On inhalation as a means of local treatment of the organs of respiration by atomized fluids and gases / by Hermann Beigel.

ON INHALATION.

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AS A MEANS OF

LOCAL TREATMENT

OF

THE ORGANS OF RESPIRATION,

BY

ATOMIZED FLUIDS AND GASES.

BY

HERMANN BEIGEL, M.D., L.R.C.P.L.,

Assistant-Physician to the Metropolitan Free Hospital;

Member of the Imperial Leopoldino-Carolina Academy of Natural Philosophy; of the Imperial Botanical and Zoological Society, Vienna; of the German Society of Physicians and Naturalists, Paris; of the Pathological Society; Fellow of the Anthropological Society, London; and late Physician to the Spas of Reinerz, Silesia.

WITH WOODCUTS.

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TO

VICTOR, BARON VON ERLANGER.

My Dear Sir and Friend,

The remembrance of past days, when we used to sit together and to discuss matters, concerning science and art, until the clock's never-resting hand pointed to an hour indicating the approaching young morning, and admonishing us to depart, will always fill me with pleasure and satisfaction. And the attentiveness with which you used to listen when I spoke of that science, to which I have devoted my life—of natural philosophy in general, and of medicine in particular,—and the interest you used to take in the progress and inventions made in the healing art, was refreshed anew in my mind, when writing this book.

You, being about to leave this great and glorious country, would add a new favour to those already bestowed upon me, by the kind acceptance of the dedication of this treatise, the elaboration of which gave me great pleasure, heightened by the thought of its bearing your name, and of its inducing you to recall to your mind many a happy reminiscence of bygone times, when you dwell and act again on that soil, where childhood's lofty dreams will unite with the earnest thoughts of mature age.

HERMANN BEIGEL.

PREFACE.

MEDICINE, as practised in our days, *viz.* as a branch of, and entirely based upon, natural philosophy, is a recent science. The progress recently made in some departments of that science is astonishing. In this respect it is merely necessary to allude to the strictly physical examination of the patient in certain affections, which enables us to diagnose diseases, of the *existence* of which former physicians had not the slightest perception. And yet a minute, scientific diagnosis is the only basis for rational treatment.

In other departments the progress could not be so rapid, being dependent upon the development of other sciences. I speak of Therapeutics. Here the evil lies in our being compelled to introduce a medicament into the circulation of the blood, and to act upon all organs, and not upon those only which really are affected.

Moreover, between the administration of a medicament and its effect, a concatination of a great number of processes takes place, which are unknown to us, and therefore, cannot be taken into consideration before experimental Physiology, Chemistry, Microscopy, &c., have stepped many paces forward. Who knows how any medicament, internally taken, acts upon the blood? How the nerves are excited by it? How the muscles, their fibres, and other tissues participate in conducting a great number of processes to that point, which we call *the effect* of the medicament?

In order to lessen the number of links in the chain of action, the treatment of our days endeavours to become *local*, wherever it is feasible. Two excellent results have recently been obtained in this direction, the one is the *hypodermic injection*, by Alexander Wood, in Edinburgh, and the other, the *inhalation of atomized fluids*, by Sales-Girons.

If there is any medicament which deserves to be called a "specific," hypodermic injections deserve that name when applied in nervous, in rheumatic,

and similar diseases; and the value of inhalations is the greater as they render great services in those illnesses which generally prove fatal to a vast number of the human race—*viz.* diseases of the organs of respiration. Chronic bronchitis is one of those foes which medicine opposes but feebly; consumption and death are still almost synonyms; and although inhalations cannot boast of being able to *cure* phthisis, yet in many cases they are able to alleviate troublesome symptoms, and to place the patient in such a position as will enable him to pursue his ordinary avocations in life. At all events, it cannot be doubted any longer that inhalations have proved serviceable, where a long-continued use of other medicaments failed.

Here I should not like to be misunderstood. I do not consider inhalations a Panacea for chest diseases; far be it from me to do so; I merely intend to show that, when applied to the appropriate cases, the atomized fluids are very valuable agents, and deserve to range prominently in the Materia Medica; but I fear, that the same fate awaits them as did the stethoscope and the plessimeter in the first years of

their application. At first derided, those instruments afterwards became so highly esteemed, that in our days it would be a shame for any physician not to possess that tube, which more than one applies to the chest without hearing anything or having a clear understanding, if any, of the sounds he hears.

There are already sufficient reports of cures, effected by means of medicated spray, to induce medical men to try the method, which still may be called new; but there are numbers of patients labouring from diseases of the larynx, the trachea, and lungs; voiceless, tormented by asthmatic fits, swallowing for years bottle after bottle of medicine, without deriving the slightest benefit, and yet are not advised to try the local treatment by means of pulverized medicaments.

The following pages are written with the intention of enabling those professional brethren who had no opportunity of making themselves acquainted with Sales-Girons' invention, to apply it in appropriate cases, and to form an opinion of their own.

As far as my knowledge goes, this treatise is the first in English Medical Literature, which treats more extensively on the subject, and thus actually remedies an existing want. The First Part is exclusively devoted to technics of inhalation; while the Second contains cases in which inhalations have been applied.

In respect to these cases, I must remark, that I have chosen illustrations in which, during the period when inhalations were used, no necessity existed for administering other medicines; but it need not be mentioned, that in other cases, where symptoms arose which I thought to suppress best by one of the well-known medicaments, I have never hesitated to do so; for the physician, I think, has no right to ride his hobby, if he knows better means by which to allay the patient's suffering.

Since I have published my first papers 'On the Inhalation of Atomized Fluids' ('Lancet,' Nos. 2 and 5, vol. ii., 1865), I have seen with great pleasure that in different parts of the country atomizers were used more frequently than they were before; but

should I by this book succeed in inducing my professional brethren at large, not only to make themselves acquainted with the application of the atomized fluids, but to use them in cases suited to that treatment, then I shall be fully recompensed for the time I have spent in the elaboration of the following pages.

H. Beigel.

3, Finsbury Square,
February, 1866.

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PART I.

ON INHALATION IN GENERAL.

CHAPTER I.

HISTORICAL REMARKS.

The application of medicaments is effected in a twofold manner—*viz.* either directly, on being applied immediately to the suffering part; or indirectly, by being received into the circulation of the blood, so that through this agency, which reaches all parts of the body, it may also affect those parts on which we intend to act. Where a direct influence is possible to the physician, he will never think of attempting to reach his aim by circuitous routes. The straight way in medicine is also the best and most effectual, and those branches of our art which could pursue this direct track have enjoyed quick and conspicuous progress. We need only call to our mind surgery, ophthalmology, midwifery, and, partly, also, the treatment of skin diseases.

But it is not very long since that even in such cases as catarrh of the conjunctiva, simple ulcers, scabies, &c., very many compound medicines were ordered—a kind of therapeutics which disappeared with the development of diagnosis and local treatment.

Many parts of the body will certainly, by their position, ever exclude a direct proceeding in the manner just spoken of; as, for instance, the basis cranii, the heart, the pancreas, spleen, kidneys, &c., because no accessible duct leads us to them. But the natural ways leading to others, which are therefore within our reach, have not been sufficiently appreciated. This was, especially, the case with the organs of respiration. The cavum oris and the pharynx were too easily accessible to be overlooked, but the glottis was considered a stoppage for any further advance, the trespassing on which is almost impossible.

One thing remains remarkable. It has always been observed that one of the most important occurrences in life, respiration, proceeds in the most immediate manner; that the inhalation of different gases produces very marked effects upon the organism; and althongh man was, and usually is, so ready to imitate easily explicable phenomena of Nature, and to use them for his benefit, nevertheless the attempts to gain influence upon the body, and particularly upon the organs of respiration, through breathing an artificially-created atmosphere, were comparatively rare, and, until recent time, never energetically tried. Attempts in this direction were already made in ancient times, and Hippocrates, who is rightly called "the father of medical science," has not only employed fumigations and

inhalations of vapours, but even thus describes* an apparatus, which was superior to many used for such purposes a few years ago:—

"Deinde suffitum illi ex aceto, nitro, origano, et nasturtii semine parato. Quæ leviter trita, pari aquæ mensura ad acetum permixta, et pauco oleo instillato, macerato, postea in ollam infusa, operculo apposito, arundine cava indita, mox prunis imposita fervefacito, et ubi per arundinis fistulam sursum vapor ascenderit, eum aperto ore intro trahat, ea cautione adhibita, ne fauces adurat. Exteriore vero parte spongias aqua calida imbutas ad genas et maxillas apponat."

The apparatus, therefore, consisted of a pot, the lid of which had an opening for the reception of a reed, through which the vapour escaped, which was inhaled through the opened mouth; the latter was protected from scalding by moistened sponges. Other Grecian, Roman, and Arabian physicians likewise recommended inhalations, but never attempted to use anything but vapours, fumigations, and bodies containing volatile oils; so that a non-volatile chemical body could not come into contact with the organs of respiration. The necessity of immediate application of medicaments to the organs of respiration was, nevertheless, at all times so urgently felt, that Mascagni, a very renowned

* 'Magni Hippocratis Opera Omnia, De Morbis,' lib. ii. sec. v Genevæ, 1657.

physician, once said, "If ever a specific should be devised against consumption, it would be such as to be introduced into the organism through the windpipe."

Besides this inhalation, some physicians of later date made use of blowing pulverized medicaments into the larynx in diseases of that organ. Aretæus made use of a tube for blowing, which method, in our times, has been renewed with great benefit by Trousseau and other physicians.

In many Continental spas arrangements were made to create an atmosphere suffused with mineral water, which the patient was recommended to inhale. But inasmuch as the mineral water for that purpose was turned into steam, it need not be said that the so-called "vaporatoria" or "inhalation saloons" were filled merely with common water vapours.

In 1849, Auphan, of Euzet-les-Bains, originated the idea of atomizing the mineral water, by throwing a jet of the liquid against the wall of the inhalatory. After a short time the same system was adopted in Lamote-les-Bains. But Sales-Giron first constructed at Pierrefonds an apparatus through which the fluid was subdivided into a fine mist, which was inhaled by the patients with great benefit. Yet his chief merit consists in his transferring this method from the vaporatory of the spas, to which it was hitherto restricted, into the hands of every physician, by

devising a portable inhalation apparatus. *Thus a long-cherished wish of the physicians was realized, and from that time a new era in the local therapy of the organs of respiration commences.*

When Sales-Giron placed the results obtained in his vaporatory, and in 1858 his portable apparatus, before the Académie de Médecine of Paris, great sensation was caused. At first it was questioned whether the atomized fluids reached the larynx, the trachea, and the lungs. As it will be shown hereafter, different opinions arose, and various experimenters arrived at different results. Meanwhile the new method gained more partizans. At last the Académie de Médecine took the investigation into their own hands; and on January 7th, 1862, Poggiale, the reporter of the elected committee, in a deeply-interesting, extensive, and brilliant discourse, gave a substantiated statement of the case, based upon experiments. This statement was entirely in favour of the new method; and it was experimentally proved also by other authorities, that not only the vapour, but the chemical bodies which, by being atomized, are incorporated into it, reach not only the trachea, but the cells of the lungs.

Some time after (in 1859), Mathieu constructed an apparatus, which he called nephogène, and exhibited it before the Académie de Médecine. But the greatest simplicity in the construction of the

inhalation apparatus was attained by Drs. Bergson and Siegle, whose apparatus is at present most used. Its construction is so simple, its application so convenient, and its management so easy, that it can readily be placed in the hand of every patient.

CHAPTER II.

DO THE ATOMIZED FLUIDS PASS THE LARYNX AND TRACHEA AND PENETRATE INTO THE LUNGS?

We often hear practitioners who have an innate dislike to everything called progress, because it disturbs them in the indulgence of their ideas, as being wise and learned men, and leaves them to the alternative of either making themselves acquainted with the objects of progress, which is sometimes troublesome, or remaining ignorant, which is disagreable, expressing their very learned opinion on inhalations as being "nonsensical," for the vapours do not at all penetrate into the lungs. Of course, these sages know inhalation merely by name, and neither do they consider it necessary to produce evidence to support their opinion, nor have they ever taken the trouble to make themselves acquainted with the history of the inhalations.

When Sales-Giron, on the 8th December, 1856, first read his paper: "Mémoire sur la Chambre de Respiration nouvelle de Pierrefonds," in the Hydrological Academy of Paris, all possible objections were made to the new method, and it was Durand-Fardel who particularly put the question, whether

the minute particles deeply penetrate into the respiratory tract. The discussion on the subject was very excited, and any arguments that could be brought against inhalations was at once produced by Durand-Fardel, Rotureau, Réveil, Lecomte, Fermonde, and Gerdy. Great interest was excited at different spas, experiments were made, and after the invention of the portable inhalation-apparatus, in private practice men and beasts underwent trials. On the 1st May, 1860, Gavaret reported on Sales-Giron's and Mathieu's pulverizing instruments to the Academy of Paris, and at the end of the same year Barthez published several papers, very favourably bearing on the question of treatment by atomized fluids by means of which he obtained very good results in several children who were afflicted with whooping cough. The fluid used was a solution of tannin. ('Revue Médicale,' 1866.) At the same time Pietra Santa published the result of his experiments, executed, partly in the presence of Poggiale, in the Inhalatorium at Eaux-Bonnes, which was arranged according to the principles of Sales-Giron. These results were unfavourable to the inhalation, and from trials made in a goat and a rabbit, Pietra Santa drew the conclusion that the atomized fluids do not even reach the larynx.

More extensive experiments in animals, yet with the same results, were made by Briau.

Sales-Giron, however, in an extensive paper

('L'Union Médicale, 1861'), criticized the conclusion at which those authors arrived, and illustrated the source whence their error had sprung. His opinions were adopted by Auphan in his memoir, 'De la Pulvérization à Euzet-les-Bain, et ses effets thérapeutiques,' which he laid, in April, 1861, before the Academy of Paris. According to his report, he had made use of inhalations even in Pneumonia, acute as well as chronic, and the resolution of hepatization took place in a very short time.

From all quarters of France reports of experiments on the question at issue were published or laid before the Academy; for the greatest number of them supported the conclusions pronounced by Pietra Santa and Biau.

Now the experiments of Fournié and Demarquay were published, whereby it was clearly proved, that experiments instituted on animals breathing through the nostrils furnished no appropriate evidence on the question at issue. Thus the conclusions drawn by Pietra Santa and Briau were shown to be void of all importance, and this result was the more remarkable as Monsieur Fournié was, and to the last remains, the most obstinate opponent to Sales-Giron's new method.

However important it was for the inhalations that the experiments of Pietra Santa and Briau were shown to be void of actual evidence, it was not yet shown that the atomized fluids *do* penetrate into

the channel of respiration. The results obtained by Fournié, on the contrary, were in the negative.

The most extensive researches were made by Demarquay, who, during a whole year, applied atomized fluids to diseases of the pharynx and larynx, and derived from them great benefit. Besides, he experimented with a great number of rabbits, whose nostrils he closed by means of a forceps, forcing them to accomplish the respiratory functions through the mouth. The inhalation lasted five minutes, and the atomized fluid was a solution of one grain of sesquichlorate of iron in 100 grains of water. A certain number of the rabbits were killed, and on the mucous membrane of the larynx, trachea, and bronchi undeniable proofs of the presence of the iron were produced by means of cyanate of potassium. Nearly all of the remaining rabbits perished in twenty-seven hours by pleuro-pneumonia, which gave additional evidence of the penetration of the fluids into the respiratory tracts. Experiments on men and dogs afforded similar results. Yet the most conclusive and most important observation was made on a nurse in the hospital of Beaujon. She had a tracheal fistula, into which a canula was placed, through which she respired. The tube was removed, the fistula closed, and a solution of tannin atomized and inhaled by the nurse, through her mouth. "Notwithstanding the unfavourable conditions under which the inhalations

were performed, yet the chemical reaction on the paper by which the fistula was closed, gave evidence that the fluids had reached the trachea." If the fistula was not sufficiently closed, no traces of penetration of fluids into the trachea could be discovered. Demarquay's experiments were performed before an auditory which contained the most renowned authorities of Paris.

Similar results were reported by Professor Gerhard, in Jena, who experimented on a patient with a laryngeal fistula, and by Dr. Schnitzler, in Vienna, whose object of experiment was a patient, thirty years of age, on whom, one year-and-a-half previously, tracheotomy had been performed, in order to cure some sores in the larynx, and who, for that purpose, still bore the canula.

