majority of cases, the first warning is diminished force, and frequency, with occasional intermittency of the pulse, and this is usually accompanied by lessened respiration. In such cases the administration should for a time be suspended. The great danger to be apprehended during the administration of chloroform is syncope.

This may be due to an excessive percentage of chloroform vapour in the air inhaled, or to shock. The symptoms are unmistakable, the face becomes pale, the pulse weak, slow, or arrested, and the respiration shallow. The inhalation must be stopped, and means resorted to for stimulating the patient. These must be adopted whether the syncope is due to loss of blood or as a sequel to vomiting, which may have occurred. It may be mentioned that a sudden momentary arrest of the respiration occurs when the large nerve-trunks are stretched, the cord cut in castration, the Fallopian tube severed in oöphorectomy, or the optic nerve divided in removal of the eyeball.

In ordinary cases, on discontinuing the exhibition of the chloroform, consciousness usually returns in a few minutes, in some cases the patient goes to sleep. In in-

fants, a kind of chloroform coma supervenes, lasting some two or three hours. It should be remembered, that if, while giving chloroform, premonitory symptoms of syncope appear, especially if it be due to shock induced by sudden and unexpected hæmorrhage, brandy administered by the rectum is of very great service.

Junker's inhaler.—The usual form of this apparatus is represented in fig. 6, it may be used either for the administration of methylene dichloride or chloroform. The advantages claimed for it are that it economises the anæsthetic and regulates with great nicety the percentage of vapour (five per cent.). If this were all that could be said in its favour, so far as chloroform is concerned, the inhaler could be dispensed with, for nothing could be safer than its administration from a piece of lint or the simple inhaler described on page 41.

In operations about the mouth and nose it is now becoming general to plug the pharynx, and administer the anæsthetic through a temporary opening in the larynx, or even with a tube passing through the mouth, as in cases of staphylorrhaphy, thus replacing the very feeble efforts of the old-fashioned gutta-percha ball; or the tube may be passed along the

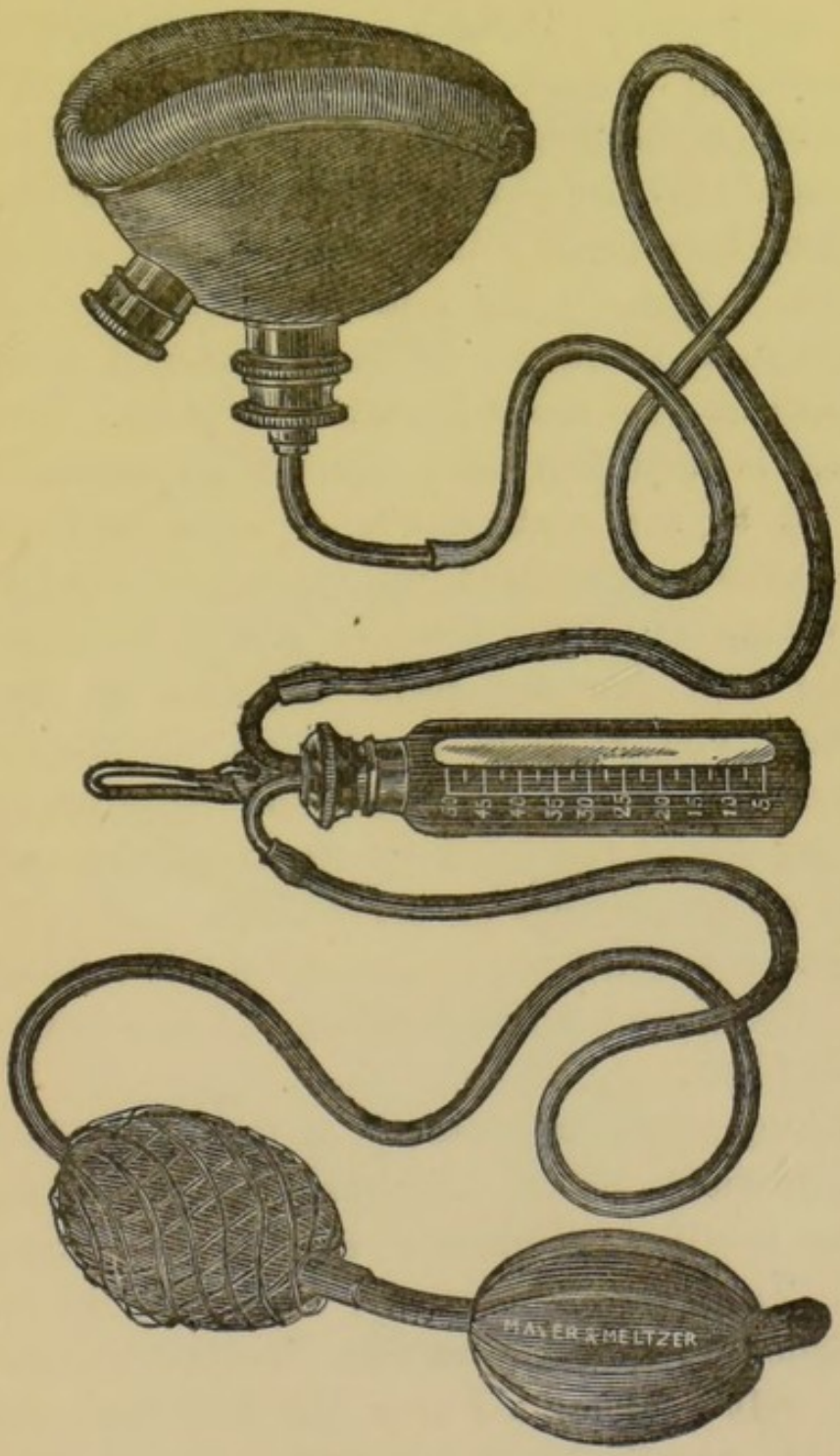


FIG. 6.—Junker's inhaler for the administration of chloroform.

floor of the nose and the chloroform inhaled by that means. In such cases this inhaler is exceedingly valuable. It consists of a bottle capable of holding two ounces, closed by an air-tight movable plug, transmitting two tubes. A long tube fitted with a hand-bellows passes to the bottom of the bottle. A shorter one commences at the top of the bottle and communicates with the vulcanite face-piece. The bottle is furnished with a hook for suspending it to the coat, and the lower half of the bottle is graduated up to eight drachms. About an ounce of fluid is poured into the bottle and the face-piece adjusted to the patient, and at each inspiration, the hand-bellows is gently squeezed, the amount of vapour being regulated by the frequency and force of the pressure on the bellows.

Dr. Dudley Buxton has modified this inhaler by substituting a foot-bellows for the india-rubber ball.

Acting on the suggestions of the Hyderabad Commission, Messrs. Krohne and Sesemann have modified Junker's inhaler by fixing (fig. 7) a feather over the expiratory valve, so delicately that it rises with the least expiration. It is intended that the administrator should attentively watch the movements of

this feather, on the hypothesis that the respiration is the first to fail.

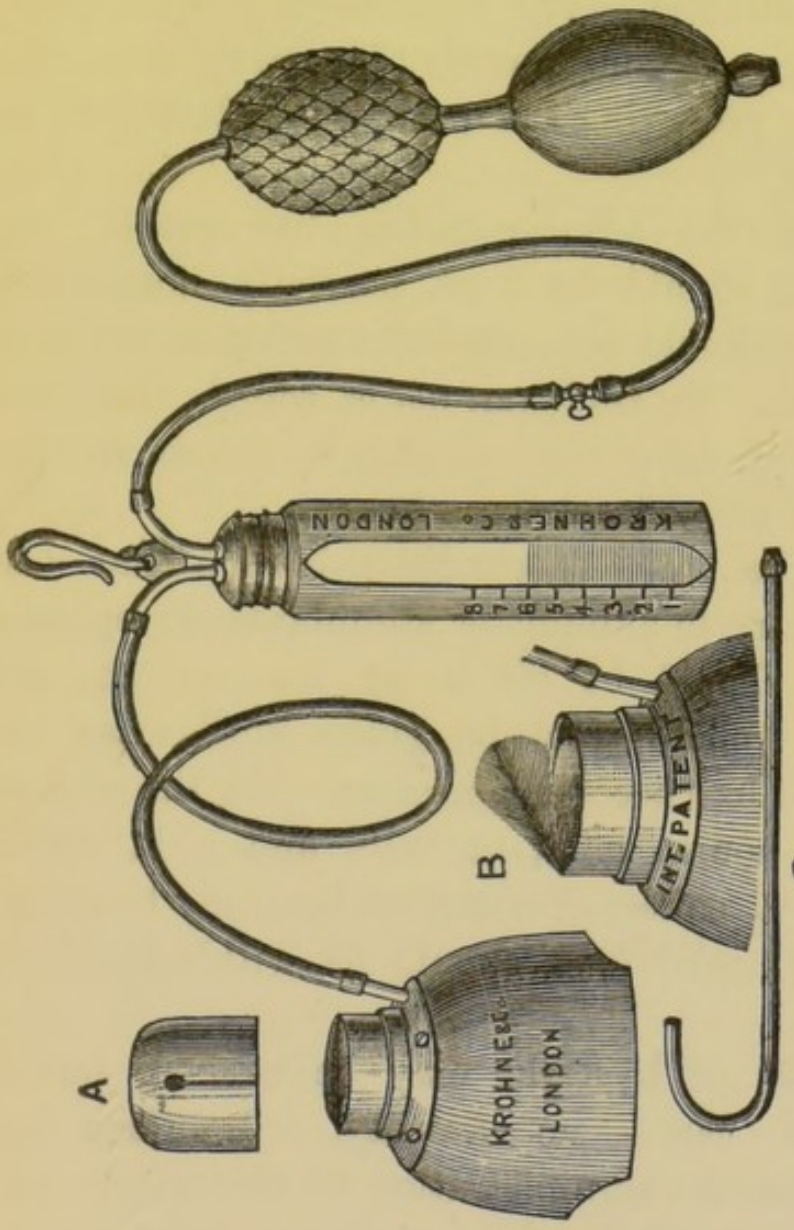


FIG. 7.—Junker with feather. A. Cap for covering the valve when the instrument is not in use. B. The valve with the feather. C. Pharyngeal tube.

After-effects of inhaling anæsthetics. The inhalation of chloroform and ether are frequently followed by effects which are, in

some cases very uncomfortable, and in others give rise to much anxiety.

Vomiting.—The chances of emesis occurring may be considerably reduced by exercising care in preparing the patient as described on page 4.

After the administration has ceased the patient should be kept perfectly horizontal, and he should be moved or shaken as little as possible: *the head must not be raised.* No food or drink or drugs should be given by the mouth for at least three hours.

If the patient's condition is such that it is necessary to administer stimulants or opiates, these should be given by the rectum, but opiates should not be given until after the patient has become conscious. At the end of three hours, milk, or milk and soda water, beef-tea, coffee, or a cup of tea may be given, but all solid food should be withheld for 24 hours.

A fit of hysteria may be excited, but it should cause no anxiety. Jaundice has followed the administration of chloroform and transient attacks of mania have followed the use of nitrous oxide, chloroform and ether.

CHAPTER V.

Anæsthetic Mixtures.

These consist of mixtures of alcohol, ether, and chloroform, or of ether and chloroform in different proportions. Of these, the A.C.E. mixture is the most valuable, it is a compound of :—

Alcohol, sp. gr. ·838, 1 part,
Chloroform, sp. gr. 1·497, 2 parts,
Ether, sp. gr. ·735, 3 parts.

This mixture was originally employed by Dr. J. Harley, and was recommended by the Chloroform Committee of the Royal Med. Chir. Soc.* They found such a mixture "as effective as pure chloroform, and a safer agent when deep and prolonged anæsthesia is to be induced, while at the same time it is sufficiently rapid in its operation to be convenient for general use." This same Committee also recommended a mixture consisting of :—

Chloroform, 1 part,
Ether, 2 parts,

* "Trans. Med. Chir. Soc." vol. xlvii., p. 340.

on the principle that the "known differences in the actions of the two anæsthetics suggest that in a mixture of them, the more dangerous properties of chloroform would be neutralised or reduced by dilution."

These mixtures have been used with great success, especially the A.C.E., but all anæsthetic mixtures are open to the great objection that the ingredients evaporate in different ratios so that it is impossible to be sure what percentage of chloroform vapour is being inhaled.

The A.C.E. mixture should always be given by the open method on a towel or piece of lint. It requires longer time to render the patient unconscious than when chloroform or ether is employed. The after-effects are similar to those of ether and chloroform.

The other mixtures are rarely employed in this country, and therefore do not demand consideration.

Bichloride of Methylene.

This liquid when first introduced was thought to possess valuable anæsthetic properties, and to be less dangerous than chloroform, but it has now fallen somewhat into disuse.

French chemists assert that the samples sold under this name were really chloroform, and that the English methylene consists of chloroform, with a small proportion of alcohol.

It has been used in England by Sir Spencer Wells, especially in the operation of ovariotomy.

Despite its limited use, a few deaths have resulted from its inhalation. It is best administered by Junker's inhaler.

Hydrobromic Ether, or Bromide of Ethyl.

Hydrobromic ether is a colourless translucent liquid with a sp. gr. of 1·4733; slightly soluble in water, but freely soluble in alcohol and ether. It is prepared by distilling ethylic alcohol with bromine, or hydrobromic acid, or bromide of phosphorus. It is difficult to obtain pure and is in itself very unstable; it readily decomposes, liberating free bromine.

Physiological effects.—When inhaled by human beings it produces unconsciousness, accompanied by muscular relaxation. Although it causes congestion of the head and neck, and a profuse secretion of saliva, there appears to be absence of laryngeal irritation.

It frequently produces vomiting which is apt to persist for some hours.

Method of Administration.—Hydrobromic ether must be given like ether with exclusion of air. The administrator should be very watchful as the patient rapidly recovers consciousness, it is therefore unsuitable for prolonged operations. It seems to have been employed mainly in dentistry. As hydrobromic ether is so unstable it is not likely to come into general use. Several fatal cases have been reported.

Ethydene Dichloride.

Ethydene dichloride is a colourless translucent oily fluid, with smell and taste resembling chloroform. Its sp. gr. is 1·225 at 115° C. insoluble in water, but soluble in alcohol, chloroform and ether. It is prepared from aldehyde, by acting upon it with pentachloride of phosphorus. It is also formed as a by-product in the preparation of chloral.

This anæsthetic seems to possess properties intermediate to those of chloroform and ether. It would seem to be less dangerous than chloroform, as it causes less depression. It is,

however, not entirely devoid of danger, as a few deaths have also resulted from its use. It is best administered by Junker's inhaler. Ethydene dichloride has an agreeable odour. It quickly produces unconsciousness, and the effects rapidly disappear. However, it is but little used.

CHAPTER VI.

Accidents during Anæsthesia and their Treatment.

It will be useful to indicate some of the accidents to which patients are liable when rendered artificially unconscious.

It cannot be too strongly emphasised that every death which occurs during anæsthesia is not due to the anæsthetic; that is to say, death *during* anæsthesia is not always synonymous with death *from* the anæsthetic.

One great risk is the impaction of foreign bodies in the upper air passages.

The practice of removing artificial teeth previous to administering anæsthetics has been forced upon the profession on account of numerous accidents which have been caused by the accidental translation of the plate from the mouth to the pharynx. In extracting teeth, a tooth or stump may slip out of the grasp of the forceps, and falling into the back of the mouth be inspired into the larynx.

In operations on the jaws, blood, in spite of

the most able assistance, may trickle into the pharynx and find its way into the air-passages, where it may give rise to dangers immediate and remote.

In removal of tumours, portions of the growth have on more than one occasion been found impacted in the larynx in supposed fatal cases of chloroform inhalation.

Surgeons are now so fully aware of these dangers that in all extensive operations on the jaws, tongue or pharynx that they avoid them by administering the anæsthetic through an opening in the trachea and plugging the pharynx by means of a sponge. In such operations as staphylorrhaphy and removal of adenoids, an admirable method is to place the patient flat on the back and draw the head over the end of the table so that it is the lowest part of the body.*

The advantages of this position in removing adenoids are the following:—The blood cannot trickle downwards into the larynx, but collects into the roof of the pharynx, which in this position forms as it were a cup to receive it, and from which the blood and fragments of adenoid tissue can be easily removed by sponging.

* See "B. M. J.," 1890, vol. i., p. 835.

A very important fact for consideration is that in this position we are sure, thanks to the admirable investigations of Dr. Howard, that the air-ways are free, for he has clearly demonstrated that in this position the epiglottis is raised from the larynx. The importance of giving these patients every facility for respiring freely cannot be too strongly insisted upon, for the whole of the naso-pharynx is not unfrequently plugged with the overgrown pharyngeal tonsil, and respiration through the nostril being obstructed, great care is required in administering an anæsthetic to these patients. I would urge the administration of an anæsthetic in these cases on the following grounds :—The surgeon can perform the operation more deliberately and with greater thoroughness ; the patient is spared much pain and discomfiture, and if unconsciousness is produced by one well skilled in the administration of anæsthetics in this particular class of case, it is as devoid of danger as in any other operation in surgery.

In operations for the relief of intestinal obstruction, stercoraceous material is sometimes vomited freely when the patient is unconscious, and may be inspired into the bronchial tubes. During anæsthesia, respira-

tion may be hampered in several ways :—In operations for empyema, the patient may be placed on the sound side in such a way as to greatly hamper respiratory movements ; in other conditions the chest may be girt about with bandages, and assistants may lean upon the abdomen or thorax.

It is the duty of the anæsthetist to be closely on the watch for the occurrence of faintness, syncope, or sudden arrest of the respiration. Faintness and syncope may arise from the operation, sudden hæmorrhage from injury to a large vessel, irritation of a nerve trunk, and the condition called shock which ensues when large portions of the limbs are severed from the trunk, and it often supervenes when the cord is tied in castration, in division of the recti muscles and optic nerve of the eyeball ; when the femur is sawn through in amputation of the thigh ; the Fallopian tube ligatured in ovariotomy ; or when the large nerve-trunks are stretched.

A striking example of shock occurring during anæsthesia but not due to it, is given by Dr. Hewitt. He writes* :—" Not long ago, I administered chloroform, by means of Junker's apparatus, to a patient of about

* "Lancet," 1890, vol. i., p. 515.

35 years of age, whose health was good. Anæsthesia was produced in from eight to ten minutes, and was characterised by muscular flaccidity, abolition of lid-reflex, and slight stertor. There were two stages in the operation about to be performed, the first of which consisted in placing a temporary ligature round the carotid artery in the neck. Whilst the artery was being exposed for this purpose the pulse became extremely feeble, the face pale, and respiration shallow, and the operator had some difficulty in recognising the carotid artery by reason of its extraordinary diminution in size. The head was lowered. After three or four compressions of the chest, the pulse improved, and as rigidity and lid-reflex soon re-appeared, I was obliged to continue the administration, having recourse to ether for the remainder of the operation, which was successfully performed. The day after the operation, whilst the wound over the carotid was being examined, the patient's face suddenly became pale, the artery contracted as on the previous occasion, the eyes were observed to turn upwards, and the muscles of the jaw to twitch, and for a few seconds unconsciousness was present. Now, in this case, when the first attack of syncope occurred

the patient was thoroughly anæsthetised by chloroform; whilst the quick return of muscular rigidity and of lid-reflex proves that the anæsthetic was in no way to blame as a *direct* cause of the symptoms. Cases of this kind are, I believe, by no means uncommon, and they would seem to point to the conclusion that reflex syncope may undoubtedly arise under chloroform even when the anæsthesia is profound."