Although the results obtained by Demarquay were very conclusive, yet now and then new authors began to discuss the question anew, and on both sides with equal skill and zeal. The evidences *pro* and *contra* were defended and refuted. The Academy, therefore, was forced to take the matter in hand, and investigate it thoroughly and impartially. Poggiale was chosen as reporter, and when he read his report before the Academy on 7th Jan., 1862, he put the following four questions, of which the first only is of interest for our purpose:—

1. Do the pulverized fluids penetrate into the respiratory tracts?

2. Is the temperature lowered when rushing forth from the atomizer?

3. Do the sulphureted waters become altered in their chemical composition through atomization?

4. Are we, at the present stage of our knowledge, enabled to estimate the value of the therapeutical results of the inhalations?

The report was very extensive, and reviewed critically with great precision all opinions hitherto expressed and the experiments performed by different authors, and was based itself upon a great many experiments which the reporter had made on men and animals. *The results of these experiments, as well as the proposition and arguments brought forward by Poggiale, tended clearly to show that the atomized fluids do penetrate into the channel of respiration.*

In the discussions on the report, on 29th April and 6th May, every speaker afforded new evidence, and the importance of the question was recognized by every one of them, and the debates had that serious character which ought always to characterize opinions expressed by men of science.

Trousseau was a warm advocate of the new method, and the conclusion of his speech run thus:—

"*I have applied the inhalations in many instances, and derived great benefit from them. They form a medicament of great value in affections of the pharynx,*

larynx, trachea, and the large bronchi. In herpetic angina granulosa, in hoarseness of orators and singers, they render good services. I have cured two extremely grave cases of œdema glottidis by means of an atomized solution of tannic acid—in one of these cases, tracheotomy seemed to me unavoidable. In syphilitic deterioration of the larynx, when we are not always enabled to avoid that operation, we shall sometimes gain time by inhalations, to wait for the effect of the specific treatment. In short, Sales-Giron has rendered a great service to the world at large by his invention of the treatment by means of pulverization."

At the close of the discussion it appears that all the speakers, except Fournié, had either maintained their original view in favour of inhalation, or by force of arguments were compelled to adopt the opinion that the atomized fluids do penetrate into the respiratory tract. For this important fact was shown by hundreds of experiments on men and animals, the only difference existing amongst the observers being that some maintained that the fluids penetrate into the very cells of the lungs, whilst others would only admit the penetration into the bronchi, according to the degree of skill with which the experiments are performed.

The Academy, therefore, nearly unanimously expressed the conformity of their opinions with that of the reports, and further investigations into the question brought the truth in favour of the inhalations

still more to light. Demarquay, Bataille, Gerhard, Zedkauer, Waldenburg, Lewin, Gibb, Mackenzie, and others, have published a very great number of cases successfully treated by means of inhalation of atomized fluids.

Now, if such critics as are mentioned above, induced either by certain notions of ease or by ignorance, condemn a method of which they know nothing, seeing that men of very high standing in the profession have taken great pains to arrive at the truth, and that the conclusions drawn by them widely differ from those of such critics, one would think that the latter ought to abstain from so superficially expressing their opinion through some feelings of shame.

But it is, of course, much easier to write a prescription and get rid of the patient, than to place in his hand an apparatus and give him instructions how to use it. But if those criticizing gentlemen really derive their opinions from observation, based perhaps upon experiments, why then do they not step forward to impart them to the scientific world? But I fear that their critical skill consists simply in the art of evading criticism.

I must dwell for a few minutes longer on the question whether the spray penetrates into the respiratory tract, as being of great importance and decisive in respect to the confidence which such medical brethren bear towards the whole method of

inhalation, who have the real wish to make themselves acquainted with the same.

In the meeting of the Academy of Paris, on 6th May, Trousseau has already expressed his astonishment how the penetration of atomized fluids could be doubted, since the penetration of coal particles, crystals, and the like into the bronchi and lungs form an established fact. "Nay," said he, "the spray may even penetrate too much, much too much, and therefore great caution is necessary in its application." He referred to Demarquay's experiments, in which so great a number of the rabbits died of pneumonia, as reported; which likewise illustrated the fact that inhalation may be applied too freely. A lady of Pesth, labouring from a stricture of the trachea, who for five or six months previous had sustained life merely by means of inhalation, made a too free application of atomized fluids, in order to accelerate the cure, but in consequence suffered from a bilateral pleuro-pneumonia.

Every physician knows that smaller or larger bodies when held before or in the mouth, may be inspired and become the cause of death or disease, if the individual fails to get rid of them by means of cough or mechanical manipulation. I have recently myself reported on such a case, where the inspiration of a large bean caused death in a child; and in post mortem the bean was found in a bronchus. ('Virchow's Archiv,' vol. xxvi. p. 220, 1862.)

It is likewise well known that workmen, who by the nature of their employment live in atmospheres impregnated with dust consisting of some small particles, as, for instance, bakers, chimney-sweepers, coal-whippers, China workmen, &c., are prominently subject to diseases of the lungs, arising from constantly inspiring that atmosphere. The same takes place in the French mill-stone makers, to the phthisis of whom Dr. Peacock recently has not only called the attention of the profession, but has also shown beyond doubt that the particles of the stone penetrated into the very cells of the lungs. ('British and Foreign Medico-Chirurgical Review,' vol. xxv., 1860.)

"The rough working of the stones is effected by a steel chisel, 'the pritchell,' which is struck by a metal hammer, and the surfaces are finished by picking with a double-pointed steel instrument fixed in a wooden handle—the 'bill and thrift.' As the burr is extremely hard, every stroke of the chisel is attended by a bright flash of light, and a cloud of dust and larger or smaller particles of stone, forming a sharp grit, are thrown off. Portions of the stone and of iron from the chisel not unfrequently become embedded in the hands of the workmen, so that the backs of the hands of those who have been long at the trade are studded with small bluish spots, and occasionally the men sustain serious injuries to their eyes."

That part of the post mortem examination of the second case of French mill-stone makers' phthisis, communicated by Dr. Peacock, which bears upon the question under discussion, runs thus:—

"Portions of the indurated pulmonary tissue, and of the diseased bronchial glands, were obligingly examined by Dr. Bristowe, who has furnished me with the following notes:—'The diseased portions of lung were much indurated, having generally an opaque whitish hue, but being thickly studded with black pigment. Under the microscope little or no trace of original lung-structure was visible, but the diseased masses appear to be made up of dense closely-arranged fibroid tissue, studded here and there with numerous irregular groups of black pigment, and generally with an abundance of transparent granules and globules of various sizes. The tissues were rendered comparatively transparent under the influence of strong acetic acid, the fibroid tissue becoming a little expanded, and many of the granules and globules disappearing. The bronchial gland presented characters identical with those of the diseased lung.'

"Portions of the indurated lung-tissue were subjected by myself to ignition in the flame of a spirit-lamp. The white ash which remained dissolved to a great extent in hydrochloric acid, and partly with effervescence; but a portion was left, which was seen under the microscope to consist of small

angular transparent granules, exactly resembling the finer portions of the siliceous dust collected from one of the workshops. Dr. Moldenhauer, assistant in the chemical laboratory at St. Thomas's Hospital, also subjected portions of the indurated lung to the action of fire and nitric acid, and found that a considerable quantity of gritty matter remained, which had an amorphous aspect under the microscope, and was inferred to be siliceous. The bronchial gland did not contain any similar material."

On the meeting of the Pathological Society of London, of 16th May, 1865, Dr. Greenhow exhibited one specimen of diseased lung from a case of grinder's asthma, and another of coal-miners' black lungs; the reports on both cases are published in the 'Transactions of the Pathological Society of London,' and since they are not less interesting than important in respect to our question, I feel obliged to reprint them in full.

"*Specimen of diseased lung from a case of grinder's asthma.*

"The specimen has been in my possession for some years. It was taken from the body of a razor-grinder, who had long suffered from grinder's pulmonary disease, but had died from an intercurrent attack of acute pneumonia. The portion of lung shown is from the upper lobe, near the apex; it is consolidated, but some parts are harder than others,

and it is intersected by a firm white band, apparently produced by the thickening of inter-lobular tissue. It is now of a dark bluish-grey colour, but is paler than when fresh. On examination of a thin slice under the microscope, a few small, apparently crystalline bodies, irregular in size and shape, were seen embedded in the tissue, which also contained numerous small, well-defined, black masses of various sizes, which gave the lung its peculiar dark colour. On the supposition that these latter might be at least partly due to the presence of oxydized iron, a very thin slice of the lung was taken and immersed for some time in hydrochloric acid; but on examination under the microscope it was found still to present appearances identical with those already described. In order to determine the nature of the apparently crystalline bodies, a small portion of the lung was carefully incinerated in a porcelain crucible; it left a bright red ash, which partially dissolved in boiling hydrochloric acid, leaving a small residue, that gravitated to the bottom of the vessel. On examination of this residue under the microscope, it was found to consist partly of an amorphous deposit, partly of small angular masses, which reflected light powerfully, and polarized light transmitted through them. A portion of this residue being, at the suggestion of my friend Mr. Heisch, Lecturer on Chemistry at the Middlesex Hospital, exposed in a shallow plati-

num vessel to the fumes of hydrofluoric acid, was entirely dissipated, proving it to be silica. A comparative experiment was tried with a portion of ordinary lung (from a patient who had died in the Middlesex Hospital) which, when incinerated, left an ash not quite so red as that from the grinder's lung, and altogether soluble in boiling hydrochloric acid. The solution of the ash from both lungs gave faint indications of the existence of iron, about equal in both cases; but the absence of free particles of iron in the grinder's lung was determined by bringing every part of the specimen into proximity with a delicate magnetic needle without causing any sensible disturbance.

"The disease from which the patient had suffered appears to have been chronic, or as Rokitansky terms it, interstitial pneumonia, and its cause was doubtless the inhalation of finely pulverized grit, given off from the revolving grindstone while the man was at work, and which as we have seen was found in the lung after death, in the form of small angular particles of silica."

"*Specimen of coal-miner's black lung.*

"This specimen, like the former, has been in my possession for some time. It was obtained from the body of a collier who had worked in the shallow and ill-ventilated coal-mines near Wolverhampton, and was taken from the free margin of the upper lobe.

The general colour of the mass is dark blue—almost black; but it was quite black when fresh, at which time a black juice could readily be expressed from its substance. The pleura is thickened, and the lung is traversed by some firm white bands, apparently formed by the thickening of interlobular tissue. The lung cuts toughly, and is very firm and solid, but not uniformly so, some ill-defined harder portions being felt in its substance when handled. Under the microscope, the lung was seen to be studded with small black deposits, apparently irregular, both in shape and size, but the examination was not made until it had been for some time immersed in spirit. On boiling a small slice in strong hydrochloric acid, the black deposit was not affected. A portion of the lung, when incinerated, left a red ash, closely resembling the ash left from burnt coal. When boiled in hydrochloric acid, this ash was partially dissolved, leaving a white or greyish amorphous residue, which did not polarize light, but evidently consisted of silica, for it was dissipated on being exposed to the fumes of hydrochloric acid.

"This case appears to have been assimilated in its pathological characters to that of the razor-grinder. The lung was similarly consolidated and traversed by white bands. *Whatever doubt may sometimes be entertained regarding the origin of the black deposit in the lungs of colliers, it appears quite certain that in this instance it arose mainly from the inhalation of finely*

pulverized coal, for on no other supposition can we explain the presence of the very large amount of amorphous silica obtained from the incinerated lung.

"Remarks.—The result of the examination of these specimens of lung accords with the history of the symptoms from which the several classes of operatives exposed to inhale grit, or other heavy dust, are practically found to suffer. The earlier symptoms are those of bronchial irritation, namely, slight dyspnœa, cough, and scanty expectoration, coloured with the material inhaled. This ailment often proceeds so slowly and insidiously, that the sufferer is scarcely aware of its existence until it becomes aggravated by some attack of catarrh, and more or less disables him from working. Hence, overlooking the previous indisposition, he, for the most part, dates the commencement of his illness from the occurrence of a cold. In a great many instances, and especially those in which the dust inhaled is of a light description, the disease often remains bronchial throughout, and presents only the ordinary characters of chronic bronchitis, with or without emphysema. But in other cases, and especially in those in which a heavy dust, such as that given off in the processes of razor-grinding or china-scouring, has been inhaled, chronic pneumonia supervenes after a time, and frequently proves fatal, either in consequence of an intercurrent attack of acute pneu-

monia, or, after a long chronic course, with symptoms resembling those of very chronic phthisis. Dyspnœa is always a very marked feature of such cases, and is sometimes so extreme as to prevent active locomotion, even while the patient is still able to continue his occupation. The physical signs are also out of all proportion to the amount of disturbance of the general health, which, in constitutionally sound subjects, is much less than in those who are the subjects of pulmonary disease, arising from constitutional cachexia. Sometimes, even when the complaint appears to be far advanced, the discontinuance of exposure to the determining cause—*viz.* the inhalation of dust—is followed by a most marked improvement of health."

These cases are quite sufficient to show that small particles of different bodies may readily be inhaled, and pass through the larynx into the trachea, bronchi, and lungs.

Now if such be the case, it would *à priori* be very difficult to perceive why the same process should be impossible if those particles be liquid instead of solid. But a conclusion *à priori* is quite superfluous, since positive evidence of the penetration has been afforded.

In conclusion, one fact must be mentioned which is not so decisive as positive facts are, but which bears forcibly upon the question: I mean the sub-

jective feelings of the patients during the inhalation. Every one of them describes, when inhaling, a sensation of penetration into the trachea and lungs. That is not only an observation which I have made daily, but one which has already been described by Fiebr, in Vienna. ('Wiener medizinifF Wochenschrift,' 1863).

It is, therefore, confirmed beyond doubt that atomized fluids enter the respiratory tract and penetrate into the very cells of the lungs; that, therefore, by means of inhalation, remedies most appropriately and successfully may be applied to the organs of respiration.

CHAPTER III.

DESCRIPTION OF APPARATUS USED FOR ATOMIZING THE FLUIDS.

It has already been stated, that the first arrangements for inhalation were made in some spas of France. The many discourses about the efficacy of or inefficacy of the new method, therefore tended exclusively to show whether or not the water of the respective spas became in any way altered by the process of pulverization. The method was at that time restricted to a few Inhalatoriums, but to place every practitioner in such a position as to enable him to make use of the new invention in private practice, Sales-Giron, in 1858, had constructed his 'Pulvérisateur portatif des liquides médicamenteux.' (Fig. 1.) *From that day a new era in the treatment of pectoral diseases commenced.*

The apparatus consists of a vessel (B) filled with the fluid to be atomized; above this vessel an air-pump (A) is placed, which compresses the air above the surface of the water. The pressure is indicated by a manameter (C). The fluid escapes through a fine opening of a tube with a stopcock (D), and strikes against a small metal disc (E); here it is

broken and turned into a very minute vapour, which now can be inhaled by the patient, while the condensed fluid escapes through a small tube (G).

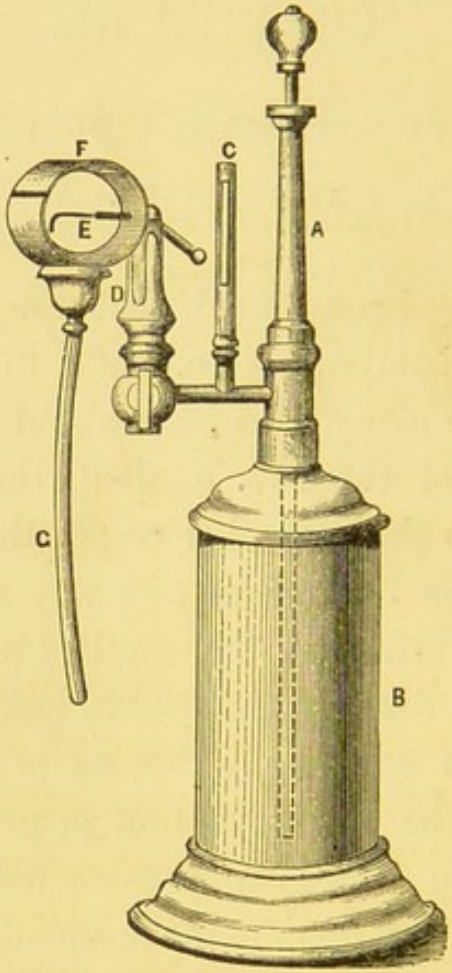

Fig. 1.

Some time after, in 1859, Mathieu constructed an apparatus, which he called Nephogène, and exhibited it before the Académie de Médecine. (Fig. 2.)

The subdivision of the fluids in this apparatus does not take place by checking a jet against a solid body, but by forcing the fluid to escape under a high pressure, together with a blast of compressed air

through a tube of a small opening. The air is compressed in a brass-ball (A), by means of a pump above it, whilst the fluid to be atomized is put into a

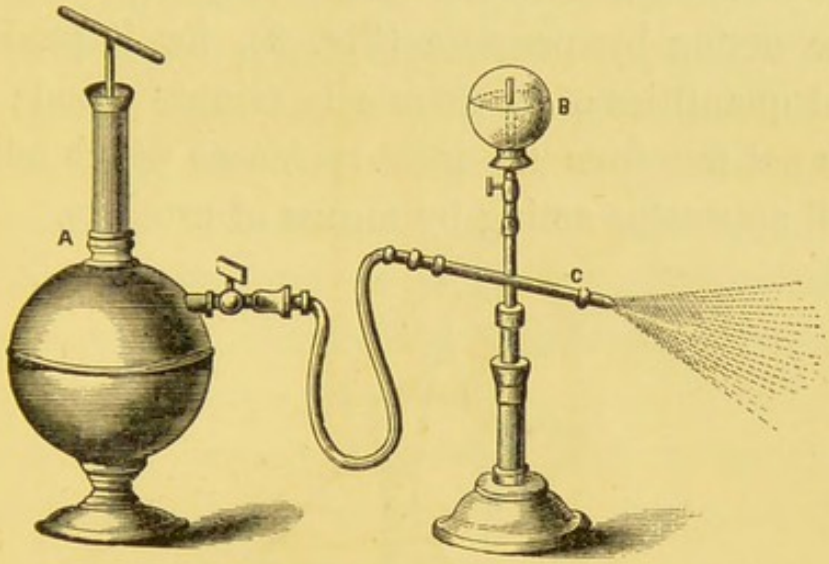

Fig. 2.

glass ball (B); in opening the two stop-cocks the fluid is projected through the opening of the tube (C) in the condition of a very fine spray, which is formed at that opening through the compulsory mixture of compressed air and the fluid. Here the patient opens his mouth, into which the cloud is driven by force. The temperature of the blast is pretty low, but can be raised by a lamp; yet the low-tempered blast, acting as a powerful exciting agent, is sometimes made use of in certain paralytic affections of the larynx.

On the principle of Sales-Giron or Mathieu, a great many apparatus have been constructed, of which those of Weiss in London, Waldenburg,

Lewin in Berlin, Leiter and Schnitzler in Vienna, and Luer in Paris, are worth mentioning.

A few months ago Windler in Berlin manufactured an apparatus which I consider the best amongst those acting by pressure (Fig. 3), for it produces great quantities of an extremely minute cloud; but it is not free from the inconveniences which adhere to all apparatus acting by means of pressure.

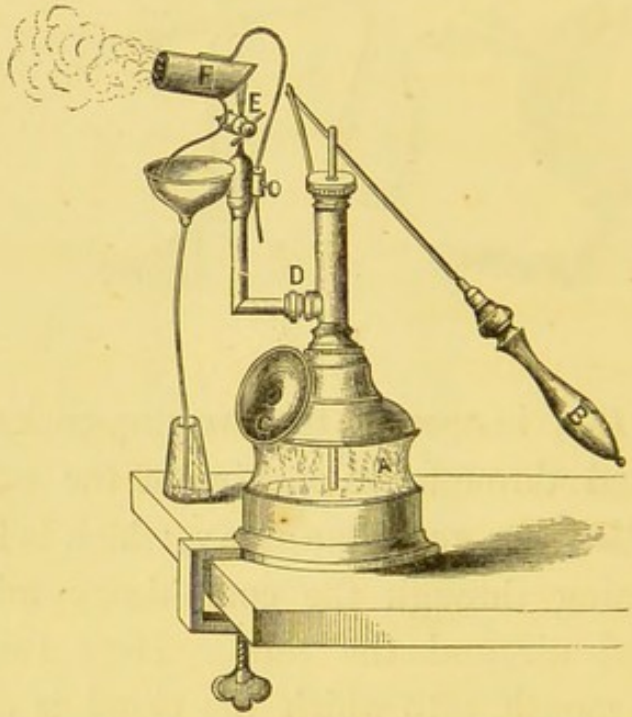

Fig. 3.

Such disadvantages are the following :—

1. As soon as the apparatus is brought into action, the pressure continually diminishes, consequently at different periods not only different quantities of the fluid are turned into vapour, but the pulverization varies at different times, being much more minutely affected by a high than by a low

pressure; but the minuteness of the spray is of the highest importance, because the minuter the particles forming the cloud, the deeper they can advance into the respiratory tract.

2. The action of such apparatus seldom lasts more than two or three minutes, the pressure must therefore be often renewed, either by the patient or by an assistant; but some of the apparatus require a considerable strength to be brought into action, a strength which patients labouring under exhausting and weakening diseases are not capable of; and even in such patients as are strong enough to move the air-pump, it is much better to let them remain quiet during the inhalation.

The inconvenience for many patients to have an assistant is obvious.

3. The apparatus require a great quantity of fluids to fill them, and many of the fluids being expensive, are for some patients a matter for consideration.

4. The fluids to be atomized more or less come into contact with metals, and thus most of them are decomposed.

Many of these inconveniences have been avoided by Dr. Bergson, in the very ingenious construction of his apparatus (Fig. 4).

He placed two glass tubes, with capillary openings at one end, at right angles to each other (D), the other (now open) end of one tube dips into a

vessel filled with the fluid which is to be subdivided (A), while the other is fastened to a caoutchouc tube about a yard in length; the middle and

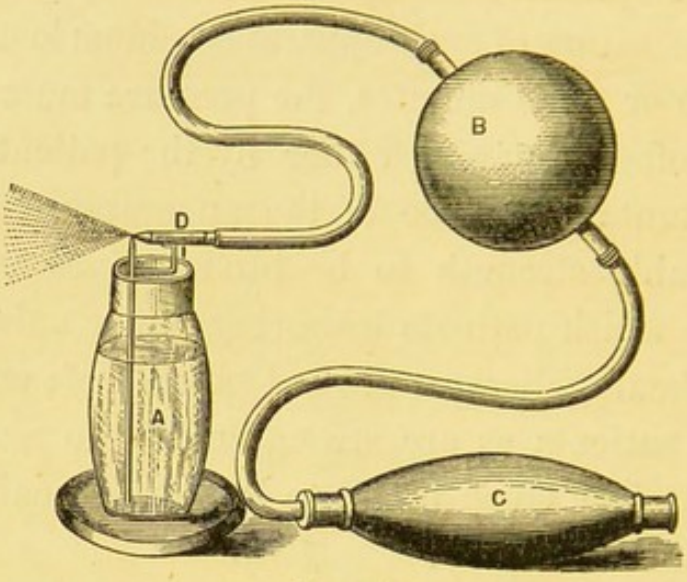

Fig. 4.

the end extended into a ball, so that the one in the middle (B) represents an air-reservoir, and that of the end (C) a pair of bellows. If the latter are pressed by the hands of the patient, the air in the upper ball is compressed, escapes through the fine opening, and causes a vacuum in the other tube; the fluid of the vessel then ascends through aspiration, and is turned into fine mist when leaving the capillary opening.

From this atomizer of Dr. Bergson, the little apparatus is taken, which is commonly sold in chemist shops, for the pulverization of different scents. The tubes have been turned into a very handsome little apparatus (Fig. 5) which, though of

a very small size is for different purposes in medical practices very useful.

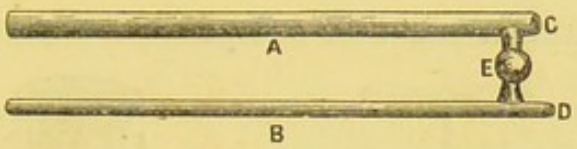

Fig. 5.

The apparatus consists of two tubes (A and B) which by means of a hinge (E) can be folded when wanted for use; the capillary openings (C and D) are then placed at right angles to each other, so that the fluid which is to be atomized, and in which the vertical little tube is dipped, whilst air is blown in through the other by the mouth of the physician, issues forth according to the principle of insufflation already described, and as daily seen with the "odorators."

Partly on the principle of Bergson, partly on that of Mathieu, Windler in Berlin has constructed an atomizer (Fig. 6), which is distinguished by great simplicity, and by the readiness with which it can be handled.

The way in which the apparatus acts is easily understood. The air is compressed in a large brass ball by means of a pump; from this brass ball a tube projects, ending in a fine opening. The fluid to be atomized is put into a glass vessel, which is placed above that opening. The bottom of the vessel is prolonged tubelike, and likewise contains a

very minute opening. As soon as the fluid is poured into the vessel, it begins to ooze from that hole, and is formed into a very fine mist, when the stop-cock is opened and a blast of compressed air rushes forth.

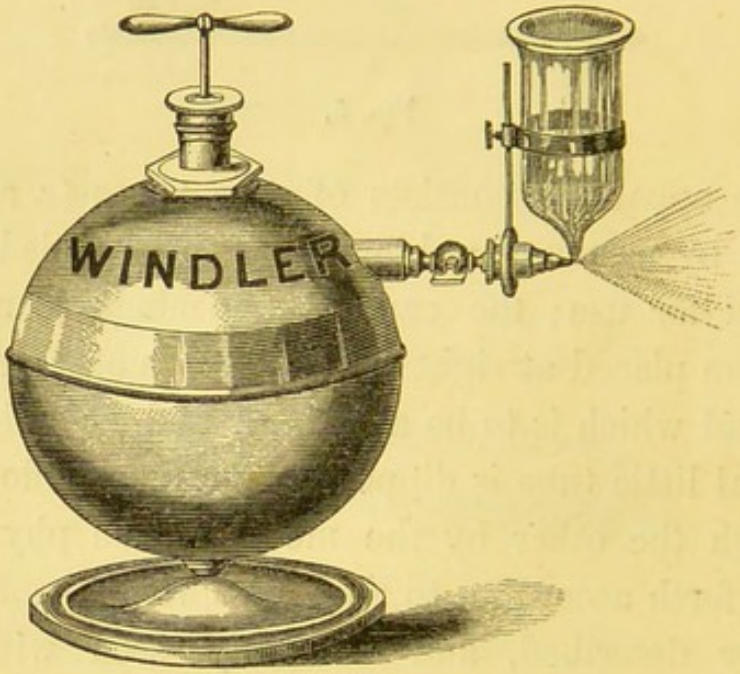

Fig. 6.

The greatest perfection has been given to the inhalation-apparatus by Dr. Siegle, of Stuttgart. He placed the patient in a position to inhale without being compelled either to put the apparatus into action by force of his hands, or to have an assistant. Adopting the principle of Dr. Bergson, he has put aside the bellows, and substituted steam instead of it, as the acting power. The following woodcut (Fig. 7) represents Dr. Siegle's original apparatus in conjunction with my screen, which will hereafter be spoken of.

The apparatus consists of a boiler, under which

is placed a spirit-lamp, provided with a thermo-barometer, the lower end of which hangs in the boiler while the other is free, containing a graduated scale. When the mercury rises to the Fig. 2, it

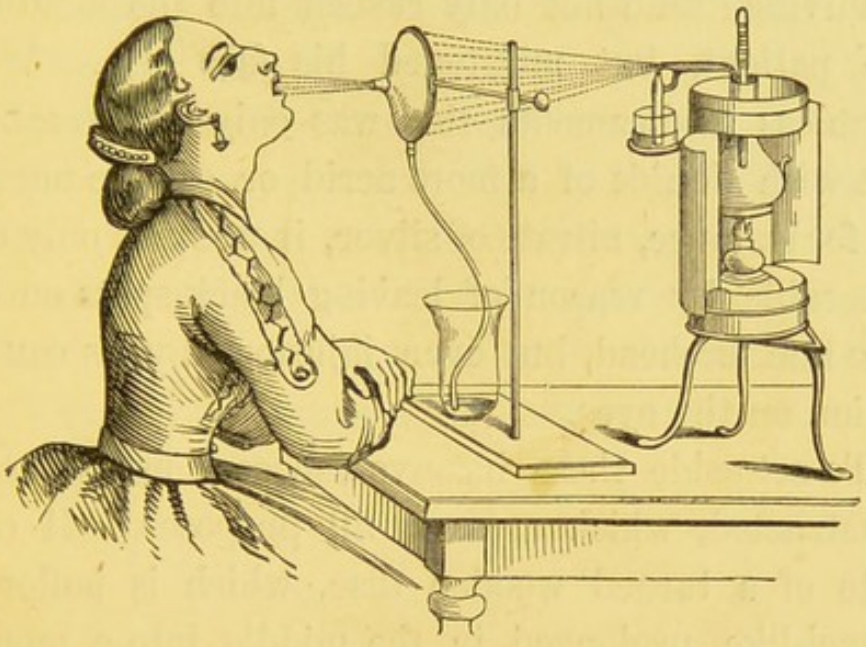

Fig. 7.

indicates the temperature and pressure of the steam most suitable for pulverization; the tube which in Bergson's apparatus is connected with a pair of bellows, descends into the boiler, carrying off the steam therefrom, when it is generated by means of the lighted spirit-lamp, and having the same effect upon the capillary opening of the other tube, which dips into the vessel with the fluid to be atomized, as the blast of compressed air has, *viz.* the fluid rises, escapes through the capillary opening, and is turned into an extremely finely attenuated spray, while the patient is sitting quietly, inhaling comfortably.

In all apparatus, those of which we have spoken already as well as those which I shall still have to describe, there is one inconvenience in common, namely, that the cloud of vapour containing the subdivided fluid not only rushed into the mouth of the patient, but moistened his face also. With harmless medicaments this was only disagreeable; but with liquids of a more acrid or caustic nature, as, for instance, nitrate of silver, it was not only disagreeable by reason of leaving black spots on the face and forehead, but even injurious by its caustic action on the eyes.

To set aside these inconveniences, I had a screen constructed, which answers all purposes. It consists of a turned wooden disc, which is hollowed funnel-like, prolonged in the middle into a mouthpiece with an opening of the size of a shilling. The rim is turned inwards, having on its lowest point a small opening, into which a gutta-percha tube is fixed, the end of which may be put into any glass, and through which the fluid, created by the superfluous steam and subdivided vapour, runs. The disc, fixed by means of an arm to a stand, can be lowered or heightened, and moved in every direction, *ad libitum*. The whole apparatus is placed, as the woodcut illustrates, between the inhalation-apparatus and the inhaler, who sits comfortably with her opened mouth before the mouthpiece of my screen, inhaling the atomized jet coming through it.

The combined system of Bergson and Siegle is, indeed, so perfect, and the apparatus answers in so high a degree to the purpose intended, that all alterations which hitherto have been made in it could only concern subordinate points, as size, shape, and the like.

In this respect great credit must be given to Messrs. Krohne and Seseman, 241, Whitechapel Road. They first gave the following very handsome shape (Fig. 8) to Siegle's apparatus, and provided it with a water-gauge and a valve, whence the vapour can escape if the pressure becomes too high.

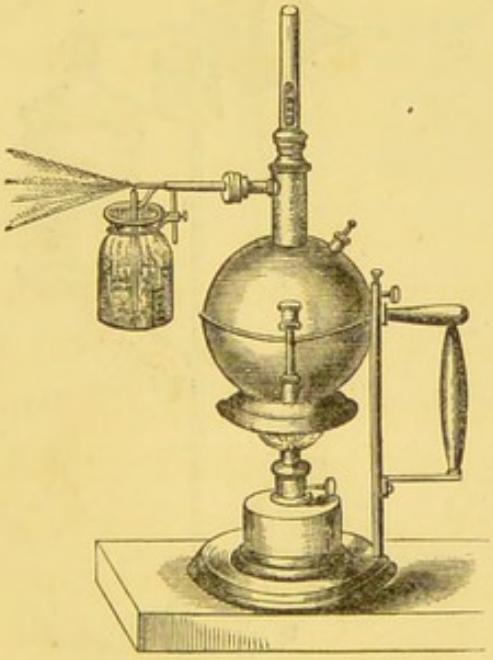

Fig. 8.