When arrest of pulse or breathing occur, the administration must be immediately stopped, the head lowered and the tongue drawn forward, and the fauces cleared of any mucus which may have accumulated there.

If the breathing is not immediately resumed then the patient's head is drawn over the end of the table and artificial respiration resorted to, and practised by the anæsthetist himself in the first instance; should there be delay in the return of respiration, an enema of half an ounce of brandy must be given, and the subcutaneous injection of half a drachm of ether will be found serviceable, with the inhalation of nitrite of amyl and strong ammonia. Whilst artificial respiration is being carried out, the tongue is held well forward with forceps, and the face flicked with a wet towel.

Signs of returning animation will be manifested by improvement in the colour of the face and the occurrence of a long drawn inspiration.

Among other restorative measures may be mentioned the application of warmth to the thorax and epigastrium. In the operating theatre of St. Mary's Hospital, I always keep india-rubber bottles filled with hot water in readiness for such emergency.

The application of mild electrical currents in the neighbourhood of the heart is recommended, but in my opinion it is of little avail. If the symptoms are due to the impaction of a foreign body in the larynx, and it cannot be quickly removed, a prompt tracheotomy must be performed.

Recently at the Royal Infirmary, Manchester, a railway guard, 27 years of age, died during re-amputation of the arm for secondary hæmorrhage. The fatal result was due to a piece of orange peel impacted in the air-passages.*

It is well recognised that in administering anæsthetics to an epileptic, gas, chloroform or ether, they are very liable to produce a fit; unless the anæsthetist is aware of this

* "Brit. Med. Journal," 1891, vol. ii., p. 21.

fact, he may be unduly alarmed, and every care must be taken that the patient does not bite his tongue. Patients may also develop a fit of hysteria during the early stage of anæsthesia.

Methods of Artificial Respiration.

Sylvester's. This method is perhaps the one most extensively used. Having cleared the air passages and drawn the tongue forward as described above, the arms are seized by the wrist and drawn above the head, and then gently brought to the sides of the patient, and firmly compressed against the sides of the chest so as to diminish still further the capacity of the thorax. By these alternate movements of elevation and depression which should be performed about fourteen to sixteen times in the minute; a regular interchange of air can be produced. If this mode of artificial respiration is to be persevered in for any length of time, relays of assistants will be requisite, for it is very fatiguing.

Howard's Method. In this plan, the person performing artificial respiration kneels in front of the patient and compresses the

thorax with his knee, as he alternately elevates and depresses the arms.

Nelaton's Method. This plan consists in inverting the patient by the legs, whilst the respiration is continued by placing one hand on the back and the other on the sternum. In chloroform syncope this method is regarded by some as being very efficacious, but there are difficulties in the way of dealing with adults in this manner.

These various methods must be perseveringly continued as long as there is any hope of recovery. If no signs of returning animation manifest themselves within half an hour, the case must be regarded as hopeless, but it ought not to be neglected for one moment for any less efficacious methods. In the meantime warm bottles may be put to the feet, an enema of brandy given and warm blankets applied to the patient.

Faradisation is of little avail.

CHAPTER VII.

On the Relative Safety of Anæsthetics.

Blest, as suffering mankind really is, in the possession of volatile fluids, the inhalation of which will induce such a condition as to enable the most painful operations to be performed without the patient being in any way conscious of it, we are not yet in possession of a perfect anæsthetic, far from it. By a perfect anæsthetic, I mean a substance which will paralyse all the sensory and motor nerve trunks without interfering with functions necessary to the life of the individual. That some such substance will be discovered we may continue to hope, and such facts as the paralysis of motorial end-plates by curare, the local action of cocaine on sensory nerves, and similar facts point in the right direction and should make us hopeful.

Some may be inclined to think that in ether and chloroform we have two almost perfect agents for the purpose of general surgery, and that a mortality of about 1 in 2,000 for

chloroform, and 1 in 20,000 for ether is relatively so small that it is scarcely worth consideration. Take for example, nitrous oxide, this is the nearest approach to a perfect anæsthetic yet discovered, in so far as safety to life is concerned. Dr. H. C. Wood, of Philadelphia, has made an interesting calculation to the effect that "anæsthesia by nitrous oxide gas is probably effected in three quarters of a million cases annually in the United States. Most of these inhalations have been given not by trained physicians, but by comparatively untrained and often very ignorant dentists: have been given to patients in a sitting or semi-sitting posture; have been given without thought or care to the general community as the units presented themselves; to the healthy and to the diseased alike, and the result is out of many millions of inhalations, only three deaths have been recorded as directly due to nitrous oxide." He pertinently asks, "could anything be safer."

The contrast between this and the results of chloroform are appalling. To-day for the purposes of general surgery the fight for supremacy lies between ether and chloroform. When compared, each possesses certain advantages over the other. The greatest dis-

advantage is that both may cause death by affecting the respiration and circulation.

It is generally accepted that ether in small doses stimulates the circulation, in very large doses it depresses the heart; but it depresses the respiration more than the circulation, and in fatal cases death is due to primary arrest of the respiration. With regard to chloroform, clinical evidence tends to show that the circulation is primarily arrested. In some cases the respiration and circulation stop simultaneously and occasionally respiration is the first to cease.

Of late years attention has been acutely directed to the comparative safety of ether over chloroform, and indeed one Medical Journal has gone so far as to assert that "deaths from chloroform are preventable, and that with due care they may be avoided," this would seem to be the case when Sir Joseph Lister in his well known article on "Anæsthetics," in "Holmes' System of Surgery," states that Mr. Syme had given chloroform in 5,000 cases without a fatal result, and between the years 1861 and 1870 he believed that no death from chloroform had occurred in the operating theatre either of the Edinburgh or Glasgow Infirmary, two of the largest surgical

hospitals in Great Britain, and in these institutions the chloroform is administered by the junior officers and students of the hospital.

Such facts as these naturally caused chloroform to be regarded by the Scotch surgeons as a safe anæsthetic, and they cling to this opinion with characteristic tenacity.

Whilst Scotland has been contending for chloroform, our American brethren have been urging the greater safety of ether; and in the United States so strong is the feeling in favour of this agent that as Dr. Wood expresses it, there is a tendency to conceal lethal cases from chloroform because the surgeon who uses it knows that if death occur from the anæsthetic a very large proportion of the profession will condemn him, either in public or in secret, for the use of this drug, and that he will be fortunate if he escape being publicly condemned by a coroner's jury.

In England the splendid reports from Scotland caused surgeons to adopt, almost exclusively, chloroform. Gradually as the method for administering ether became improved, this agent began to find such favour in England that it has, especially in London, been adopted as the routine anæsthetic by nearly all those

who practise as specialists in this department, and it is rapidly replacing chloroform on account of its greater safety. Yet in spite of this, fatal results from chloroform inhalation are alarmingly frequent as judged from the reports which find their way into the papers, and we may be quite sure that in this metropolis as well as in the United States, all the fatal cases are not reported.

Chloroform has recently been prominently brought before the profession in consequence of the conclusions arrived at by the Hyderabad Commission.

This now famous Commission owed its existence to Surgeon-Major Lawrie, this officer desiring to prove the correctness of Syme's teaching that chloroform may be administered with perfect safety providing the respiration was watched with sufficient care by the administrator, induced the Nizam's government to appoint a commission to demonstrate the truth of this opinion by experiments on animals. The members of the first commission consisted of Dr. Hehir and Messrs. Kelly and Chamarette. The commission, from a series of experiments, arrived at the conclusion that chloroform always arrests the respiration before the heart.

This was so totally opposed to the prevailing opinion that the great danger of chloroform was due to its paralysing effects upon the heart, that great hesitation was manifested in accepting the conclusion of the commission.

This hesitation led to the formation of a second commission, and the Nizam's government, with commendable liberality, contributed a sum of a thousand pounds, and invited the "Lancet" to send a representative to serve on the commission.

Dr. Lauder Brunton, F.R.S., was selected, and on his arrival at Hyderabad the commission was formed: it consisted of Surgeon-Major Lawrie, Drs. Lauder Brunton, Bomford, and Rustomji, and the members of the first commission were associated with them.

A very large number of experiments were undertaken upon Pariah dogs and monkeys. Chloroform was administered in a variety of ways, alone, or in combination with morphine, atropine and strychnine.

The experiments were conducted upon the diseased as well as upon healthy animals. The result of the experiments seemed to be constant: in every case the respiration stopped before the heart, and in some instances the

respiratory preceded the cardiac arrest by eleven minutes in a dog, and twelve in a monkey. The evidence obtained by the commission and the extremely careful way in which the experiments were conducted establish the fact that *when Pariah dogs are fatally chloroformed respiration stops before the heart.*

As the result of the enquiry the Commissioners added to their report fourteen rules, and state that :—*

"The commission has no doubt whatever that, if these rules are followed, chloroform may be given in any case requiring an operation with perfect ease and absolute safety, so as to do good without the risk of evil."

Among these rules the following occurs :—

"IX. The administrator should be guided as to the effect entirely by the respiration. His only object whilst producing anæsthesia is to see that the respiration is not interfered with."

When this is interpreted it means that in administering chloroform to human beings we need pay *little or* no attention to the pulse, but attentively watch the respiration for signs of impending danger.

In a paper read before the Harveian

* "Lancet," 1890, vol. i., p. 149.

Society,* Nov., 1890, I pointed out that admitting that chloroform kills by paralysing respiration, whereas heretofore it had been regarded as a cardiac paralysent, this fact in no way increases its safety. Chloroform is admitted by all, even by the Commissioners, as a very powerful drug, and that it is more powerful than ether is proved by the fact that according to statistics obtained from published cases, as already mentioned, the mortality from chloroform is nearly ten times greater than ether.

To my mind it signifies little so far as choice of drug is concerned whether chloroform kills by paralysing respiration or circulation first; the question is, which drug is more likely to produce a fatal effect. At any rate, the plan upon which I work is, to select ether for a patient (supposing chloroform and ether to be equally suitable for the purposes of the surgeon) as the safer anæsthetic; and I believe the best method to adopt is to select our cases and not blindly use one drug to the exclusion of the other.

Without entering into the scientific aspect of the conclusions arrived at by the Hyderabad

* "The Brit. Journal of Dental Science," Dec., 1890, p. 1064.

Commissioners, it seems to me that one of the results which will follow the propagation of their report is that chloroform will be used more and more as a routine agent, and that deaths will become more frequent.

Since the publication of the report of the Hyderabad Commissioners, Dr. MacWilliam* of Aberdeen has given an account of his experimental investigation on the action of chloroform and ether.

In this investigation the most important results were obtained on cats. The mode of conducting the experiments was extremely ingenious, and successful graphic representations of the effects of the anæsthetic upon the heart were obtained.

The evidence furnished by these experiments must be received with caution, because portions of the thoracic walls were removed, the pericardium opened and the recording apparatus brought into direct contact with the heart. Under such conditions, respiration had to be maintained artificially.

In the course of the experiments, Dr. MacWilliam had several opportunities of witnessing the phenomenon known as cardiac delirium on the cat's heart from the influence

* "Brit. Medical Journal," Oct. 11, 18, 25, 1890.

of chloroform. In this curious condition, the normal beat becomes abolished, and the ventricles are thrown into "wildly irregular, incoordinated ineffective action."

This effect only occurred when an overdose of strong chloroform vapour was pumped into the lung.

We have no evidence that chloroform ever produces this condition in man, but as MacWilliam suggests, it is possible that in hearts depressed and dilated by chloroform this peculiar delirium cordis may occur and cause death.

One of the most interesting conclusions arrived at in this investigation is that relating to the dilatation of the cavities of the heart due to the direct effects of chloroform upon the cardiac mechanism, and not due to the action upon the vagi, and that cardiac failure occurs by a more or less sudden enfeeblement and dilatation of the organ, and not by a sudden complete cessation of rhythm.

Dr. MacWilliam also observed that the free dilution of chloroform with air—the restriction of the percentage of the vapour to 4 and $3\frac{1}{2}$ per cent.—gives no security against an overdose. A percentage that gives safe anæsthesia during ordinary breathing may lead to fatal

collapse, if given during exaggerated breathing.

But by far the most important result of this excellent research is the evidence furnished concerning the effect of *ether* upon the heart, for he writes, "There is commonly seen a very striking and important difference between the relative influence of the two anæsthetics upon certain functions.

"Ether can abolish the conjunctival reflex and induce profound anæsthesia with no appreciable direct effect upon the heart, while chloroform in causing a less deep anæsthesia, in which the conjunctival reflex is not abolished, may directly cause marked dilatation of the whole heart."

It seems to me that this conclusion derived from experiment accords very closely with clinical observation.

In order to point out the risk to life from chloroform inhalation, I have collected the records of fatal cases occurring in England which have been reported in the "Lancet" and "British Medical Journal" during five years ending Dec., 1891, eliminating of course those cases in which death occurred from accidents whilst the patient was anæsthetic, such as the impaction of foreign bodies in the larynx, and

the like. During this period there were 72 deaths distributed as follows :—

	Chloroform.	A.C.E.	Ether.
1887	17	0	1
1888	11	1	0
1889	10	0	0
1890	12	1	2
1891	15	1	1
	65	3	4

These facts beyond showing that the inhalation of chloroform is attended with considerable risk, do not help us much as we have no evidence to guide us as to the actual number of times chloroform was administered. An examination of the cases shews that many were of such simple nature, *e.g.*, opening abscesses, for phymosis, removal of fingers, extraction of teeth and the like; operations which could equally well be performed with ether or even gas. Indeed in more than half the fatal cases from chloroform, there appears to have been no good reason to employ chloro-

form in preference to ether. Of the 65 fatal cases from chloroform, no fewer than six occurred in patients suffering from pleural effusion or empyema; two of the fatal cases occurred during delivery, and three when unconsciousness was induced for the reduction of a dislocated humerus.

CHAPTER VIII.

Local Anæsthesia—Cocaine.

The agents usually included under the above heading are cocaine, ether spray, and carbolic acid. We shall only consider the most important one—Cocaine.

The employment of local anæsthesia in certain surgical operations has recently been revived in consequence of the introduction of cocaine. The expectations which were raised regarding the practical utility of this local anæsthetic, when it was first introduced, are likely to be fulfilled, for in many minor operations it is destined to replace chloroform, more especially in cases where the mucous membranes are concerned.

Cocaine is an alkaloid obtained from the leaves of the **erythroxylon coca.** The leaves in this plant have been long in repute among many South American tribes, as enabling those who habituate themselves to its use, to perform feats of great endurance, requiring little rest or food whilst under its influence.

Properties. The alkaloid cocaine forms crystals which dissolve with difficulty in water. It forms with hydrobromic acid, hydrochlorate of cocaine, a salt easily soluble in water. It is also miscible with melted vaseline. Aqueous solutions of cocaine undergo deleterious change, if kept, and produce evil effects when injected. Many attempts have been made to overcome this by adding antiseptic substances to the solution; the best way of avoiding untoward results from this cause is to always employ freshly prepared solutions.

Physiological action. The alkaloid in the form of the hydrochlorate of cocaine is that usually employed. When a solution of the alkaloid is placed upon the tongue, tactile sensibility and sense of taste are both lost. In every case the effect is merely transitory and passes off in about twenty minutes or half-an-hour.

The anæsthetic effects of cocaine are best exhibited when applied to mucous membranes. Its action, however, may be more extended when the solution is used hypodermically, so as to cause it to invade the subcutaneous tissues. Its effects are more transitory when applied to the skin. In this situation the anæsthesia is in most cases preceded by a sensation of warmth.

There is reason to believe that the effects of the drug are not merely local, that is they extend to tissues beyond those which come immediately into contact with them.

According to the experiments conducted by Hughes Bennett,* in 1873, with the view of determining the physiological properties of cocaine and the allied alkaloids, theine, caffeine, etc., the following conclusions may be drawn :—

In small, not fatal doses, they produce cerebral excitement and partial anæsthesia ; in large doses, complete anæsthesia, tetanic spasms, and death. They paralyse the entire posterior columns of the spinal cord and the peripheral sensory nerves, but do not affect the motor tract. They first increase, then impede, and lastly stop the respirations. They at first increase, and finally diminish both the force and frequency of the heart's contractions. They produce at first contraction and afterwards dilatation of the capillaries and small blood-vessels, with stasis of the blood, indicating first irritation and subsequently paralysis of the vaso-motor nerves.

These conclusions of Hughes Bennett have recently been confirmed by Von Anrep (1880).

* "Edinburgh Medical Journal," vol. xix., p. 323.

This experimenter also notices the mydriatic effects of the drug when applied locally or generally in warm blooded animals, this was also noticed by Bennett. The prominence which cocaine now enjoys is due to the zeal of Dr. Koller, who in the "Lancet" (Dec. 6, 1884, p. 990) drew attention particularly to its local anæsthetic action, especially in its application to ophthalmic practice. In this department of surgery its utility was so obvious and its advantages so great that it speedily found favour not only with ophthalmologists, but with laryngologists and general surgeons in operations on the nasal mucous membranes, the rectum, vagina, urethra, and bladder.

It will now be convenient to study the various methods of employing this agent for special purposes, commencing with the eye. In ophthalmic practice the strength of the solution will vary according to the purposes for which anæsthesia is required. The most convenient strength is a four per cent. solution. A few drops of a freshly made solution are instilled into the conjunctiva two or three times in the course of five minutes. At the end of this time the patient's cornea may be touched or pricked without giving rise to pain and the iris will now be found dilated, and the

accommodation suspended. In this condition foreign bodies may be removed from the cornea, the base of an ulcer divided, iridectomy and cataract extractions may be performed. Should pain be evinced during the operation, more solution should be applied and the operation proceeded with after the lapse of half-a-minute.

In glaucoma it seems that insensibility to pain is not always established in the iris; this is probably to be explained by the heightened tension within the anterior chamber, preventing the absorption of the cocaine.*

In operation for strabismus it is necessary not only to instil the solution into the conjunctiva, but by means of a hypodermic syringe to inject the solution into the subcutaneous tissues over the muscle to be divided. In operations on the canaliculi and nasal duct the cocaine should be of the strength of 20 per cent., and needs to be injected into the canaliculus to thoroughly arrest the pain.

The solution when applied to the eye even in the strength of 4 per cent. solution is said to cause the cornea to become flaccid,† it is well to bear this in mind, as it somewhat

* See Jessop, "Practitioner," page 5, January, 1885.

† See Jessop, *Ibid.*

increases the difficulty of removing foreign bodies when firmly embedded in the cornea. In operations upon the nasal mucous membranes, especially for the removal of polypi, cocaine in 20 per cent. solution is extremely valuable. The solution is well painted over the nasal fossa with a camel's hair brush. This is repeated at intervals until the parts are insensible. The surgeon then proceeds to remove the growths until there is evidence of pain. Halting for a few seconds and reapplying the cocaine, the anæsthesia is again profound, and in this way the operation is completed. By using solutions of this strength, overgrown mucous membrane may be torn from the turbinated bones, tonsils removed, and the uvula amputated with a minimum amount of inconvenience to the patient and greatly to the advantage of the operator.

To facilitate the employment of cocaine in ophthalmic practice, easily soluble tablets are prepared: one of these, placed in the oculo-palpebral fold, will serve to produce anæsthesia of the conjunctiva ("B. P.," 1885).