I consider these additions of importance, and if a nice shape can be combined with usefulness—*dulce cum utile*—it ought never to be neglected. Messrs

Krohne and Seseman manufacture also my screen, and keep a large stock of inhalation-apparatus of all kinds. The only point of the last-mentioned apparatus to be taken into consideration is, that its price prevents it from being given into the hands of *every* patient, although the apparatus is a masterpiece of mechanical skill of neatness and usefulness, and the price, indeed, very low for that description of work. It was therefore my aim to have an atomizer of a lower price, and I had the following (Fig. 9) constructed by Messrs. Krohne and Seseman.

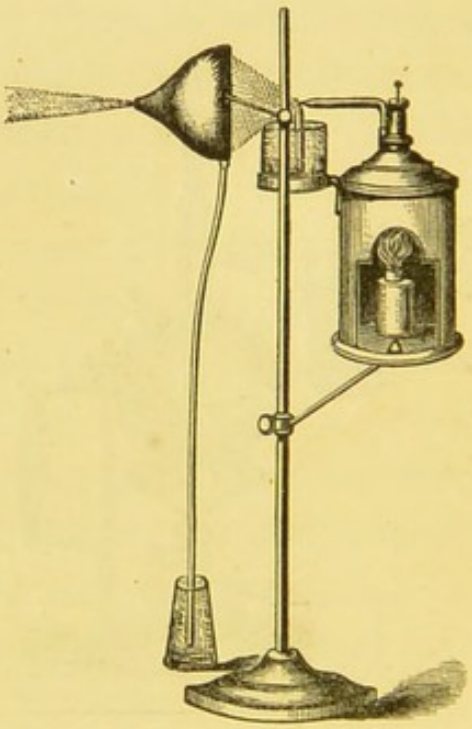

Fig. 9.

The apparatus needs no explanation; suffice it to say, that its price is one guinea, and without the screen 12*s.* 6*d.* only.

Although the portability of this apparatus, by its being much smaller than the original of Siegle's, is very convenient, yet it not seldom occurred to me that I had to treat patients who, by the nature of their business, were obliged to travel, but were ordered to inhale. An apparatus for such patients requires to be very small, so as to be carried in the pocket. I had, therefore, the following apparatus (Fig. 10), by Messrs. Krohne and Seseman, manufactured, which is known as "The Traveller's Atomizer."

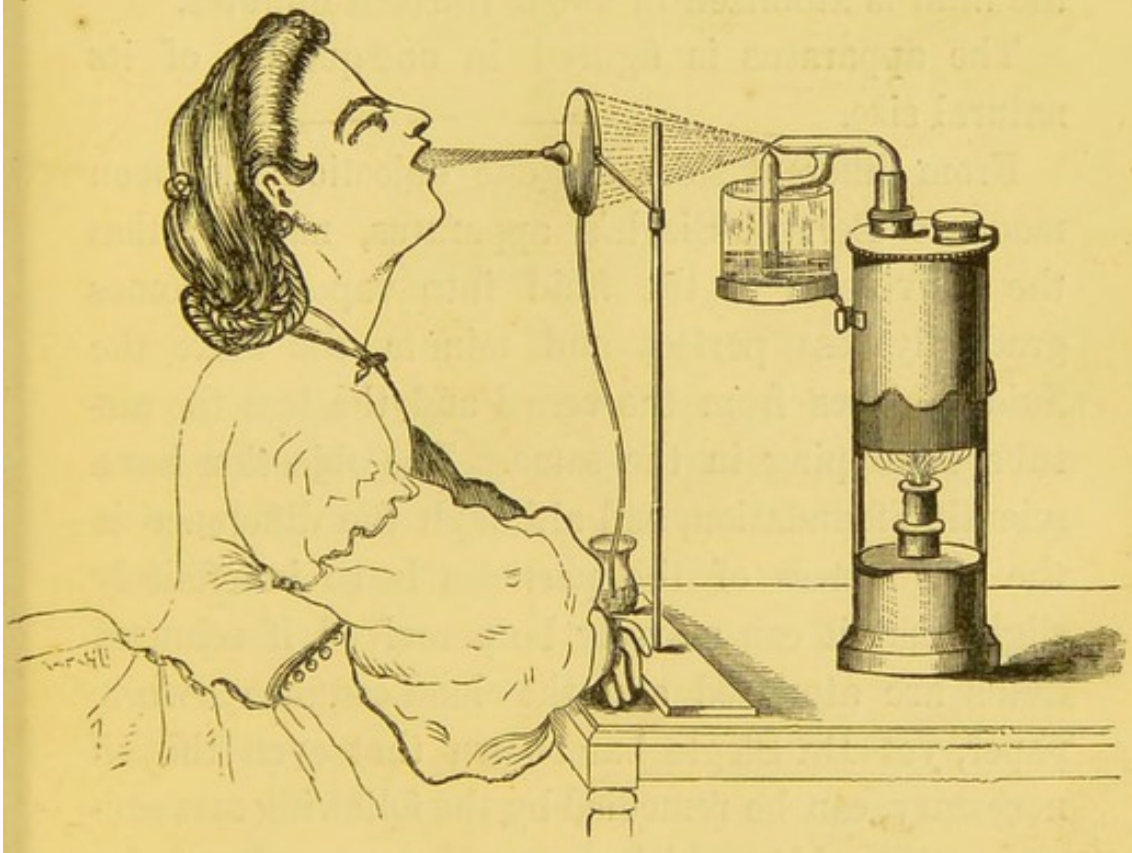

Fig. 10.

The whole apparatus represents a metal tube, $4\frac{3}{4}$ inches in length and $1\frac{3}{4}$ inches in diameter. The

upper part of the tube is occupied by the boiler, which is also provided with a valve, the lower by the spirit-lamp. The space between the lamp and the boiler contains, when the apparatus is not acting, the vessel for the fluid to be atomized. The whole apparatus is packed in a small box 7 inches long, $2\frac{1}{2}$ inches in breadth, and 2 inches in height. The capacity of the boiler is one ounce-and-a-half of water, but for action is filled only with six or seven drachms, which in about two minutes begin to be turned into vapour, by means of which one ounce of the fluid is atomized in about thirteen minutes.

The apparatus is figured in one-quarter of its natural size.

From different sides the one objection has been made to Bergson-Siegle's apparatus, namely, that the conversion of the fluid into vapour becomes gradually less perfect and minute, the more the fluid vanishes from the vessel and the less the air-tube is dipping in the same. The objection has a scientific foundation, and although the difference in the minuteness of the particles is so indefinitely slight that it can scarcely be perceived if coloured fluids are atomized and the cloud caught on white paper, yet Dr. Siegle has shown that even this, if necessary, can be remedied by the following arrangement (Fig. 11), which I consider superfluous for inhalations, but very useful indeed for scientific researches into the nature of the atomized clouds.

The apparatus consists of a little bottle (D), which by means of a tube communicates with another tube (C). It is filled by covering the opening B with a

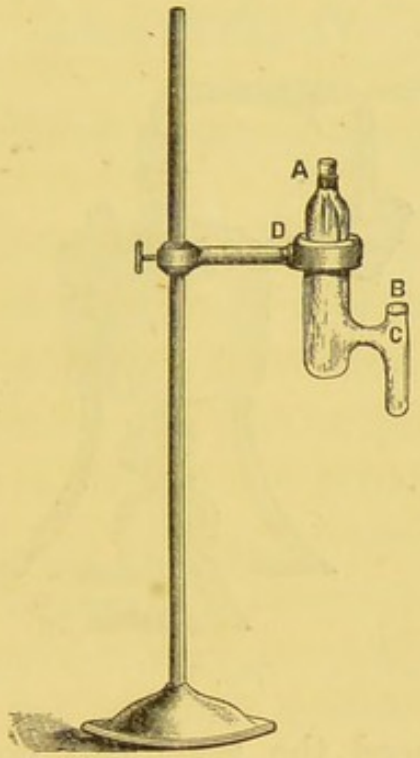

FIG. 11.

finger, and pouring the fluid through the opening A, closing the latter tightly and opening B. Now, the exhausting tube of the apparatus is dipped into B, the level of the fluid continually remaining in the height of C. The whole apparatus, based upon a well-known physical law, has commonly been used in bird-cages for supplying the birds with water, whence Dr. Siegle seems to have taken his idea. As I intend hereafter to make a few remarks on the introduction of the inhalations into hospitals and dispensaries, where cheapness is the first requisite

to be considered, it may, in conclusion, not be amiss to present the following sketch of Siegle's apparatus (Fig. 12), first manufactured by Schlösser, in Königsberg.

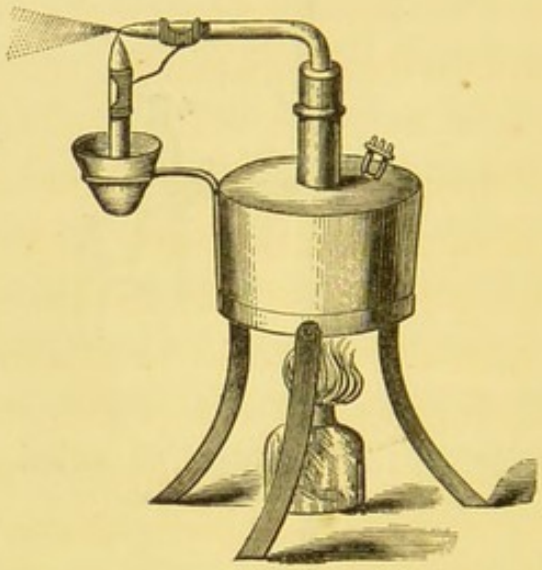

Fig. 12.

In case of need the apparatus could be manufactured for a very few shillings by any ordinary workman, which is of especial importance for country practitioners, who are not always near an instrument maker, so that the acquisition of fifty or a hundred of such apparatus, according to the number of patients, in order to lend them to the latter, would not be a matter of great consideration for any hospital or dispensary.

CHAPTER IV.

SOME POINTS TO BE OBSERVED IN INHALATIONS.

When inhalations of atomized fluids were introduced into medical practice, they were invariably taken in the residences of the medical men. The reason why such was the case is not to be sought for in the convenience of the practitioners, but in the novelty of the method—which required the physicians to make strict observations on it—as well as in the price of the apparatus, which was too high to be afforded by every patient. This, now, is altered, for the inhalations in the doctor's residence is exceptional; the apparatus are manufactured at different prices, and many of them are quite cheap enough to get into the possession of every patient, who receives his instruction for the points to be observed from his medical adviser.

Although the whole procedure is very simple, yet there are, nevertheless, some items which cannot be neglected without being detrimental to the cure.

The first thing for the patient is, of course, to acquire a true knowledge of the construction of the apparatus, in order to enable him to put it into action, and to keep it clean afterwards. The

apparatus generally recommended by me to patients is either that depicted in Fig. 8 or 9, and since the minuteness of the spray in a great manner depends upon the size of the capillary openings of the rectangular tubes, it will be a matter of consideration whether to use tubes with finer or larger openings, according to the diseases to be treated.

In respect to the mode in which the inhalations may be executed, many remarks have been made and rules given by several authors, upon which I shall not dwell, as the important points which require attention, after some consideration, become self-evident.

The pulverized fluid can influence an extensive region of the body. If we set aside the effect, praised by Demarquay, Leiblinger, and others, in conjunctivitis and keratitis, likewise the effect upon the ear, upon ulcers, &c., and only consider the effect upon the organs of respiration, from the mouth and pharynx with its arches, the uvula, the glands through the larynx and trachea with its ramifications to the lungs, we meet with a great number of diseases upon which the local therapy just spoken of exercises a great influence.

But as the respiration is performed more or less powerfully and deeply, the atoms of the pulverized fluid reach the more or less distant organs of that function. From this fact it becomes self-evident that it will be necessary to inspire feebly if the

influence should be directed upon parts situated in the mouth or pharynx, more powerfully and sometimes strenuously if it should be our intention to act upon the larynx, trachea, or lungs. And, further, as the lungs admit the greatest amount of air when the sitting position is assumed, it is manifest that we should place the patient in that position if we intend a deep penetration of the atomized cloud, whilst we should allow him to stand if we merely intend to act upon organs not so far distant.

I do not intend to allude to such individuals as are excited and "nervous" at the aspect of every, even the most innocent, instrument; suffice it to say, that the inhalation-apparatus do not enjoy an exception. But there are persons—happily not frequently met with—whose respiratory channels are so sensitive, even in a healthy state, that they cannot bear inhalations, either with pure water or any other fluid, at the first attempt, and several sittings are necessary to accustom them to the process. In one case, under my own observation, it seemed impossible to accustom the patient to pure water inhalations. I then used milk instead of water, which caused no cough at all; and when I, after several inhalations, again employed water instead of milk, and instead of this afterwards astringent solutions, the inhalations were effected without any inconvenience whatever.

In some patients the larynx is so sensitive that

several weeks elapse before they become accustomed to the influence of the atomized fluids, and in many such cases I thought it necessary to commence a preliminary treatment, by blowing astringent powders into the larynx, in order to put a stop to this great sensitiveness. All cases of such high sensitiveness which I have hitherto observed were patients with laryngeal diseases; whilst with others, and particularly with those suffering from diseases of the lungs, inhalations agreed very well.

The *temperature* of the atomized cloud, of course, varies in proportion to the distance from the spout of the apparatus, and must be regulated according to the nature of the special case. For some patients it is even necessary to have the fluid to be atomized warmed; for which purpose Seigle's apparatus, as now manufactured, have a little lamp placed beneath the stand of the vessel containing the fluid. It is likewise evident that there are many cases in which all apparatus, acting by compression of air, cannot be applied, for the patients are not able to bear the cold blast by which the apparatus is brought into action.

When the apparatus is in order and ready to act, the screen is placed at a proper distance from it, the patient stands or sits, and inspires more or less powerfully and deeply, according to the requirement of the case.

The advice which has been given, that the patient

should put out his tongue and keep his nostrils closed when inhaling, is, in my opinion, superfluous and useless.

All patients incline, when inhaling, to respire very quickly, and some of them I have seen with their faces and foreheads covered all over with heavy drops of perspiration; in others, headache, giddiness, and exhaustion were the consequences. It is, therefore, of great importance to be, if possible, present at the first inhalations, to give the necessary advice, and particularly to warn the patients against such a hurry in the act of respiration.

Many patients, after the first trial, came to me, reporting their entire inability to use inhalations, and giving different reasons for their statements; but *in all* such cases I was able to trace the inability to some faults committed during inhalation; and since, in two cases, I have observed blood-spitting as consequences of such faults, I never begin the treatment without being present at the first inhalations, *viz.* until I am convinced that the patient scrupulously acts according to my directions.

I generally begin with a hundred inhalations, making a pause of a few seconds after every ten or fifteen deep inspirations, and afterwards increase the number, according to the indications of the particular case.

Some patients, after the first inhalation of astringent fluids, have an unpleasant sensation in their

throat, which disappears after the second or third repetition of the inhalation. The same may be said of a slight cough, which, in a sensitive larynx, proves that the spray passed the glottis, and is, therefore, rather an agreeable sign than the reverse.

To clean the rectangular lobes after inhalation, the vessel from which the fluid has now vanished need only be filled with pure water, whilst the apparatus is kept in action for a few minutes longer.

I have not thought it superfluous to dwell upon such trifling matters, for I am too well aware that some of them, if they occur, are sufficient to baffle a patient, while upon others a good deal of the desired success depends.

CHAPTER V.

WHAT QUANTITY OF THE ATOMIZED FLUIDS REACH THE LARYNX, TRACHEA, AND LUNGS?

THE answers given to this question can merely be an approximation to the truth, for any experiments made in this direction hold good only for the apparatus used for such experiments; to draw an inference, as some authors have done, from one atomizer and to apply it to another, is perfectly absurd. Two principally important points bearing on the question, are the minuteness of atomization and the force of the blast which escapes from the spout, rushing into the mouth. But both these points may differ, even in the same instrument; and therefore, from a series of experiments, a ratio can only be obtained, applicable to a certain apparatus, and only to that one.