To the laryngologist it is indispensable, for the application of a 20 per cent. solution not only renders the fauces tolerant of the mirror, but by blunting the sensibility of the larynx

enables papillomata and similar growths to be removed from this organ by simpler means than would otherwise be possible. In addition, topical applications of cocaine either with a brush or in the form of a spray are exceedingly serviceable in many painful forms of

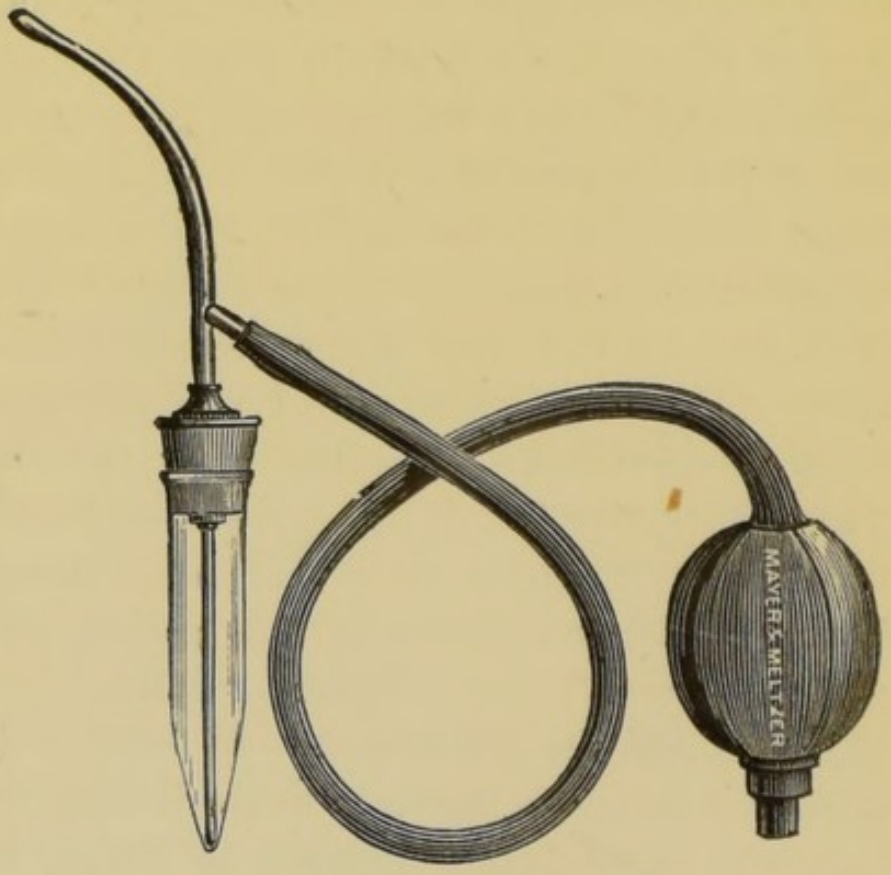


Fig. 8.—Miller's Atomiser.

sore throat and in dysphagia. It is well to remember that before applying solutions of cocaine to mucous membranes, the part should be well dried, otherwise its anæsthetic properties do not display themselves to the full.

Cocaine solution may be readily applied to the throat by means of a spray or atomiser. A good form of atomiser is that invented by W. J. Miller (see fig. 8).

On the mucous membrane of the genito-urinary tract cocaine exerts very beneficial effects. In cases where catheterisation, on account of extreme sensibility of the urethra, is badly borne, an injection of a small quantity of a 20 per cent. solution annuls it. If a stricture be present, the injection rarely passes beyond it. In these cases smearing the catheter with vaseline containing 5 per cent. of hydrochlorate of cocaine is often very serviceable. In painful cystitis the injection of a 4 per cent. or even a stronger solution affords great relief.

There are very many other purposes to which cocaine may be applied, such as local applications to relieve neuralgia, and otalgia, for sprinkling on burns and scalds, to allay the irritation of uterine stems, &c. These uses, however, are outside the scope of this little work.

Several ingenious methods have been devised to employ the hypodermic injection of cocaine in amputations, but the injection of large quantities of this drug into the tissues

even when its entrance into the circulation is hindered by the tourniquet is open to many grave objections. In dentistry, the usefulness of cocaine is not great. For teeth extraction small doses are useless, and large ones are not free from risk and many alarming cases have been reported. The utility of cocaine and its risks are discussed in two elaborate papers by Mr. W. Hern and Dr. Geo. Cunningham before the Odontological Society of Great Britain.*

The toxic effects of cocaine.—The very general employment of cocaine as an anæsthetic in minor surgical operations has resulted in the publication of cases in which the exhibition of the drug has led to toxic effects.

It would seem that untoward symptoms produced by injections of this drug are extreme pallor, faintness, intermission of the pulse, and pain in the precordial region. Vomiting is produced in some cases, whilst in others the patient becomes unconscious. It has been found that when strong solutions of cocaine are applied to the eye, a certain amount of exophthalmos follows, but this soon passes off and gives rise to no unpleasant effects. I am not aware that in any of the recorded cases of cocaine intoxi-

* "Trans. Odont. Soc., Gt. Britain," vol. xix.

cation this curious phenomenon has been noticed.

An examination of the recorded cases of toxic effects caused by this drug, shows that in some instances a very small dose may produce as alarming symptoms as when a very large dose is administered. These effects have followed the instillation into the eye of a few drops of a 20 per cent. solution, also when one grain has been administered hypodermically.

In most cases the patients have been women, or men in feeble health. The same results, however, have also followed the injection of a grain of cocaine dissolved in water and injected into the prepuce of a guardsman.* In one reported case, again, a morphia habitué survived the subcutaneous administration of twenty-three grains in one day.

The treatment to be adopted in cases of cocaine poisoning is that in vogue for dealing with syncope. The patient should be placed on the floor, or on a couch at full length, and allowed fresh air, brandy being cautiously administered.

* "Lancet," December 18, 1886.

INDEX.

LONDON: PRINTED BY H. K. LEWIS, 136 GOWER STREET, W.C.

SELECTED LIST
OF
NEW AND RECENT WORKS
PUBLISHED BY
H. K. LEWIS,
136 GOWER STREET, LONDON, W.C.
(ESTABLISHED 1844)

**** *For full list of works in Medicine and Surgery published by H. K. Lewis see complete Catalogue sent post free on application.*

ALFRED H. CARTER, M.D. LOND.
Member of the Royal College of Physicians; Physician to the Queen's Hospital, Birmingham, &c.

ELEMENTS OF PRACTICAL MEDICINE. Sixth Edition, crown 8vo, 9s. [*Just published.*

SIDNEY COUPLAND, M.D., F.R.C.P.
Physician to the Middlesex Hospital, and Lecturer on Practical Medicine in the Medical School; Examiner in Medicine at the Examining Board for England.

NOTES ON THE EXAMINATION OF THE SPUTUM, VOMIT, FÆCES, AND URINE. 12mo, 1s. *nett*, interleaved 1s. 6d. *nett*. [*Just published.*

PROCTER S. HUTCHINSON, M.R.C.S.
Assistant Surgeon to the Hospital for Diseases of the Throat.

A MANUAL OF DISEASES OF THE NOSE AND THROAT; including the Nose, Naso-pharynx, Pharynx, and Larynx. With Illustrations, cr. 8vo, 3s. 6d. [*Now ready.*

HENRY R. SWANZY, A.M., M.B., F.R.C.S.I.
Examiner in Ophthalmic Surgery in the Royal University of Ireland; Surgeon to the National Eye and Ear Infirmary, Dublin, etc.

A HANDBOOK OF DISEASES OF THE EYE AND THEIR TREATMENT. Third Edition, Illustrated with Wood Engravings, Colour Tests, etc., large post 8vo, 10s. 6d.

1000—4/91.

SIR WILLIAM AITKEN, KNT., M.D., F.R.S.
Professor of Pathology in the Army Medical School.

ON THE ANIMAL ALKALOIDS, THE PTOMAINES, LEUCOMAINES, AND EXTRACTIVES IN THEIR PATHOLOGICAL RELATIONS. Second edition, crown 8vo, 3s. 6d.

E. CRESSWELL BABER, M.B. LOND.
Surgeon to the Brighton and Sussex Throat and Ear Dispensary.

A GUIDE TO THE EXAMINATION OF THE NOSE WITH REMARKS ON THE DIAGNOSIS OF DISEASES OF THE NASAL CAVITIES. With Illustrations, small 8vo, 5s. 6d.

JAMES B. BALL, M.D. (LOND.), M.R.C.P.
Physician to the Department for Diseases of the Throat and Nose, and Senior Assistant Physician, West London Hospital.

A HANDBOOK OF DISEASES OF THE NOSE AND NASO-PHARYNX. With Illustrations, post 8vo, 6s.
[*Now ready.*

G. GRANVILLE BANTOCK, M.D., F.R.C.S. EDIN.
Surgeon to the Samaritan Free Hospital for Women and Children.

I.

RUPTURE OF THE FEMALE PERINEUM. Second Edition, with Illustrations, 8vo, 3s. 6d.

II.

ON THE USE AND ABUSE OF PESSARIES. With Illustrations, Second Edition, 8vo, 5s.

FANCOURT BARNES, M.D., M.R.C.P.
Physician to the Chelsea Hospital; Obstetric Physician to the Great Northern Hospital, &c.

A GERMAN-ENGLISH DICTIONARY OF WORDS AND TERMS USED IN MEDICINE AND ITS COGNATE SCIENCES. Square 12mo, Roxburgh binding, 9s.

H. CHARLTON BASTIAN, M.A., M.D., F.R.S.
Examiner in Medicine at the Royal College of Physicians; Physician to University College Hospital, etc.

PARALYSES: CEREBRAL, BULBAR, AND SPINAL. A Manual of Diagnosis for Students and Practitioners. With numerous Illustrations, 8vo, 12s. 6d.