I shall, therefore, proceed to state the results which I obtained with Siegle's apparatus (Fig. 8). If the boiler, which contains about eight ounces, is half filled, *viz.* with four ounces of water, and the lamp beneath lighted, the evolution of steam begins in about ten minutes. One ounce of fluid is then, between twenty-five to thirty minutes, turned into spray and inhaled. The quantity of condensed fluid,

after the inhalation, obtained through the tube of my screen, is about four drachms, the loss in the boiler one ounce. Half-an-ounce of medicated spray was, therefore, mixed with one ounce of steam. About half of that quantity recoils from the screen into the air, while the other half reaches the mouth. Here again, about half the quantity remains, to be either swallowed or spit away, *whilst the other half*, viz. *about three drachms of mixture of steam and medicated fluid, passes the glottis and penetrates into the respiratory tract.*

In respect to that mixture, the conclusion may fairly be drawn that it contains a far greater quantity of atomized fluid than vapour. Not only because it can be assumed, *à priori*, that the heavier particles of the fluid are driven by the force of the blast into the mouth, whilst the lighter steam mixes very readily with the atmosphere, but because an analysis of the fluid, obtained by condensation, shows that the original strength of the solution is diminished but little—at least, it was so in solutions of common salt, which I have tested.

The experiment to show that the steam dissolves into the air, while the atomized cloulds rush forth, can easily be made with my screen. The opening through which the patient inhales is closed, the apparatus put into action, and the condensed fluid gathered. If steam merely escapes, we find that, after one ounce of water has been turned into

steam, about twenty minims only have been condensed and gathered in the vessel, while it contains about six drachms when atomization has taken place at the same time.

The conclusion is, therefore, obvious, that the strength of the medicated fluid is altered but very little through its mixture with the steam.

CHAPTER VI.

MEDICAMENTS USED IN INHALATION.

Generally speaking every chemical body which is soluble can be atomized, and therefore inhaled. Thus the greater number of remedies contained in the 'Materia Medica' can be used for the local treatment of the respiratory organs.

But it must be borne in mind that besides the local effect of the spray, absorption takes place also, and that the medicaments are even much more readily absorbed through the mucous membranes than they are by internal application—a fact which must be taken into consideration when the dose is to be decided on.

Since we are not able to restrict the action of the applied fluids, adstringent, caustic, &c., to the affected spot only, the question may be put whether it be not injurious for the healthy part of the mucous membrane, likewise to be covered with the same dew of atomized fluid, which we consider useful for the diseased part. The answer is given by analogy. The treatment of conjunctivitis by means of so strong solutions of nitrate of silver, as we never use for inhalations, or even of pure sul-

Instillationes.

Instillatio Acidi Sulphurosi

℞. Acidi Sulphurosi 10 cubic centimetres
" Carbolici 5 c.c.
Aquae destillatae 85 c c ℥.

Instill: Creasoti

℞. Creasoti
Alcoholis Athylici ā ā ℥ss. aq:

Instill: Eucalypti

℞. Ol. Eucalypti
Alc. Ethyl ā ℥ss aq

Instill: Iodi et Carbolici

℞. Iodi 50 centigr
Athris 15 c c
Acid Carbolici 15 c c
Creasoti 10 c c
Sp. Rectif. 60 c c

Instill. Iodoformii Co

℞. Ol. Eucalypti 10 c c
Chloroformii 2 c.c.
Sp. Rectif. 10 c c
Iodoformii 1 grm.

Instill: Pini Sylvestris

℞ Ol. Pini Sylvestris
Alcoholis Ethyl. ā ā ℥ss. aq.

Instillatio Thymol.

℞. Thymol 2 grms
Camphorae 2 "
Aeid Carbolici 2 cc
Sp. Rectif 20 cc M

Insufflationes

Insufflatio Aluminis

℞. Aluminis gr ij
Sacchari Lactis gr ij

Insuffl Iodoformii et Morphinae

℞. Iodoformi
Acidi Borici
Sach. Lact. ā gr j
Morphinae Hydrochlor gr ¼

Vapores

Vapor Acid Carbolic

℞. Acid Carbolic f xx
Aq ferventis Oj
Inhalatur vapor ex vase idoneo.

Vapor Benzoini

℞. Tr Benzoin Co f ℥j
Aq ferventis Oj

Vapor Eucalypti

℞. Ol. Eucalypti ♏ 40
Magnes levis gr xx
Aq distill f. ℥j
f ℥j pro inhalatione ex Aq Calid Oj.

Vapor Terebene

℞. Terebene ♏ xu
Mag. levis gr xx
Aq dist. f ℥j
℥j pro inhal. ex Aq Calid. Oj

Fumigationes

Fumig: Nitrosa Composita

℞. Pu. Bellad. fol
" Hyos "
" Stramon "
Pot. Nitrat. part. aeq.

½ Teaspoonful for each fumigation

Fum. Stram et Pot. Chlor

℞. Ext. Stram gr xxx
Pot. Chlor gr xx
Aq Calid. ℥i

Saturate white blotting paper in this solution & dry it. Cut the paper into 3 × 1 in strips. One to three papers may be burnt at each fumigation

Fum. Arsenici

℞ Sodii Arseniatis gr v
Potass Nitrat. gr v
Aq Dest. q.s.

Saturate white blotting paper to divide into 20 strips of 3 × 1 in — each = gr ¼ Sod. Arsen. Dry it.
Use 1 or 2 strips.

phate of copper, is recent and very effectual. Here the conditions are the same, and from that treatment we learn a fact, formerly unknown, that the *healthy* mucous membranes are very tolerant even of strong caustic solutions, and form no hindrances to the application of such solutions to membranes affected by acute or chronic inflammation, which are cured with much more certainty, and in a much shorter period than formerly was the case.

At all events the impossibility to act upon the diseased parts only does not exclusively apply to the method of inhalation, since any medicament internally administered is intended to be received into the blood, and *we hope* that, exercising its influence upon *every* part of the body, it will also influence the affected part; there exists, therefore, the one great difference—that with inhalation the local action is obvious; with medicaments internally given, is often highly problematical.

In respect to the number of medicaments which may be used for inhaling purposes, the same holds good that may be said of Materia Medica in general. From the vast number of drugs every practitioner chooses a few which proved to him or others deserving the most confidence, and the cases are rare which require him to abandon his favourite remedies and replace them by others.

This is much more so the case in inhaling therapeutics; here few drugs have been tried on a large

scale, a circumstance which makes the duty incumbent upon us to confine ourselves, first, to those few that have proved themselves beneficial. These are the following :—

1. *Nitrate of silver*, which in the inhaling treatment of the pectoral organs deserves a prominent place ; its dose is three to five grains in one ounce of distilled water. It is particularly serviceable in inflammatory conditions of the pharynx and larynx. The strength of the solution, the frequency and duration of the sittings, must be adapted to the nature of the particular case. It need scarcely be mentioned that proper care, in respect to the state of the lungs, must be taken if strong solutions are inhaled.

2. Much milder in its effects is *Nitrate of aluminium*, which, as far as I am aware, was first used by myself for inhalation. I prepared it from a simple solution of the metal in nitric acid ; agitating the crystals in distilled water repeatedly, condensing the solution by evaporation, and re-crystallizing. It rendered great service, not only in inflammation, but also in nervous affections of the larynx and trachea. The dose is from two to five grains in an ounce of water.

3. *Tannin* acts highly satisfactorily as an adstringent as well as a styptic. In certain inflammatory conditions of the respiratory tract, particularly in chronic catarrhs, its application will render good

Gargarismata

Garg
— Acid Acetic ℥ xv — ℥j
— Acid Hydrochlor dil ℥ xv — ℥j
— Glyc. Acid Tannic ʒj — ℥j
— Aluminis — gr x — ℥j
— Boracis gr x — ℥j
— Pot. Chlor. gr xv — ℥j

Haust.

℞ Glyc. Acid Gallic ♏ xx Inf Rosæ Acid ℥j

℞ Acid Hydrobrom ♏ xx Syr ♏ xx Aq ℥j

℞ Acid Nitr Hcl ♏ xv Inf Gent Co ℥j

℞ T Nucis Vom ♏ v Sp Chlorof ♏ xv
Haust Acid Nitr Hcl ℥j

℞ Acid Phosph dil ♏ xv Liq Strych Hcl ♏ iij
Sp Chlorof ♏ xv Inf Quass ℥j

℞ Liq Arsen ♏ iv Sp Am Co ʒss
Ferr Am Cit gr v Aq ℥j

℞ Liq Arsen Hcl ♏ iij Liq Ferr Perch ♏ x Inf Quass ℥j

Haust Balsami Co
℞ T Benz Co, T Tolut. āā ♏ xv Glyc ʒj
Mist Acaciæ ʒss. Aq ad ℥j

Haust Benzoini c Opio
℞ T Benz Co, T Camph Co āā ʒss
Syr Tolu ʒss Inf Senegæ ad ℥j

Haust Bromid Co
℞ Am. Brom, Pot. Brom gr v
Sod Brom gr x T Camph Co ʒss
Aq Cinnamomi ad ℥j

Haust Morphiæ et Ferri
℞ Liq Morph Hcl ♏ x T Ferr Perch ♏ xv
Sp Chlor ♏ x Aq ℥j

Haust Sodæ Hypophosph gr v ℥j

Haust Terebene ♏ x ℥j c Trag et Glyc

services. *Dose:* from one to ten grains in an ounce of water.

4. Of *Alum* the same may be said, with the addition that a stronger solution of it in a coarser pulverization can be more extensively applied in inflammatory conditions of the fauces; it acts then much better than gargles do. *Dose:* from one grain to a scruple in an ounce of water, or of an aromatic infusion, as, for instance, camomile and the like.

5. *Sesquichloride of iron* is one of the most valuable medicaments in inhalations; it is less its adstringent power of which we make use, than its styptic properties. In hæmoptoe, whether its origin be the capillary system of the lungs or of the bronchi, sesquichloride of iron is a true specific and its efficacy almost instantaneous, in so far as there are many cases on record in which the red-tinged expectoration ceased to be so after a few, or even immediately after the first inhalation. It need scarcely be mentioned that such an effect can only be possible if the source of bleeding is a capillary, and not a larger vessel, in which case no remedy will be able to check it. *Dose:* From five to twenty-five minims in an ounce of water.

6. *Acetate of lead;* it renders sometimes good service in inveterate, troublesome colds, which do not yield to other medicaments. Its dose is from three to ten grains.

7. *Sulphate of zinc* is in small quantities used in

chronic inflammation of the mucous membrane of the respiratory tract, and in strong solution as inhalatory gargles. *Dose:* from one to ten grains.

8. *Common salt* has long since been considered a most useful agent in the treatment of diseases of the organs of respiration. On the supposition that it is present in the atmosphere near the sea and saline springs, from olden times up to our present day physicians have been in the habit of sending to the sea-shores patients affected with pectoral diseases; and to give the full benefit of it to those who were not able to travel, it has always been the object of physicians to create an artificial *sea-air;* but it is only since the invention of the atomizing-apparatus that this indication could be completely fulfilled.

The application of common salt for the purposes of inhalation is therefore very extensive and produces very marked effects. I make use of it in doses of from three to twenty grains to an ounce of water, and do not only apply it in the form of common inhalation, but very often advise patients to put the apparatus at different parts of their rooms into action with a solution of salt, so as to mix the saline spray with the atmosphere of the room which they then breathe.

In all stages of consumption these inhalations and the relief afforded by them to the patients are inestimable.

9. *Tincture of opium*, from five to twenty minims to one ounce of water, is very often beneficially applied, when it is our aim to rid the patient of a troublesome cough, be it a symptom of phthisis or of any other pathological process of the respiratory organs, provided that no phenomenon exists preventing us from the application of opium in general.

10. *Liquor arsenicalis potassæ*, from five to ten minims in one ounce of water, has very much been used in inveterate cases of asthma; its action is very often marked by rapid success after different medicines have been tried in vain.

11. *Pure water*, cold or warm, or even as hot as the patient can bear it. It renders in many cases of inflammation or paralysis of the larynx great service.

12. *Glycerine* has been recommended by Demarquay as soothing the irritation from inflammation of the pharynx, particularly if applied in the first stage. The antiseptic qualities of glycerine destroy, according to the same author, the fœtid odour which is frequently exhaled by patients labouring from certain diseases of the pharynx and palate. Scott Alison recommends it in laryngitis and tracheitis associated with hoarseness or loss of voice.

13. *Lime-water*, consisting of one part of lime to hundred parts of water; highly recommended by several authors as possessing powerful qualities

of solving the pathological exudative membranes in diphtheria.

There have been recommended the salts of iodine, bromine, chlorine, and others, but I had no need to digress from the medicaments just enumerated, and every practitioner may easily try the one or the other if he considers it necessary or desirable.

14. In conclusion, *Cod-liver oil* may be mentioned. It can also be turned into a spray, if an apparatus is used with rectangular tubes, the openings of which are wider than usual, and a larger flame than commonly necessary is kept up. Although I am led to believe that the administration of cod-liver oil by means of inhalation would prove much more convenient and beneficial than when that substance is internally taken, yet it has the inconvenience that the room wherein the atomization has taken place for many weeks retains the smell of the oil, so that the administration in the form of spray could only be effected in hospitals, where a separate room could be spared for the purpose wherein the patients could remain for some hours of the day, being entirely involved in clouds of cod-liver-oil.

+ Carbolic acid recently used in Kelley Hospital Adams Inhaler - 1 part to 100 water - gradually increased to 3 & 7 grains - (pure acid) it checks purulent effect. remarkably - to patients great relief - Med. R. & Circ. Nov 3. 1869 -

Inhalation

onchitic Asthma - see Dr. Moore's excellent case, where
uces Spraying. T. Anthoxanthum - with 5 drops of ☉
1. 3. hours - very rapid recovery - all usual Hom^c medicin
suffering - & allopathic treatment quite inert - M. H. Rev March
1871

CHAPTER VII.

IMMEDIATE EFFECTS OF THE INHALATION OF ATOMIZED FLUIDS.

Regularly performed inhalations have in many instances certain immediate effects, which must be known to the physician to enable him to predict them to the patient; some of these effects being of such a nature as to alarm both the patient and the physician if they are not aware of the possibility of their occurrence.

Every inhaling patient, as already mentioned, describes the feeling of penetration of the spray into the lungs. Sometimes—although a rare occurrence during or after the first one or two inhalations—a sensation of soreness in the chest is felt, which, if excessive or increasing after every inhalation, I consider a valuable indication either for diminishing the strength of the solution or for discontinuing the inhalation altogether, till that sensation has disappeared.

No mode of treatment can stand in comparison with the atomizer in its efficacy to enable the patient to expectorate those thick, sticky sputa connected with different diseases of the respiratory organs, and

which very often are the cause of a violent, very troublesome, and sometimes exhausting cough.

To many patients this effect was soon known, so that they made immediate use of the apparatus on their own authority when such cough began to trouble them. In many cases a phenomenon disappeared almost after the first inhalation, which not seldom may be found in persons labouring under the more advanced stages of consumption, or individuals whose nutrition is much impaired and whose general health is reduced to a very low degree. In such patients, morning sickness is a common occurrence, as it is met with in hard drinkers; it is this phenomenon which I have seen vanish after a very few inhalations. I thought it at first to be due to the quantities of condensed fluid which during the inhalation remain in the mouth and may be swallowed. But close examinations have shown the opinion to be erroneous, and the explanation of the fact can be given in another manner. The vomiting occurs, as already mentioned, in those individuals whose bronchi and trachea in the morning are filled with sputa. To expectorate the latter, a cough is required, and as the latter, by the nature of the sputa or by their quantity, must be a strong one, retching or vomiting is the consequence. Now we have seen that inhalations are the best means for easily expectorating sticky sputa; but in such a case no violent cough is necessary,

and consequently the source of vomiting is dispensed with.

But not only an alleviation of expectoration is frequently arrived at after inhalation, but also a diminution of the quantity, and in such instances the convalescence of the patient makes a rapid progress, his general health improves, he takes more food and digests better, his complexion grows healthier, his spirits get lighter, and his strength increases.

If in cases as phthisis I speak of a rapid progress of the patient's convalescence, I mean to say that we rid the patient of molesting symptoms, and place him in a condition which makes him feel tolerably well. I must make this remark as a guard against placing myself amongst that class of practitioners who—according to their belief, at least according to their own assertion—are able to cure phthisis.

If there exists an inflammatory condition of a slight nature in the larynx and hoarseness in consequence of it, the latter sometimes disappears after a few inhalations, or even after the first. The same observation may sometimes be made as well in certain pains of the larynx, when its mucous membrane is inflamed as in those slight catarrhal affections, commonly called "colds." The efficacy of certain atomized fluids in capillary bleeding of the organs of respiration has already been spoken of,

and the cases published by Dr. Fieber, in Vienna, show that some of them were very serious.

The greater rapidity of the pulse, and the raising of the temperature of the patient's body during the inhalation, proceed from the exertion consequent on an increased number of respirations rather than from the physiological effect of the inhaled atomized spray.

Hæmopthysis, as an occasional occurrence in consequence of the inhalation, has already been spoken of.

CHAPTER VIII.

ARRANGEMENTS FOR INHALATIONS OF ATOMIZED FLUIDS IN HOSPITALS AND DISPENSARIES.

If atomized fluids can be considered most appropriate, powerful, and beneficial medicaments for certain diseases, then the duty becomes incumbent upon us to make them accessible to those people who principally labour under such diseases. Virchow calls phthisis very rightly, "The tears of the poor, inwardly wept." Bad dwellings, insufficient food, the want of the most necessary things in life form a prolific soil for the growth of that disastrous plant generally called "Consumption." One glance over the annual returns of the registrar general shows it to be the cause of death in a vast number of men, particularly of the lower classes, and every practitioner who has an opportunity to see the pale-faced and emaciated out-patients of any hospital in labouring districts knows the horrible truth of that fact. The amount of money spent in London only for the relief of such patients is immense. Yet a close examination would soon show that the relief obtained stands in no proportion to the large sums spent for it. And this result is not due to insufficient arrangements or

similar circumstances; no, charity contributes whatever it can, the physicians have always endeavoured to treat their patients with that devotion and self-sacrifice which their noble art requires of them; but science is not yet far enough advanced to enable us to put a stop to that—like other—terrible disease which ravages amongst us, and daily puts more individuals to death than any of the so much feared epidemics ever did.

Of all progresses and inventions made in the never-exhausting science of medicine, in those which concern treatment, the public is most interested. Now if inhalations are shown to be of the greatest value—I will not say of curing such a disease, from which the bullets shot by us from the chemist shops mightlessly recoil — but of suppressing very disagreeable and sometimes dangerous symptoms, why should we not at once make arrangements in order to let those people partake in the new method who are most concerned in it?

In every well-managed hospital and dispensary, and particularly in those destined for the reception of patients suffering from diseases of the organs of respiration, an inhalation room should not be wanting. Where a small steam apparatus is already existing, the arrangement can be effected with great ease, but also in cases where an apparatus must be procured, the inconsiderable expense would be in no proportion to the benefit derived from it, and

even soon recompensed by economy in the use of medicine.

The principle applied could be either that manifested in the apparatus Fig. 6, or that of Siegle. The one tube whence the steam rushes forth, would be turned into a tube, running round the walls of the inhalation-room at an appropriate height, from which branches or arms, with a very fine opening and a stop-cock, would project into the room. By this arrangement the number of patients at one time inhaling could be as many as there are arms, and each might, if necessary, inhale a different fluid.

I repeat that this is an arrangement which should not be omitted in any well-managed hospital or dispensary. If we consider again, that by far the greater proportion of all patients, particularly out-patients, are so called sufferers from diseases of the chest, and that the inhalations in a great number of those diseases, are of much greater effect than internal remedies; if we consider that the atomized fluids, according to the statements of distinguished authors, are also very serviceable in other diseases —as, for instance, in certain diseases of the eye, in certain affections of the ear, &c.—the force of the above expressed opinion becomes still more evident.

But even in those dispensaries where no room can be spared for an additional arrangement, a number of atomizers ought to be kept, in order to be placed

into the hands of patients for whom inhalations are considered to be beneficial. This would be practical also from another point of view, namely, the treatment by means of inhalations is much cheaper than the ordinary one by means of medicines. Charity would, therefore, be extended over a much larger number of sufferers; the more so, as cheapness is not the only advantage inducing to the just-mentioned purpose, but the abbreviation of the cure, which is decidedly effected in a shorter time and in a much more agreeable manner than in the ordinary way,—a point very carefully and particularly to be considered in a patient whose whole fortune and whose family's existence depends on his daily labour.

CHAPTER IX.

INHALATIONS OF VOLATILE CHEMICALS, GASES, &c.

We have seen in the historical remarks that this kind of inhalation, on which I intend to speak a few words, has been applied already in ancient times. We know, moreover, that Celsus did not only recommend his patients, labouring from diseases of the lungs, to undertake sea voyages, but that, according to Pliny, inhalations of the air in pine-tree woods for such patients were considered very salubrious; an opinion which has been renewed in our times, and the application of pine extract is now very common in some parts of the Continent.

A great many authors have communicated their experience derived from inhalations of emollient vapours, fumigations, volatile oils, and other medicaments; however, this kind of treatment never became general. Here the so-called 'Hypoglottides' may be mentioned, which, as appears, at a certain period have been considered of great value. They consisted of a kind of lozenges, which the patient kept under his tongue, whereby it was supposed that certain quantities of the dissolved medicine reach the trachea; at least, there are a great many prescrip-

tions for the preparation of those hypoglottides by Galen, Dioscorides, Mithridates, and others.

It would be useless to refer to all medicaments which have been used for inhalations, and which still are made use of by the skilled and scientific physician, as well as by the money-making charlatan. Cigars of leaves of datura stromonium, iodine, bromine, and chlorine, vapours of aromatic plants, creosote, preparations of ammonia, volatile oils, and a great number of other chemicals are still used, although their efficacy is very problematic, and their application rests on no scientific ground. But this, of course, is no reason why any medicament should not be put upon trial, since for the application of the vast majority of the chemicals constituting the Materia Medica, no strict scientific reason can be given. We apply them, as we say, empyrically, and we must further confess that the most valuable medicaments range under this class. The time seems still far distant when the physician will be enabled to choose his medicaments with the same distinct relationship between them and a given disease, as exists between the surgeon's knife and the growth to be removed. But there are other medicaments for the application of which a scientific reason can be given, and such medicaments ought to occupy the first place in the Materia Medica. This can safely be said of—

The Inhalations of Oxygen Gas.

Their efficacy can easily be explained, if applied to the proper cases. In all diseases in which dyspnœa forms one of the most dangerous consequences, no doubt can exist of the manner in which oxygen acts, as in diseases of the heart, for instance, in bronchitis, in asthma, emphysema, and more especially in phthisis. Here a part or parts of the lungs are impermeable to the air. But the body requires a certain amount of oxygen (an adult about 23,000 cub. centim. or 34 grammes per hour), for the process of decarbonization of the blood, without which its existence is either impossible or very much disturbed. The diseased lungs are therefore forced to counterbalance by the number of respirations what in a healthy state they would have done by the greater capacity of the same. Hence respiration in individuals labouring from a disease which impairs healthy breathing becomes irregular, difficult, frequent, which frequency in lung diseases is in close relationship to the area of the lungs that became impermeable. Now if we assist the lungs in their unnatural labour, by giving them either pure oxygen or such an atmosphere as contains a greater amount of that gas than usual, or, in other words, if we assist the decarbonization of the blood in a manner which does not force the lungs to perform such an exhausting exercise, we place the

patient in the best possible position. In diseases of the heart the same takes place, with the difference that imperfect circulation of the blood is the cause of its being insufficiently decarbonized.

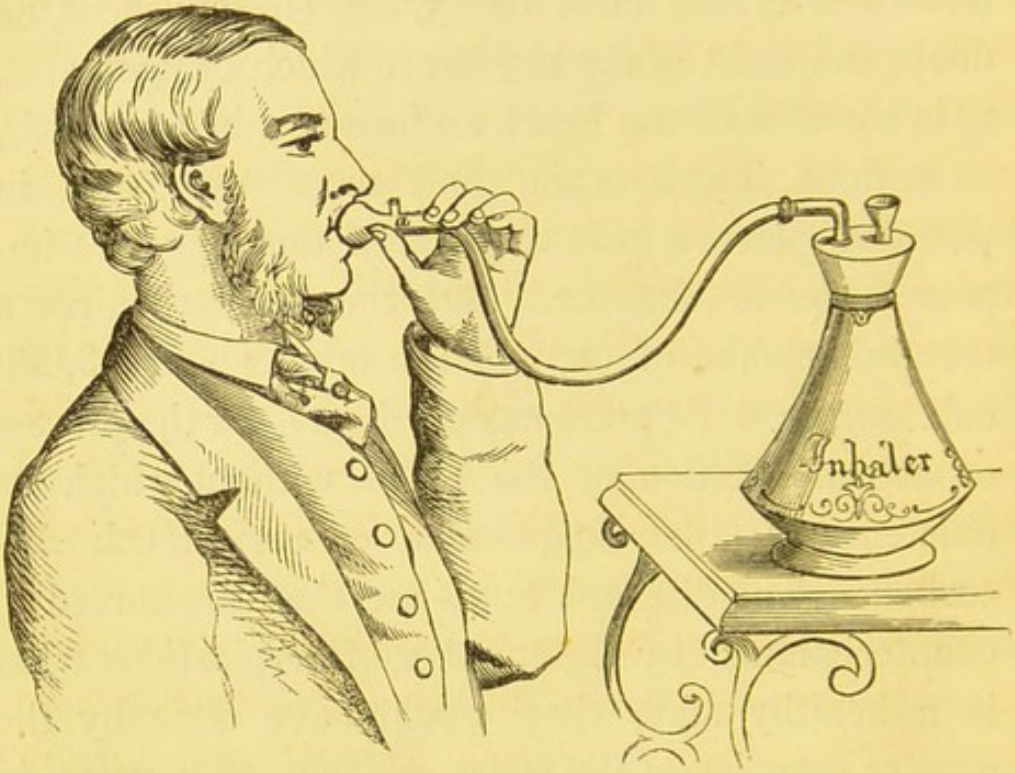

Fig. 13.

After Priestley had detected oxygen, and Beddoes and Davy had begun to treat patients by means of that gas, the fate of oxygen was the same as it is of all medicaments which were considered to possess such properties as to cure almost every disease. Medicaments of that kind do not exist and cannot exist, and disappointment has always been the result of such assumptions; but then the fault is generally made in the other extreme direction, namely, the conclusion is then drawn, that because the respective

medicament did not cure *all* diseases, it does not possess healing properties at all.

Neither of those ways is the path science strides, separately and minutely examining every action and every property of a body, accepting that which is found to be useful, and rejecting that which has proved useless.

From this point of view we must admit that inhalations of oxygen, pure or mixed with air, are an agent highly valuable in diseases, in which imperfect decarbonization of the blood takes place,—be it by impermeability of some parts of the lungs, be it by imperfect circulation of the blood, by closure of the glottis, by admixture of poisonous substances to the blood, or other causes.

It is not long since the application of compressed air in certain diseases of the chest has been recommended, and Bertin, Junod, Tabarié, and Pravaz have endeavoured to show it to be the most effective remedy in such affections. Now Dr. Lange has gathered all facts hitherto known in connection with the subject, and maintains that the efficacy of the compressed air principally rests upon the blood being more richly supplied with oxygen, and that a healthier nutrition is the immediate consequence of it. He proves that by the application of compressed air, a considerable increase of the negative pressure of inspiration and of the positive pressure of expiration takes place, whereby the power of the muscles of inspiration becomes greater, the pres-

sure of the blood in the aortic system is lowered, and the frequency of the heart's pulsation diminished. The animal heat lowers likewise after the application of a compressed air-bath, the organs of digestion are placed in a better position, whilst the appetite increases and the functions of the bowels are performed with greater ease. Increase in secretion of the urine has been observed in most of the cases.

It has generally been thought that pure oxygen cannot be inhaled without injury to health; but Demarquay and Leconte have shown that they, as well as their friends, could readily inhale from twenty to thirty litres without suffering any injury, and Ducroy has stated in the Academy of Paris that pure oxygen, contrary to the general belief, can be inhaled for several hours without being detrimental to health; that its action is antagonistic to that of chloroform; that it is a powerful remedy for the disagreeable accidents arising from chloroform and other anæsthetics; and that in asphyxy from poisonous gases—as, for instance, from carbonic acid —it exercises likewise a beneficial influence. Ducroy, therefore, proposed to make every patient, awaking from a chloroform-narcosis, inhale oxygen, in order to rid him of head-ache and other inconveniences following the administration of that anæsthetic. According to the reports of different authors, it should be a rule, whenever chloroform is administered, to have the oxygen-inhaler ready for use.

In compliance with the foregoing remarks, Mr. Erichsen, in his 'Monograph on Asphyxia,' says: "In a considerable number of experiments that I have performed on this subject, I have never succeeded in re-exciting the contractions of the ventricles by means of the inflation of the lungs with common air, provided they had fairly ceased to act before artificial respiration was set up." He was then led to try oxygen, and in several instances was successful in restoring the action of the ventricles after the entire cessation of the heart's action.

Most interesting are the experiments made by Beddoes, whereby it was clearly shown that animals drowned, and kept in water till death had apparently occurred, soon recovered in the free air, when, previous to their being drowned, they had inhaled oxygen, while others which had not, died. The same result was obtained with animals put into mixtures which produce a very low temperature. Those which had previously inhaled oxygen could for a long time remain in such mixtures, whilst others were frozen to death; others, again, were exposed to an atmosphere of hydrogen, and kept therein until entire cessation of respiration. Those treated previously by oxygen soon recovered when brought into the air, whilst animation could not be restored in the others.

But to return to our theme, *viz.* the application of oxygen, it has proved to be of great value in cases in which insufficient oxidation, or an abnormal com-

position of the blood, forms a prominent symptom—as in asthma, in the more advanced stages of consumption, in chronic bronchitis, anæmia, Bright's disease, chlorosis, and other similar affections. Inflammatory stages of phthisis, inflammatory conditions of the respiratory organs in general, contra-indicate the application of oxygen. It need not be mentioned, that an alternately combined treatment of oxygen and atomized fluids sometimes will render better services than either of them exclusively applied, as will be seen in many cases to be reported on in the second part of this treatise.

It remains now for me to make a few remarks on the apparatus I use for the administration of oxygen gas, as well as for inhalations of volatiles, &c. It is depicted in Fig. 13, and sold by Messrs. Robbins & Co., 372, Oxford Street; it differs from the inhalers hitherto constructed, not only in shape and finish, forming a fine ornamental vase, but tends also to remedy some inconveniences connected with other similar apparatus. The patient was hitherto, after each inspiration, obliged either to turn his face from the apparatus, in order to perform the expiration, or to expire into the apparatus, whereby the oxygen became mixed with the expired air.

The only apparatus which tried to avoid this inconvenience is that of Dr. Richardson. But the mouthpiece of his apparatus, covering very inconveniently the patient's mouth and nose, is not only

rather clumsy, but the valves which were intended to regulate the inspiration and expiration, soon became rolled up and never acted, or in a very insufficient manner only.

The following section of the mouthpiece of my inhaler (Fig. 14) sufficiently explains its construc-

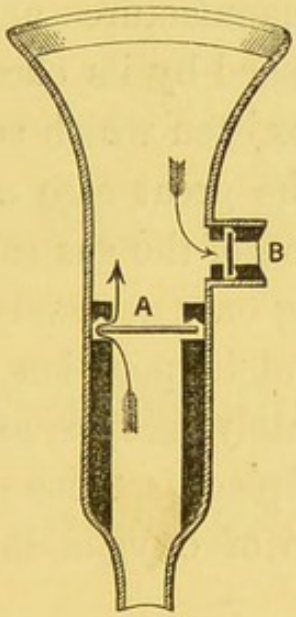

Fig. 14.

tion. The two valves (A and B) are made of vulcanite, and, acting extremely easily, close and open with great precision. It is obvious that the inhalation of the oxygen with each inspiration—during which the valve B gets closed—takes place in the direction of the arrow at A; while during expiration A closes, and the expired air escapes in the direction of the arrow at B.