E. H. BENNETT, M.D., F.R.C.S.I.
Professor of Surgery, University of Dublin,
AND
D. J. CUNNINGHAM, M.D., F.R.C.S.I.
Professor of Anatomy and Chirurgery, University of Dublin.

THE SECTIONAL ANATOMY OF CONGENITAL CŒCAL HERNIA. With coloured plates, sm. folio, 5s. 6d.

HORATIO R. BIGELOW, M.D.
Permanent Member of the American Medical Association; Fellow of the British Gynæcological Society, etc.

GYNÆCOLOGICAL ELECTRO-THERAPEUTICS. With an introduction by Dr. Georges Apostoli. With Illustrations, demy 8vo, 8s. 6d.

DRS. BOURNEVILLE AND BRICON.

MANUAL OF HYPODERMIC MEDICATION. Translated from the Second Edition, and Edited, with Therapeutic Index of Diseases, by Andrew S. Currie, M.D. Edin., etc. Crown 8vo, 6s.

STEPHEN S. BURT, M.D.
Professor of Clinical Medicine and Physical Diagnosis in the New York Post-graduate Medical School and Hospital.

EXPLORATION OF THE CHEST IN HEALTH AND DISEASE. Post 8vo, 6s.

HARRY CAMPBELL, M.D., B.S. LOND.
Member of the Royal College of Physicians; Assistant Physician and Pathologist to the North-West London Hospital.

I.

THE CAUSATION OF DISEASE. An exposition of the ultimate factors which induce it. Demy 8vo, 12s. 6d.

II.

FLUSHING AND MORBID BLUSHING, THEIR PATHOLOGY AND TREATMENT. With plates and wood engravings, royal 8vo, 10s. 6d.

P. CAZEAUX.
Adjunct Professor in the Faculty of Medicine of Paris, &c.
AND
S. TARNIER.
Professor of Obstetrics in the Faculty of Medicine of Paris.

OBSTETRICS: THE THEORY AND PRACTICE; including the Diseases of Pregnancy and Parturition, Obstetrical Operations, &c. Seventh Edition, with plates, and wood-engravings, royal 8vo, 35s.

FRANCIS HENRY CHAMPNEYS, M.A., M.B. OXON., F.R.C.P.
Obstetric Physician and Lecturer on Obstetric Medicine at St. George's Hospital; Examiner in Obstetric Medicine in the University of London, etc.

EXPERIMENTAL RESEARCHES IN ARTIFICIAL RESPIRATION IN STILLBORN CHILDREN, AND ALLIED SUBJECTS. Crown 8vo, 3s. 6d.

W. BRUCE CLARKE, M.A., M.B. OXON., F.R.C.S.
Assistant Surgeon to, and Senior Demonstrator of Anatomy and Operative Surgery at St. Bartholomew's Hospital, &c.

THE DIAGNOSIS AND TREATMENT OF DISEASES OF THE KIDNEY AMENABLE TO DIRECT SURGICAL INTERFERENCE. Demy 8vo, with Illustrations, 7s. 6d.

WALTER S. COLMAN, M.B. LOND.
Formerly Assistant to the Professor of Pathology in the University of Edinburgh.

SECTION CUTTING AND STAINING: A Practical Guide to the Preparation of Normal and Morbid Histological Specimens. Illustrations, crown 8vo, 3s.

W. H. CORFIELD, M.A., M.D. OXON.
Professor of Hygiene and Public Health in University College, London.

DWELLING HOUSES: their Sanitary Construction and Arrangements. Third Edition, with Illustrations, crown 8vo. [*In the press.*

EDWARD COTTERELL, M.R.C.S. ENG., L.R.C.P. LOND.

ON SOME COMMON INJURIES TO LIMBS: their Treatment and After-Treatment including Bone-Setting (so-called). Imp. 16mo, with Illustrations, 3s. 6d.

CHARLES CREIGHTON, M.D.

ILLUSTRATIONS OF UNCONSCIOUS MEMORY IN DISEASE, including a Theory of Alteratives. Post 8vo, 6s.

H. RADCLIFFE CROCKER, M.D. LOND., B.S., F.R.C.P.
Physician, Skin Department, University College Hospital.

DISEASES OF THE SKIN: THEIR DESCRIPTION, PATHOLOGY, DIAGNOSIS, AND TREATMENT. With Illustrations, 8vo, 21s.

EDGAR M. CROOKSHANK, M.B. LOND., F.R.M.S.
Professor of Bacteriology, King's College, London.

I.

MANUAL OF BACTERIOLOGY. Third Edition, coloured plates and wood engravings, 8vo, 21s.

II.

HISTORY AND PATHOLOGY OF VACCINATION. 2 vols., royal 8vo, coloured plates, 36s.

HERBERT DAVIES, M.D., F.R.C.P.
Late Consulting Physician to the London Hospital, and formerly Fellow of Queen's College, Cambridge.

THE MECHANISM OF THE CIRCULATION OF THE BLOOD THROUGH ORGANICALLY DISEASED HEARTS. Edited by ARTHUR TEMPLER DAVIES, B.A. M.D. Cantab., M.R.C.P. Crown 8vo, 3s. 6d.

HENRY DAVIS, M.R.C.S. ENG.
Teacher and Administrator of Anæsthetics to St. Mary's and the National Dental Hospitals.

GUIDE TO THE ADMINISTRATION OF ANÆSTHETICS. Fcap. 8vo, 2s.

ARTHUR W. EDIS, M.D. LOND., F.R.C.P.
Senior Physician to the Chelsea Hospital for Women; Late Obstetric Physician to the Middlesex Hospital.

STERILITY IN WOMEN: including its Causation and Treatment. With 33 Illustrations, 8vo, 6s. [*Just published.*

AUSTIN FLINT, M.D., LL.D.
Professor of Physiology and Physiological Anatomy at the Bellevue Hospital Medical College, New York, &c., &c.

A TEXT-BOOK OF HUMAN PHYSIOLOGY. Fourth edition, with 316 illustrations, royal 8vo, 25s.

J. MILNER FOTHERGILL, M.D.

I.

A MANUAL OF DIETETICS. Large 8vo, 10s. 6d.

II.

THE HEART AND ITS DISEASES, WITH THEIR TREATMENT; INCLUDING THE GOUTY HEART. Second Edition, entirely re-written, copiously illustrated with woodcuts and lithographic plates, 8vo, 16s.

III.

INDIGESTION, BILIOUSNESS, AND GOUT IN ITS PROTEAN ASPECTS.

PART I.—INDIGESTION AND BILIOUSNESS. Second Edition, post 8vo, 7s. 6d.

PART II.—GOUT IN ITS PROTEAN ASPECTS. Post 8vo, 7s. 6d.

IV.

THE TOWN DWELLER: HIS NEEDS AND HIS WANTS. Post 8vo, 3s. 6d.

FORTESCUE FOX, M.D. LOND.
Fellow of the Medical Society of London.

STRATHPEFFER SPA, ITS CLIMATE AND WATERS, with observations, historical, medical, and general, descriptive of the vicinity. Illustrated, cr. 8vo, 2s. 6d. *nett*.

JOHN HENRY GARRETT, M.D.
Licentiate in Sanitary Science and Diplomate in Public Health, Universities of Durham and Cambridge, &c.

THE ACTION OF WATER ON LEAD: being an inquiry into the cause and mode of the action and its prevention. Crown 8vo, 4s. 6d.

ALFRED W. GERRARD, F.C.S.
Examiner to the Pharmaceutical Society; Teacher of Pharmacy and Demonstrator of Materia Medica to University College Hospital, etc.

ELEMENTS OF MATERIA MEDICA AND PHARMACY. Crown 8vo, 8s. 6d.

JOHN GORHAM, M.R.C.S.
Fellow of the Physical Society of Guy's Hospital, etc.

TOOTH EXTRACTION: A manual of the proper mode of extracting teeth, with a Table exhibiting the names of all the teeth, the instruments required for extraction and the most approved methods of using them. Third edition, fcap 8vo, 1s. 6d.
[*Just published.*

GEORGE M. GOULD, A.B., M.D.
Ophthalmic Surgeon to the Philadelphia Hospital, etc.

A NEW MEDICAL DICTIONARY. A compact concise Vocabulary, convenient for reference, based on recent medical literature. Small 8vo, 16s.
[*Now ready.*

J. B. GRESSWELL, M.R.C.V.S.
Provincial Veterinary Surgeon to the Royal Agricultural Society.

VETERINARY PHARMACOLOGY AND THERAPEUTICS. Fcap. 8vo, 5s.

BERKELEY HILL, M.B. LOND., F.R.C.S.
Professor of Clinical Surgery in University College; Surgeon to University College Hospital, and to the Lock Hospital.

THE ESSENTIALS OF BANDAGING. For Managing Fractures and Dislocations; for administering Ether and Chloroform; and for using other Surgical Apparatus. Sixth Edition, with Illustrations, fcap. 8vo, 5s.

BERKELEY HILL, M.B. LOND., F.R.C.S.
Professor of Clinical Surgery in University College.

AND

ARTHUR COOPER, L.R.C.P., M.R.C.S.
Surgeon to the Westminster General Dispensary, &c.

I.

SYPHILIS AND LOCAL CONTAGIOUS DISORDERS. Second Edition, entirely re-written, royal 8vo, 18s.

II.

THE STUDENT'S MANUAL OF VENEREAL DISEASES. Being a Concise Description of those Affections and of their Treatment. Fourth Edition, post 8vo, 2s. 6d.

NORMAN KERR, M.D., F.L.S.

[President of the Society for the Study of Inebriety; Consulting Physician, Dalrymple Home for Inebriates, etc.

INEBRIETY: ITS ETIOLOGY, PATHOLOGY, TREATMENT, AND JURISPRUDENCE. Second Edition, crown 8vo, 12s. 6d. [*Now ready*

J. WICKHAM LEGG, F.R.C.P.

Assistant Physician to Saint Bartholomew's Hospital, and Lecturer on Pathological Anatomy in the Medical School.