In respect to the production of oxygen gas, it is now quite cheap enough as to be used almost by every patient. Hitherto, Messrs. Robbins & Co.'s Oxygenesis has been frequently used. But though

a quantity of the gas could readily be obtained by it in a short period, two things prevented the preparation from being generally applied — namely, its price and the necessity of placing into the patient's hand a quantity of sulphuric acid. But these impediments do no longer exist, since Messrs. Robbins & Co. recently manufacture another preparation, which is distinguished by its cheapness and by the large amount of oxygen which can be produced by it, as well as by the great ease and simplicity with which the evolution of the gas can be carried on by the patient, it being only necessary to put the powder into the inhaler and to pour hot water over it—the gas then immediately escapes, and can be inhaled through the mouthpiece. Thus no obstacle to the general application of oxygen in appropriate cases any longer exists.

In conclusion, it might not be amiss just to mention, that recently certain vapours, obtained during the process of purification of common burning gas, have been applied for whooping-cough. From different parts of the Continent cases have been reported in which cure was effected very rapidly. In many of those reports an enthusiasm prevailed, which very often takes possession of such new inventions and adorns the reports with a hue which vanishes before the rays of cool, critical investigation. At all events, there are not yet reports enough to enable us to express an opinion as to the value of this new medicament.

PART II.

ON INHALATION APPLIED TO SPECIAL DISEASES.

CHAPTER X.

INTRODUCTORY REMARKS.

If it were necessary to urge upon us the conviction that every advancing step in the treatment of the diseases of the respiratory organs bestows a benefit upon an incomparably larger number of our fellow-citizens than if made in the therapeutics of any other disease, one glance at the Registrar-General's reports —publications containing bare facts of the greatest importance and of the highest interest, but understood and cared for by comparatively a few only—would at once afford us the conviction of that truth. I may be permitted to quote a few figures only, as far as they refer to the diseases we are about to treat on, taken from the 'Supplement of the Twenty-Fifth Annual Report of the Registrar-General of Births, Deaths, and Marriages in England, 1864.' Therefrom it appears that the mean population in England and Wales in 1851–61 was:—

Males	9,278,742
Females	9,718,174
Total ...	18,996,916

The number of deaths in all ages was, during the ten years 1851–60 :—

Males	2,138,536
Females	2,072,179
Total ...	4,200,715

This number is distributed amongst twenty and three different causes of death, from which we quote only those concerning the organs of respiration.

Males.

Diphtheria	9,844
Whooping Cough	42,668
Phthisis	239,305
Diseases of Lungs	308,255
Total of Men ...	600,072

Females.

Diphtheria	10,879
Whooping Cough	52,956
Phthisis	269,618
Diseases of Lungs	265,571
Total of Women ...	599,024
Total of Men ...	600,072
Grand total ...	1,199,096

From these figures we learn, that in England during a period of ten years rather more than the fourth part

of the whole population dies; and that in one of four of all deaths, the cause is a disease of the organs of respiration.

The organs through which respiration is performed, are the nose, mouth, pharynx, larynx, trachea, bronchi, and the lungs; although in all diseases of these organs inhalations may be applied beneficially, yet I do not consider it necessary to treat on affections of the nose and mouth, being parts too easily accessible to any local application of remedies. But it must be borne in mind, that even in many of these cases of inflammation and ulceration of the uvula, the tonsils, the soft palate, &c., the atomizer has been applied, and that more benefit has been derived from it than from any other mode of local treatment.

The larynx and those organs of respiration situated beneath it, are objects in the researches of which pathological anatomy and diagnosis of recent times have gained the most excellent triumphs.

Laennec's invention has laid the foundation for recognition of morbid alterations of the pectoral organs during life; and the application of the laryngeal mirror has rendered the diagnosis of diseases of the throat, as certain as those of the eye have been made by Helmholz's discovery.

Hence the duty becomes incumbent upon every

medical man to make himself thoroughly acquainted with the use, both of the stethoscope and the laryngoscope, lest he should not be enabled to furnish himself with such diagnoses, as is necessary in order to decide on the treatment, rationally to be adopted in a particular case.

Were I to decide on the skill of a practitioner, I would do it only after having seen him examining a patient; and in chest diseases, whether and how he uses those physical implements for exploration of impaired health, which modern discoveries have placed into our hands for the good of our suffering fellow-creatures. To neglect the use of those inventions is a crime committed not only against science, but against the patient, because, though a minute exploration, and consequently a very precise diagnosis may not always exercise an influence upon the treatment of a disease, yet it will decidedly, in many cases, upon the prognosis, which very often is of the gravest importance to the patient himself and his family.

In this part I intend to treat on the principal diseases of the air-passages, in which inhalations have been applied by myself and others, and to illustrate them by cases which came under my care, either in private practice or in the Metropolitan Free Hospital.

Some authors have treated on tumours and other pathological excrescences in connection with

inhalations, but such formations I have excluded from my consideration as unfit for inhalatory treatment.

But treatment being the principal aim of this book, I shall merely briefly allude to the diagnostic and pathological features of the special diseases, just as much as necessary for my present purpose; and should there be any case on record, more apt to illustrate a special disease than that of my own observation, I shall not hesitate to refer to the same or to relate the history of such diseases in which I had no sufficient opportunity to apply inhalations.

I shall therefore proceed to treat on:

I. *Diseases of the Pharynx, Larynx, and Trachea.*

1. Laryngeal Hyperæsthesia.
2. Œdema glottidis.
3. Laryngitis.
4. Croup.
5. Diphtheria.

II. *Diseases of the Bronchi and Lungs.*

6. Bronchitis.
7. Asthma.
8. Emphysema.
9. Hæmoptysis—Spitting of Blood.
10. Phthisis—Consumption.
11. Gangræna Pulmonum.
12. Whooping Cough.

CHAPTER XI.

I. DISEASES OF THE LARYNX AND TRACHEA.

1. *Laryngeal Hyperæsthesia.*

The principal nerves of the larynx are the superior and inferior laryngeal; the former commanding the sensitive functions, the latter the voluntary and involuntary movements of the vocal chords. Upon every injury inflicted upon the inferior nerve alteration of the voice will follow and the complete inactivity of the nerve as a consequence of pressure, in struma, for instance, or of dragging, as by aortic aneurism, will be followed by hoarseness, soundless voice or aphonia (Hyrtl.)

These nerves are easily exposed to injuries, not only by over-exercise, which they frequently undergo, but by exposure to cold air, sudden changes of temperature, and the like. The affections arising therefrom are mostly of an inflammatory character; but very often they are merely and exclusively nervous, recurring at certain periods, lasting a certain time, during which pain, and very vehement pain too, hoarseness or even aphonia prevails, disappearing again and leaving in the interparoxysmal period no

traceable marks of their existence. Sometimes such an attack comes on suddenly, sometimes having certain forerunners, as indisposition, headache, want of breath, roughness in the throat, difficulty of swallowing, and the like; sometimes it is associated with sensations of suffocation, laborious breathing, yawning, sighing, &c.

Case I.—*Painful attacks after a cold; recurring several times a day. Cured by inhalations, after blistering, morphia, and Indian hemp, have been resultlessly tried.*

E. F——, a vocalist, had caught a severe cold, in consequence of which he was very often attacked with considerable pain in his throat, of a choaking character; he felt besides, during each attack, a burning sensation in the larynx, and his face was covered with perspiration. Each attack lasted about ten minutes, then it disappeared, and returned several times in the course of the day. There was no typical appearance to be observed. The larynx was, in the interparoxysmal line, indifferent to external pressure. The result of laryngoscopy was negative. Blistering, internal application of the acetate of morphia, cannabis Indica, opium, and iron were had recourse to, but without any effect. I applied the acetate of morphia by means of inhalation (half a grain to an ounce of distilled water), and the effect was a perfect cure after ten applications.

Case II.—*Regularly recurring attacks of a suffocating sensation and aphonia; application of atomized fluids. Cured.*

B. L.——, a girl of seventeen, who earned her living by singing almost every evening in a public-house. One night she sung and danced much, and being very hot, returned home and went to bed. At about four o'clock in the morning she was roused from sleep by an extremely painful sensation in the throat, and thought that she was dying from suffocation. She tried to call her mother, who slept in the same room, but was unable both to call or speak. After a few minutes her body was covered with perspiration, the symptoms ceased, and she slept the rest of the night quite soundly. Four weeks elapsed without her having another attack or any inconvenience in the throat, when in the night of July 20 she was roused again, finding herself in a similar state as that described above. This time she could not account for the attack at all. Her night's rest was henceforth disturbed by similar attacks; she attended several hospitals as out-patient, and took different medicines, without receiving any benefit.

On *November* 4, 1865, the patient came under my care. She is of a fair complexion, rather too delicate, but otherwise healthy. Neither physical examination of the chest nor the laryngoscopical aspect of the throat, revealed any abnormal condition of the

organs of respiration. She speaks well and sings clearly, continues singing every evening as before, and feels well; all natural functions are regular, appetite good. The only complaint consists in the attacks which occur every night with remarkable regularity, and which are very troublesome indeed. She has taken different medicines, of which she knows one only, *viz.* quinine. I ordered inhalations of acetate of morphia (one grain to an ounce of water) twice a day.

November 8.—The attacks returned regularly, but with the difference, that the suffocating sensation has almost lost its strength, so that during the attack the patient does not suffer half so much as she used before the inhalations. Inhalations continued (two grains to an ounce).

November 15.—She had had only two slight attacks since last date. Continuation of the inhalation.

November 22.—No attacks have occurred.

December 2.—Patient has continued undisturbed, and was discharged totally relieved of her great suffering.

2. *Œdema Glottidis.*

Serous infiltration into the submucous tissues, particularly of the lower surface of the glottis and of the ary-epiglottic folds, are the most prominent anatomical signs of that disease, the course of which may be acute, subacute, or chronic. If acute, the

disease appears suddenly with terribly suffocating phenomena, and in a very short time ends fatally. Happily the occurrence of the subacute and chronic form is more frequent than that of the acute.

The laryngeal mirror shows the ary-epiglottidean folds and arytenoidean cartilages to be of a pale reddish, firm, puffy appearance, wholly concealing the vocal chords. The hinder wall of the larynx generally does not partake in the œdema; the arytenoidean cartilages are of very large size.

The differential diagnosis between œdema glottidis and croup can be sufficiently ascertained by means of a close laryngoscopic examination of the pharynx and larynx; but besides this it must be borne in mind, that while croup generally occurs in healthy children, œdema glottidis is a disease of adults, who nearly always have previously suffered from some affection of the throat.

I am not aware whether, since Trousseau has reported to the Academy of Paris on two cases which he successfully treated by means of a pulverized solution of tannin, other physicians have applied inhalations to that disease. In one of Trousseau's cases tracheotomy was considered unavoidable in order to save the patient's life. Trousseau therefore highly advocates inhalations in œdema glottidis, yet there can be no doubt that we shall at once proceed to scarification, or use other means if necessity should require them, and afterwards apply

either inhalations of warm water, as Dr. Gibb proposes, in his able work 'On Diseases of the Throat and Windpipe,' or of adstringents, as tannin, alum, &c. Inhalation of oxygen during the attacks would doubtless render the patient more fit to bear the consequences of the suffocating symptoms.

3. *Laryngitis.*

Inflammation of the mucous membrane lining the larynx, and forming the vocal chords, is the prominent feature of the disease which has been described by different authors, and classified into a great many divisions and subdivisions, to each of which separate names have been applied. Laryngitis occurs either idiopathically, or as a symptom of other diseases, as for instance of tuberculosis, bronchitis, &c., and assumes either an acute or chronic character; the former often being very dangerous, the latter seldom fatal; both rarely being restricted to the larynx only, but affecting also either the pharynx or the trachea. In other instances, again, certain parts only of the larynx are inflamed, as for instance, the vocal chords in public speakers and singers, particularly in those whose voice is clear under extra-exertions, but more or less hoarse in ordinary speech. A sensation of soreness of the throat, of tickling, cough, with or without expectoration, pain, tenderness, hoarseness, but in severer cases fever, difficulty of breathing, are the

most prominent symptoms. *The laryngoscope* shows the mucous membranes to be red, infiltrated, the vocal chords swollen, abundantly covered with mucus, whereby hoarseness is produced.

From the slightest affection of a feeble cough or tenderness of the throat, the disease may vary up to the stage in which the livid-faced patient has no moment's rest, gasping for air, and dying from suffocation.

But this is just one of the diseases in which the influence of inhalations has proved much more powerful than the application of other medicines. Pulverized solutions of salt, extract of hyoscyamus, tincture of opium, morphia, iron, zinc, alum, and nitrate of silver, have been applied, but in many cases of a more severe character, inhalations of oxygen are of the greatest importance.

Case III.—*Acute catarrh of the larynx; cough; expectoration. Cured by four inhalations.*

J. J——, merchant, twenty-one years old, a well-built gentleman, came on August 7, 1865, under my care. For four days he has had a constant tickling in the throat, which makes him cough, and particularly at night. The cough is followed by expectoration, though the latter is not copious. The voice is rough, not quite hoarse. The examination of the chest gives no abnormal signs, the laryngoscope shows a catarrhal condition of the larynx.

The patient inhaled on the morning and evening of August 7th one ounce of a pulverized solution of alum (three grains to the ounce of water), and repeated the inhalation on the following day. After the second inhalation the symptoms had nearly disappeared, but after the fourth, the normal conditions of the throat was restored.

Case IV.—*Hoarseness, many years lasting; the larynx painful; redness of its mucous membrane; many medicines tried in vain. Cured by inhalations of alum.*

A. B——, an unmarried lady, consulted me at the end of 1864 for hoarseness, from which she had suffered for several years, and which was the more unpleasant to her as she sang well and a great deal previous to that affection—a pleasure the deprivation of which gave herself and her friends great concern. The voice was coarse and without *timbre*; the larynx was painful only at the beginning; now it is indifferent to external pressure. Laryngoscopy can easily be effected, and shows only a slight unnatural redness of the mucous membrane of the larynx and of the vocal ligaments. No other inconvenience exists. In course of the affection a great many medicaments were tried, and all without effect. I applied inhalations of alum (ten grains to the ounce of water). After three applications a striking improvement was observed, which after five

was so complete that I discharged the patient, advising her not to sing yet; but after a week she could no longer resist; therefore resumed singing, and sang as before the affection.

Case V.—*A long-lasting catarrhal affection of the throat, exacerbating in the winter; hoarseness, cough, expectoration of blood. Cured by inhalations of tannin.*

G. F,—— upholsterer, forty-seven years old, married, and father of eight healthy children; no tubercular disease in his family; never suffered from any illness during childhood or youth; has been in the trade since his fourteenth year, breathing very often a dusty atmosphere. He continued well till about ten years ago, when he was seized with a "cold," which disappeared after a few days; but since that time a slight cough remained, which was never troublesome, being worse in the autumn and winter than in mild or warm seasons. In December, 1864, the respiration became more difficult, and was soon followed by extreme pain in the throat, strong cough, hoarseness, and blood-tinged expectoration. Leeches and ice were applied to the throat for twenty-two hours. On the next day the symptoms were less vehement, but still very troublesome. Several medicaments were administered, but without any effect.

January 14, 1865, the patient came under my care. The following was then his state. He is well-

made, strong, muscular, of fair complexion, visible mucous membrane well coloured. The supra and infra clavicular region of the thorax rather flattened, respiration audible, twenty-five in a minute. Percussion-sound of the upper part of the chest rather dull, but the respiration at this region, though feeble, yet vesicular. The larynx very tender, the slightest pressure causing heavy cough, followed by expectoration mixed with blood. The pharynx appears red, the glottis and larynx likewise injected in a high degree, the vocal chords swollen and red. Laryngoscopy causes great pain, appetite is impaired, pulse ninety-eight in a minute, large, regular.

Inhalation of a solution of tannin and opium.

℞ Tannini, gr. iv.
Tinct. opii, min. x.
Æq. dest. ℥i.
Man. nocteque inhaland.

January 16.—The throat bears a much greater pressure than it did, pain diminished, expectoration not mixed with blood. No alteration in the voice.

January 18.—Tenderness of the throat diminished, moderate pressure does not produce any cough, the mucous membranes are no longer as red as they were, breathing without noise and without difficulty, pulse eighty-two, respiration nineteen, appetite fair.

Patient continued the inhalations till March 3rd, when his larynx had an entire healthy appearance, and his voice become quite clear. He ceased to

cough, and considered himself perfectly well, and in a much better condition than he was before the attacks.