A GUIDE TO THE EXAMINATION OF THE URINE; intended chiefly for Clinical Clerks and Students. Sixth Edition, revised and enlarged, with additional Illustrations, fcap. 8vo, 2s. 6d.

LEWIS'S POCKET CASE BOOK FOR PRACTITIONERS AND STUDENTS. Designed by A. T. BRAND, M.D. Roan, with pencil, 3s. 6d. *nett.*

LEWIS'S POCKET MEDICAL VOCABULARY.
Second Edition, 32mo, limp roan, 3s. 6d. [*Just ready.*

T. R. LEWIS, M.B., F.R.S. ELECT, ETC.

Late Fellow of the Calcutta University; Surgeon-Major Army Medical Staff.

PHYSIOLOGICAL AND PATHOLOGICAL RESEARCHES. Arranged and edited by SIR WM. AITKEN, M.D., F.R.S., G. E. DOBSON, M.B., F.R.S., and A. E. BROWN, B.Sc. Crown 4to, portrait, 5 maps, 43 plates including 15 chromolithographs, and 67 wood engravings, 30s. *nett.*

WILLIAM THOMPSON LUSK, A.M., M.D.

Professor of Obstetrics and Diseases of Women in the Bellevue Hospital Medical College, &c.

THE SCIENCE AND ART OF MIDWIFERY. Third Edition, revised and enlarged, with numerous Illustrations, 8vo, 18s.

JEFFERY A. MARSTON, M.D., C.B., F.R.C.S., M.R.C.P. LOND.

Surgeon General Medical Staff (Retired).

NOTES ON TYPHOID FEVER: Tropical Life and its Sequelæ. Crown 8vo, 3s. 6d. [*Now ready.*

LEWIS'S PRACTICAL SERIES.

These volumes are written by well-known Hospital Physicians and Surgeons recognised as authorities in the subjects of which they treat. They are of a thoroughly Practical nature, and calculated to meet the requirements of the general Practitioner and Student and to present the most recent information in a compact and readable form; the volumes are handsomely got up and issued at low prices, varying with the size of the works.

HYGIENE AND PUBLIC HEALTH.

By LOUIS C. PARKES, M.D., D.P.H. Lond. Univ., Assistant Professor of Hygiene, University College, London; Fellow, and Member of the Board of Examiners of the Sanitary Institute; etc. Second Edition, with Illustrations, cr. 8vo., 9s. [*Now ready.*

MANUAL OF OPHTHALMIC PRACTICE.

By C. HIGGENS, F.R.C.S, Ophthalmic Surgeon to Guy's Hospital; Lecturer on Ophthalmology at Guy's Hospital Medical School. Illustrations, crown 8vo, 6s.

A PRACTICAL TEXTBOOK OF THE DISEASES OF WOMEN.

By ARTHUR H. N. LEWERS, M.D. Lond., M.R.C.P. Lond., Assistant Obstetric Physician to the London Hospital; Examiner in Midwifery and Diseases of Women to the Society of Apothecaries of London; etc. Third Edition, with Illustrations, crown 8vo, 10s. 6d.
[*Just ready.*

ANÆSTHETICS THEIR USES AND ADMINISTRATION.

By DUDLEY W. BUXTON, M.D., B.S., M.R.C.P., Administrator of Anæsthetics to University College Hospital and to the Hospital for Women, Soho Square. Second Edition, crown 8vo. [*Nearly ready.*

TREATMENT OF DISEASE IN CHILDREN: EMBODYING THE OUTLINES OF DIAGNOSIS AND THE CHIEF PATHOLOGICAL DIFFERENCES BETWEEN CHILDREN AND ADULTS.

By ANGEL MONEY, M.D., F.R.C.P., Assistant Physician to the Hospital for Children, Great Ormond Street, and to University College Hospital. Second Edition, crown 8vo, 10s. 6d.

ON FEVERS: THEIR HISTORY, ETIOLOGY, DIAGNOSIS, PROGNOSIS, AND TREATMENT.

By ALEXANDER COLLIE, M.D. (Aberdeen), Medical Superintendent of the Eastern Hospitals. Coloured plates, cr. 8vo, 8s. 6d.

HANDBOOK OF DISEASES OF THE EAR FOR THE USE OF STUDENTS AND PRACTITIONERS.

By URBAN PRITCHARD, M.D. (Edin.), F.R.C.S. (Eng.), Professor of Aural Surgery at King's College, London; Aural Surgeon to King's College Hospital. Second Edition, with Illustrations, crown 8vo. [*Just ready.*

A PRACTICAL TREATISE ON DISEASES OF THE KIDNEYS AND URINARY DERANGEMENTS.

By C. H. RALFE, M.A., M.D. Cantab., F.R.C.P. Lond., Assistant Physician to the London Hospital. With Illustrations, crown 8vo, 10s. 6d.

DENTAL SURGERY FOR GENERAL PRACTITIONERS AND STUDENTS OF MEDICINE.

By ASHLEY W. BARRETT, M.B. Lond., M.R.C.S., L.D.S., Dental Surgeon to, and Lecturer on Dental Surgery and Pathology in the Medical School of, the London Hospital. Second Edition, with Illustrations, crown 8vo, 3s. 6d

BODILY DEFORMITIES AND THEIR TREATMENT: A Handbook of Practical Orthopædics.

By H. A. REEVES, F.R.C.S. Ed., Senior Assistant Surgeon and Teacher of Practical Surgery at the London Hospital. With numerous Illustrations, crown 8vo, 8s. 6d.

*** *Further Volumes will be announced in due course.*

WILLIAM MARTINDALE, F.C.S.
AND
W. WYNN WESTCOTT, M.B. LOND.

THE EXTRA PHARMACOPŒIA with the additions introduced into the British Pharmacopœia 1885; and Medical References, and a Therapeutic Index of Diseases and Symptoms. Sixth Edition, limp roan, med. 24mo, 7s. 6d.
[*Now ready.*

ANGEL MONEY, M.D., F.R.C.P.
Assistant Physician to University College Hospital, and to the Hospital for Sick Children, Great Ormond Street.

THE STUDENT'S TEXTBOOK OF THE PRACTICE OF MEDICINE. Fcap. 8vo, 6s. 6d.

A. STANFORD MORTON, M.B., F.R.C.S. ENG.
Senior Assistant Surgeon, Royal South London Ophthalmic Hospital.

REFRACTION OF THE EYE: Its Diagnosis, and the Correction of its Errors, with Chapter on Keratoscopy. Third Edition. Small 8vo, 3s.

C. W. MANSELL MOULLIN, M.A., M.D. OXON., F.R.C.S. ENG.
Assistant Surgeon and Senior Demonstrator of Anatomy at the London Hospital.

SPRAINS; THEIR CONSEQUENCES AND TREATMENT. Crown 8vo, 5s.

WILLIAM MURRELL, M.D., F.R.C.P.
Lecturer on Materia Medica and Therapeutics at Westminster Hospital.

I.

MASSOTHERAPEUTICS; OR MASSAGE AS A MODE OF TREATMENT. Fifth Edition, crown 8vo, 4s. 6d. [*Now ready.*

II.

WHAT TO DO IN CASES OF POISONING. Sixth Edition, royal 32mo, 3s. 6d. [*Just published.*

G. OLIVER, M.D., F.R.C.P.

I.

ON BEDSIDE URINE TESTING: a Clinical Guide to the Observation of Urine in the course of Work. Fourth Edition, fcap. 8vo, 3s. 6d.

II.

THE HARROGATE WATERS: Data Chemical and Therapeutical, with notes on the Climate of Harrogate. Crown 8vo, with Map of the Wells, 3s. 6d.

K. W. OSTROM.
Instructor in Massage and Swedish Movements in the Hospital of the University of Pennsylvania.

MASSAGE AND THE ORIGINAL SWEDISH MOVEMENTS. With Illustrations, 12mo, 2s. 6d. *nett.*

R. DOUGLAS POWELL, M.D., F.R.C.P., M.R.C.S.
Physician to the Hospital for Consumption and Diseases of the Chest at Brompton, Physician to the Middlesex Hospital.

DISEASES OF THE LUNGS AND PLEURÆ INCLUDING CONSUMPTION. Third Edition, with coloured plates and wood-engravings, 8vo, 16s.

FRANCIS H. RANKIN, M.D.
President of the Newport Medical Society.

HYGIENE OF CHILDHOOD: Suggestions for the care of children after the period of infancy to the completion of puberty. Crown 8vo, 3s.

SAMUEL RIDEAL, D.SC. (LOND.), F.I.C., F.C.S., F.G.S.
Fellow of University College, London.

I.

PRACTICAL ORGANIC CHEMISTRY. The detection and properties of some of the more important organic compounds. 12mo, 2s. 6d.

II.

PRACTICAL CHEMISTRY FOR MEDICAL STUDENTS, Required at the First Examination of the Conjoint Examining Board in England. Fcap. 8vo, 2s.

E. A. RIDSDALE.
Associate of the Royal School of Mines.

COSMIC EVOLUTION: being Speculations on the Origin of our Environment. Fcap. 8vo, 3s.

SYDNEY RINGER, M.D., F.R.S.
Professor of the Principles and Practice of Medicine in University College, Physician to, and Professor of Clinical Medicine in, University College Hospital.

A HANDBOOK OF THERAPEUTICS. Twelfth Edition, revised, 8vo, 15s.

FREDERICK T. ROBERTS, M.D., B.SC., F.R.C.P.
Examiner in Medicine at the University of London; Professor of Therapeutics in University College; Physician to University College Hospital; Physician to the Brompton Consumption Hospital, &c.

I.

A HANDBOOK OF THE THEORY AND PRACTICE OF MEDICINE. Eighth Edition, with Illustrations, large 8vo, 21s.

II.

THE OFFICINAL MATERIA MEDICA. Second Edit., entirely rewritten in accordance with the latest British Pharmacopœia, fcap. 8vo, 7s. 6d.

ROBSON ROOSE, M.D., F.R.C.P. EDIN.

I.

LEPROSY, AND ITS TREATMENT AS ILLUSTRATED BY NORWEGIAN EXPERIENCE. Crown 8vo, 3s. 6d.

II.

GOUT, AND ITS RELATIONS TO DISEASES OF THE LIVER AND KIDNEYS. Sixth Edition, crown 8vo, 3s. 6d.

BERNARD ROTH, F.R.C.S.
Fellow of the Medical Society of London.

THE TREATMENT OF LATERAL CURVATURE OF THE SPINE. Demy 8vo, with Photographic and other Illustrations, 5s.

DR. B. S. SCHULTZE.

THE PATHOLOGY AND TREATMENT OF DISPLACEMENTS OF THE UTERUS. Translated by J. J. Macan, M.A., M.R.C.S., and edited by A. V. Macan, B.A., M.B., Master of the Rotunda Lying-in Hospital, Dublin. With Illustrations, medium 8vo, 12s. 6d.

JOHN SHAW, M.D. LOND., M.R.C.P.
Obstetric Physician to the North-West London Hospital.

ANTISEPTICS IN OBSTETRIC NURSING. A Textbook for Nurses on the Application of Antiseptics to Gynæcology and Midwifery. Coloured plates and woodcuts, 8vo, 3s. 6d.

WM. JAPP SINCLAIR, M.A., M.D.
Honorary Physician to the Manchester Southern Hospital for Women and Children, and Manchester Maternity Hospital.

ON GONORRHŒAL INFECTION IN WOMEN. Post 8vo, 4s.

ALEXANDER J. C. SKENE, M.D.
Professor of Gynæcology in the Long Island College Hospital, Brooklyn.

TREATISE ON THE DISEASES OF WOMEN. With 251 engravings and 9 chromo-lithographs, medium 8vo, 28s.

ALDER SMITH, M.B. LOND., F.R.C.S.
Resident Medical Officer, Christ's Hospital, London.

RINGWORM: ITS DIAGNOSIS AND TREATMENT. Third Edition, rewritten and enlarged, with Illustrations, fcap. 8vo, 5s. 6d.

JOHN KENT SPENDER, M.D. LOND.
Physician to the Royal Mineral Water Hospital, Bath.

THE EARLY SYMPTOMS AND THE EARLY TREATMENT OF OSTEO-ARTHRITIS, commonly called Rheumatoid Arthritis. With special reference to the Bath Thermal Waters. Small 8vo, 2s. 6d.

LOUIS STARR, M.D.
Clinical Professor of Diseases of Children in the Hospital of the University of Pennsylvania.

HYGIENE OF THE NURSERY. Including the General Regimen and Feeding of Infants and Children, and the Domestic Management of the Ordinary Emergencies of Early Life. Second edition, with illustrations, crown 8vo, 3s. 6d.

W. R. H. STEWART, F.R.C.S., L.R.C.P. EDIN.
Aural Surgeon to the Great Northern Central Hospital; Surgeon to the London Throat Hospital, &c.

EPITOME OF DISEASES AND INJURIES OF THE EAR. Royal 32mo, 2s. 6d.

LEWIS A. STIMSON, B.A., M.D.
Professor of Clinical Surgery in the Medical Faculty of the University of the City of New York, etc.

A MANUAL OF OPERATIVE SURGERY. With three hundred and forty-two Illustrations. Second Edition, post 8vo, 10s. 6d.

JUKES DE STYRAP, M.K.Q.C.P.

Physician-Extraordinary, late Physician in Ordinary to the Salop Infirmary; Consulting Physician to the South Salop and Montgomeryshire Infirmaries, etc.

I.

THE YOUNG PRACTITIONER: With practical hints and instructive suggestions, as subsidiary aids, for his guidance on entering into private practice. Demy 8vo, 7s. 6d. *nett.*

II.

A CODE OF MEDICAL ETHICS: With general and special rules for the guidance of the faculty and the public in the complex relations of professional life. Third edition, demy 8vo, 3s. *nett.*

III.

MEDICO-CHIRURGICAL TARIFFS. Fourth edition, revised and enlarged, fcap. 4to, 2s. *nett.*

IV.

THE YOUNG PRACTITIONER: HIS CODE AND TARIFF. Being the above three works in one volume. Demy 8vo, 10s. 6d. *nett.*

C. W. SUCKLING, M.D. LOND., M.R.C.P.

Professor of Materia Medica and Therapeutics at the Queen's College, Physician to the Queen's Hospital, Birmingham, etc.

I.

ON THE DIAGNOSIS OF DISEASES OF THE BRAIN, SPINAL CORD, AND NERVES. With Illustrations, crown 8vo, 8s. 6d.

II.

ON THE TREATMENT OF DISEASES OF THE NERVOUS SYSTEM. Crown 8vo, 7s. 6d.

JOHN BLAND SUTTON, F.R.C.S.

Lecturer on Comparative Anatomy, and Assistant Surgeon to the Middlesex Hospital.

LIGAMENTS: THEIR NATURE AND MORPHOLOGY. Wood engravings, post 8vo, 4s. 6d.

EUGENE S. TALBOT, M.D., D.D.S.

Professor of Dental Surgery in the Women's Medical College.

IRREGULARITIES OF THE TEETH AND THEIR TREATMENT. With 152 Illustrations, royal 8vo, 10s. 6d.

H. COUPLAND TAYLOR, M.D.
Fellow of the Royal Meteorological Society.

WANDERINGS IN SEARCH OF HEALTH, OR MEDICAL AND METEOROLOGICAL NOTES ON VARIOUS FOREIGN HEALTH RESORTS. Crown 8vo, with illustrations, 6s. [*Now ready.*

E. G. WHITTLE, M.D. LOND., F.R.C.S. ENG.
Senior Surgeon to the Royal Alexandra Hospital, for Sick Children, Brighton.

CONGESTIVE NEURASTHENIA, OR INSOMNIA AND NERVE DEPRESSION. Crown 8vo, 3s. 6d.

JOHN WILLIAMS, M.D., F.R.C.P.
Professor of Midwifery in University College, London; Obstetric Physician to University College Hospital

CANCER OF THE UTERUS: BEING THE HARVEIAN LECTURES FOR 1886. Illustrated with Lithographic Plates, royal 8vo, 10s. 6d.

BERTRAM C. A. WINDLE, M.A., M.D. DUBL.
Professor of Anatomy in the Queen's College, Birmingham; Examiner in Anatomy in the Universities of Cambridge and Durham.

A HANDBOOK OF SURFACE ANATOMY AND LANDMARKS. Illustrations, post 8vo, 3s. 6d.
[*Just published.*

EDWARD WOAKES, M.D.
Senior Aural Surgeon and Lecturer on Aural Surgery at the London Hospital, Surgeon to the London Throat Hospital.

I.

POST-NASAL CATARRH, AND DISEASES OF THE NOSE CAUSING DEAFNESS. With Illustrations, crown 8vo, 6s. 6d.

II.

NASAL POLYPUS: WITH NEURALGIA, HAY-FEVER, AND ASTHMA, IN RELATION TO ETHMOIDITIS. With Illustrations, crown 8vo, 4s. 6d.

DAVID YOUNG, M.C., M.B., M.D.
Fellow of, and late Examiner in Midwifery to, the University of Bombay, etc.

ROME IN WINTER AND THE TUSCAN HILLS IN SUMMER. A Contribution to the Climate of Italy. Small 8vo, 6s.

PERIODICAL WORKS PUBLISHED BY H. K. LEWIS.

THE NEW SYDENHAM SOCIETY'S PUBLICATIONS. Annual Subscription, One Guinea.

Report of the Society, with Complete List of Works and other information, gratis on application.

THE BRITISH JOURNAL OF DERMATOLOGY. Edited by Malcolm Morris and H. G. Brooke. Published monthly, 1s. per no. Annual Subscription, 12s. post free.

THE THERAPEUTIC GAZETTE. A Monthly Journal, devoted to the Science of Pharmacology, and to the introduction of New Therapeutic Agents. Edited by Drs. H. C. Wood and R. M. Smith. Annual Subscription, 10s., post free.

THE GLASGOW MEDICAL JOURNAL. Published Monthly Annual Subscription, 20s., post free. Single numbers, 2s. each.

LIVERPOOL MEDICO-CHIRURGICAL JOURNAL, including the Proceedings of the Liverpool Medical Institution. Published twice yearly 3s. 6d. each number.

MIDDLESEX HOSPITAL. Reports of the Medical, Surgical, and Pathological Registrars for 1883 to 1888. Demy 8vo, 2s. 6d. *nett* each volume.

TRANSACTIONS OF THE COLLEGE OF PHYSICIANS OF PHILADELPHIA. Volumes I. to VI., 8vo, 10s. 6d. each.

CLINICAL CHARTS FOR TEMPERATURE OBSERVATIONS, ETC. Arranged by W. Rigden, M.R.C.S. Price 1s. per doz., 7s. per 100, 15s. per 250, 28s. per 500, 50s, per 1000.

Each Chart is arranged for four weeks, and is ruled at the back for making notes of cases; they are convenient in size, and are suitable both for hospital and private cases.

LEWIS'S NURSING CHART. 25s. per 1000, 14s. per 500, 3s. 6d. per 100, 2s. per 50, or 1s. per 20.

*** Mr. Lewis is in constant communication with the leading publishing firms in America and has transactions with them for the sale of his publications in that country. Advantageous arrangements are made in the interests of Authors for the publishing of their works in the United States.

Mr. Lewis's publications can be procured of any Bookseller in any part of the world.

Complete Catalogue of Publications post free on application.

Printed by H K. Lewis, Gower Street, London, W.C.