Case VI.—*Chronic laryngitis; vehement exacerbations; loss of voice; oxygen inhalations affording great relief during the attacks; inhalations of atomized fluids. Cured.*

A. Y——, aged nineteen, unmarried, general servant, was, up to her fifteenth year, never ill; then she was attacked with typhus fever, from which she recovered after three months. The only symptom that remained was hoarseness, so that she could not speak loudly. Four months ago she began to feel uneasiness when swallowing and difficulty in speaking; these phenomena became very soon intensified, so that in the evening she was obliged to go to bed, where she remained extremely restless for a few hours, but then was obliged to get up again, because the pain in the throat became excruciating; it extended all around her throat, so that she felt as if she must die from suffocation; her face assumed a livid colour, and was covered with heavy drops of perspiration; breathing was difficult, and the patient in great agony. A medical man was called, but before the prescription was made, the symptoms were reduced very much in intensity, and patient felt tolerably well. From that time every fortnight or every three weeks, a similar attack recurred, lasting

from five minutes to half-an-hour. The choaking sensation, according to the description of the patient, was always the worst of all the symptoms. Leeches, blistering, ointments, hot poultices, Turkish baths, liniments, and medicines administered internally could not check the recurrence of the attacks.

September 3, 1865, the patient came under my care. She was a fine-looking girl, well-built, dark complexion, and muscular; her head was somewhat defectively covered with hair, such having been the case, as she says, from the time when she suffered from typhus. By the examination of the chest no abnormal sign can be found; the larynx is not very tender to pressure, pharynx red, laryngoscopy easily effected, glottis and mucous membrane of the larynx above the vocal chords and likewise Morgagni's ventricles very much inflamed; at the right side a very small round ulcer; vocal chords puffy, swollen, but not much injected. Voice is extremely defective, hoarse, low, scarcely audible. Patient has always regularly menstruated, and states that she has never been affected by venereal disease.

She was ordered to use, twice a day, inhalations of common salt.

℞ Sodii chlorid. gr. v.
Æq. com. ʒi.
Mane nocteque inhaland.

Besides this she inhaled once in the middle of the day pulverized pure water.

September 7, she reports, with very great pleasure, that yesterday the voice was several times quite clear, but lasted only a couple of minutes and disappeared. A much more agreeable sensation takes place in the throat, and it seems as if respiration was performed much more freely than before.

September 10.—On the evening of the eighth, an extremely vehement attack recurred, which lasted for about half-an-hour. No other appearance since last report. She was furnished with an inhaler for oxygen, and with Robbins's powder, and instructed how to make use of both, in case she should be attacked again.

October 2.—On the evening of the fifteenth, an attack recurred, but was of a very slight kind only, in consequence of oxygen having been applied at once; no duskiness of the face, no suffocating sensation. Yesterday another attack was entirely checked in the same manner. In the patient's health a great improvement has taken place. No pain in the throat, and the voice, though still hoarse, is loud and very much better than it was. Patient continued to inhale warm water at noon, the solution of salt in the evening, but in the morning she inhaled

℞ Sulphatis ferri, gr. ii.
Æq. dest. ℥i.

The ulcer was twice touched with nitrate of silver.

On October 17, she was discharged with a perfectly healthy state of the larynx, and an entirely

clear voice. At the end of December she called again on me, to inform me of the continuation of her perfect health.

The important conclusions drawn from some of these cases are,—that by means of inhalation we are often enabled to rid the patient, not only of troublesome symptoms, but of really inveterate diseases, which have for a long time resisted different kinds of treatment.

4. *Croup* (*Angina membranacea*).

Inflammation of the larynx, trachea, of the larger bronchi, and sometimes of the pharynx, or of all at a time, producing such exudative membranes as to line these organs, and thus forming a mechanical obstruction in the respiratory tube, and causing very laborious, whistling, stertorous breathing, or producing death by suffocation, are prominent features of that very fatal disease. The fibrinous exudation or pseudo-membrane does not firmly adhere to the mucous membranes, but can easily be separated either in shreds or preserving the shape, and forming a perfect mould of the respective organs.

The disease seems to be produced by atmospheric influences, but is not contagious; it attacks adults only exceptionally, and sometimes runs its course within a few hours. The larynx is almost invariably the starting point of the affection, whence the exudative process progresses towards the pharynx in the one direction and towards the trachea in the

other. Croup of the bronchi is a rare occurrence. If the pseudo-membranes line the larynx and vocal chords, then aphonia is the natural consequence, and the barking cough, which is seldom absent in croup, is of such a characteristic nature as never to be forgotten by him who once has had opportunity to hear it. Although nature, neither in this nor in any other disease, rests in her course in order to mark certain divisions, yet for clinical purposes three stages in croup are generally accepted, *viz.* the precursory or catarrhal, the stage of development, and the suffocative or stage of collapse.

Cases of this disease treated by means of inhalation are not very numerous on record, yet reports have been published by Trousseau, Barthez, Schnitzler, Biermer, and others. Dr. Gibb says:—"I have recently employed the spray of a solution of nitrate of silver (sixty grains to the ounce) as an injection into the larynx and trachea in croup, and the severity of the symptoms was so diminished that I almost doubted whether the disease was actually croup; yet all the well-marked symptoms were present. I would, therefore, unhesitatingly advise local treatment to the upper air-passages in the manner referred to, in conjunction with other measures. The solution certainly prevents the tendency to fibrous exudation."

From the reports of other authors it appears, likewise, that the action of the atomizer was very

powerful, and this encourages us the more to its application, as nothing prevents our combining with it the administration of those medicaments which have proved valuable.

The great importance of the subject will justify me in communicating some interesting cases of other authors. The following is one of the cases published by Barthez (Revue médicale, 1860).

Case VII.—*Case of angina membranacea in its second stage; treatment by frequently repeated inhalations of a pulverized solution of tannin. The disease remains nearly three days unchanged, then undergoes rapid improvement, and finally cure is effected.*

F. P., a strong boy, three years old, was on August 14, 1860, admitted an in-patient to Sainte-Eugénie Hospital. The child has hitherto enjoyed good health, but has been ill the last four days; his mother knows only that in the previous night the little patient was nearly suffocated, and that an emetic has been administered to him with good effect.

At the reception (10 o'clock p.m.) the breathing was laborious, and laryngeal whistling could be heard distinctly. A dose of ipecacuanha was administered, which caused vomiting. The night passed tolerably well.

August 15.—Appearance pretty good, no anxiety perceptible on the well-coloured countenance. Fever, heat, and dryness of the skin moderate,

the submaxillary glands very small. In the pharynx a few pseudo-membranes can be seen distinctly, which are of a yellowish colour, and do not appear firmly to adhere to the mucous membrane; the largest covers the right tonsil; nose free. There exists decidedly a stoppage to the free passage of air through the larynx; breathing is whistling and more frequent than normal; cough coarse, dry and somewhat hoarse; voice in some measure extinct. On examination of the chest by auscultation everywhere a whistling, stertorous noise can be heard, which conceals the vesicular breathing. The child took easily some food (beef-tea, broth, eggs).

No diarrhœa, no albumen in the urine.

Emetics (Pulv. Ipecac.) and inhalation of pulverized solution of tannin (5 gram. tannin, 100 gram. water) administered.

Copious vomiting; the patient bears the inhalations so well, that fifteen can be performed a day, each lasting twenty minutes; several times the little patient fell asleep during the inhalation, which he performed readily. Before each inhalation the cough is more frequent and hoarse, the voice feebler, and the laryngeal whistling decidedly drier than after the inhalation, so that it becomes difficult to doubt the efficacy of that medicament.

In the evening no change; respiration still impaired, an emetic which was administered had almost no effect. The child slept but

little; during sleep the respiration by far less noisy.

August 16.—The condition remained satisfactory. The pseudo-membranes covering the tonsils, and particularly the right one, neither separated nor enlarged. Breathing still difficult; cough at one time rough, and as if extinct at another; the sonorous noise in the chest still perceptible. Twenty inhalations, each of ten minutes' duration, were administered. In the evening three watery motions. Night passed pretty well.

August 17.—The child appears much more depressed; intense and prolonged whistling in the larynx, but these alarming symptoms became gradually feebler. There exists, in fact, but a slight difference between the patient's condition of to-day and of yesterday. Meanwhile the pseudo-membranes of the tonsils seem to vanish, being partly replaced, partly covered by sticky, yellowish mucus.

Twenty inhalations, each of ten minutes' duration.

Seven thin, slimy stools; no albumen in the urine.

Since *August* 18, the progress towards recovery was obvious. The remainder of the right tonsil's pseudo-membranes were divided in small pieces, forming only a few small spots, and entirely disappearing on August 20, after the fifth day of treatment and the ninth of the disease. Gradually respiration became free, the cough moist. The sonorous rattling which was heard all over the

chest appeared less frequently, and was restricted to the root of the bronchi only.

On the 23rd it was not heard any more, after having assumed the character of a mucous noise. The diarrhœa soon gave way to a few injections of starch, containing 4 grammes of ratania-extract and 30 grammes of syrup of quinine. On the 24th the little patient was perfectly cured and discharged.

A few days afterwards a papulous eruption appeared all over the skin, which made the re-reception of the child into the hospital necessary. Sulphur-baths were successfully applied, and when the patient, on September 3, again left the hospital, he enjoyed perfect health.

Professor Biermer reports (Schweitzerische Zeitung für Heilkunde, 1864) the following case in an adult:

Case VIII.—*Laryngitis crouposa, suffocative phænomena; loss of consciousness and sensibility; no relief through emetics. The atomizer successfully applied.*

A girl, eighteen years old, on March 1, 1864, was treated for simple laryngitis. On March 13, at breakfast, she was seized with an attack of severe cough combined with suffocative phænomena, cyanosis, cool extremities, loss of consciousness, and entire absence of sensibility. A physician was called, who immediately tried to revive her, and applied a hot hammer to her chest, but without causing the

slightest reaction. After inflicting several strong irritations upon the skin and after administering some doses of Liq. ammon. anis., the patient became conscious, and by vomiting brought up a considerable quantity of croup-membranes, after which respiration was performed easier. From this day respiration evidently remained difficult, noisy, and whistling. At her reception into the hospital (on the morning of the 13th) the patient's countenance was still very livid, eyes dull, pulse imperceptibly small, nose and extremities cool, and the stertorous respiration accompanied by cough and expectoration of croup-membranes; one of these membranes was ringshaped, forming a cast of a tracheal ring. Through irritants, applied to the skin, the despnœal attack was reduced in force. But on the morning of the following day, a suffocating attack appeared again, accompanied by that type of prolonged inspiration, which often can be observed in croup; strong exertions of all auxiliary muscles of respiration, and considerable excavation of the scrobiculus cordis during inspiration. An emetic was administered, which caused vomiting, but in spite of it the orthopnœal symptoms, the duskiness of the face and great anxiety increased, whilst cough had ceased entirely. Under these circumstances, and in order to moisten the dry respiratory tract, the application of hot water by means of pulverization was tried. This proved very agreeable to the patient; she

declares that she feels the better, the hotter the spray is; so that, finally, boiling water was pulverized. Thus she inhaled for an hour, and perceived that the painful dryness and the impaired respiration were diminished. But soon after, vehement coughing occurred, combined with suffocating sensation, whereby a considerable quantity of mucus and shreds of croup-membranes were expectorated, which caused very great relief. From that time the patient inhaled every two hours tepid lime-water (one part of lime to thirty of water), each inhalation of a quarter of an hour's duration. The symptoms of the croupous stenosis of the larynx soon decreased, and thick, purulent, crumbling pieces were expectorated; the fever from that time likewise diminished, and in the following days entire reconvalescence began; the aphonia still remained until April 9th, when it likewise began to decrease.

In a previous chapter some remarks have been made on the use of oxygen in diseases accompanied by suffocative attacks. This is particularly applicable to croup. Here we do not intend to cure the disease by inhalation of oxygen, but to guard the patient from the consequences of such attacks, which frequently prove fatal, and to place him in such a position as to enable us to apply other remedies. Oxygen, under such circumstances, has in some measure the same effect as tracheotomy,

whereby we intend to evade a particular part of the respiratory tract in order to gain time till we possibly master the inflammation, as well as the formation of the pathological products represented by the croupous membranes.

As an illustration of that fact, I reproduce the following case, reported by Miquel (Correspondence Blatt des Vereins für gemeinschaftliche Arbeiten, 1862) :—

Case IX.—*Severe case of croup; application of the usual medicaments without benefit. Immediate alleviation after oxygen had been inhaled.*

Patient was a boy twenty-one months old, hitherto perfectly healthy. On February 21, 1862, Miquel was summoned, and found the child in the following condition :—Breathing, noisy and whistling, short, some forty respirations in a minute, but irregular, as well in respect to the rhythm as to duration; pulse small, very frequent, impossible to be counted; countenance pale, lips livid; all muscles are active during breathing, and the regular movements of the levatores alæ nasi, of the muscles of the throat, &c., were combined with irregular spasmodic movements, which now and then agitated the face. The little patient frequently bent his head quite backwards, the expression of his countenance being very anxious, and seized his throat convulsively with his hands. His face was moist

and cold. The child very seldom yet made efforts to cough; when coughing, the voice appeared barking, hoarse, suppressed. According to the report of the house-doctor, nine days ago the child was seized with symptoms of croup, which at first decreased by emetics, leeches, and other remedies, but three days ago have recurred with great intensity. The usual remedies were applied again, but failed to do any good, and a newly administered emetic was to the same effect; involution of the legs in mustard powder and inhalations of hot steam were vainly resorted to. At half-past ten, inhalations of oxygen were tried. One cubic foot of that gas, one volume of pure oxygen, mixed with a smaller portion of atmospheric air, in a gasometer, was brought to the patient's residence. The amount of respiration might have been about five cubic inches, the quantity of gas (1,728 cubic inches) was, therefore, sufficient for 350 inspirations, which might have been performed in about nine or ten minutes, yet the procedure lasted about fifteen to twenty minutes. The child's condition after the inhalation was the following:—Pulse perceptible, less frequent, number of respirations about the same. The appearance of the child was, according to the judgment of all persons around him, more quiet, less anxious; patient became more reactive to the impediment to respiration, so that he coughs frequently, though with the peculiar croup sound; once such a cough spontaneously pro-

duced vomiting. The spasmodic movements of the muscles of the face, as well as of other regions of the body, ceased, and at one o'clock in the morning the parents came to me to report that the child had slept pretty quietly, and that the spasm and anxiety had disappeared. They added, that on no previous night the suffocating seizures and the expression of the countenance were so alarming; but that on none of the four previous nights was the patient so quiet as he is to-night. On the following morning the child was found to be still better, and though the oppression recurred on the following evening in a slight degree, yet all the remainder vanished by medicaments applied for the disease itself, and the patient recovered entirely.

5. *Diphtheria.*

Since Bretonneau has published his observations on Angina maligna made in the epidemics at Tours, from 1818 to 1824, in which report he considered croup and diphtheria to be identical diseases, all French, and a few English and German, authors have followed his example, and treat both these affections under the one heading, "diphtheric process," or, as Millet, in Tours, did as "la diphthérie de larynx—croup." This assumption is not based upon sound observation; neither are the clinical phenomena, nor the pathological results, of such a nature as to justify the course adopted by these authors. According to

Virchow, croup deposits its fibrinous, curdy exudation upon the free surface of the mucous membrane, to which it adheres, but from which it may be separated without causing defects of substance. Diphtheria, however, not only deposits its exudation upon the surface, but into the very tissues of the membranes, which are replaced by the former. When trials are made to separate these deposits, considerable defects are hereby caused—*i. e.* sores, which again become enlarged by new diphtheritic deposits.

But it is not only this anatomical characteristic which distinguishes diphtheria from croup, but also the entirely different clinical course which it pursues, so that it appears that the two illnesses are so widely different from each other, although there is no such ætiological connection between them; as is a primary chancre from the secondary or tertiary syphilitic process, the one affection having, as it were, a more local character, the other being connected with a poisonous state, often followed by dissolution, of the blood. I mean to say that croup would never, but exceptionally, be fatal, if nature had not chosen the larynx as the place for the pathological depositions of that disease, which depositions mechanically cause suffocation; whilst the danger attached to diphtheria, chiefly arising from the septic condition of the blood, would under all circumstances remain the same. In fact, in diphtheria the deposits are not restricted to the

pharynx and its neighbouring parts, as nose, velum, larynx, but have been observed also in the lining membranes of the intestines; and if wounds exist in patients, afflicted with diphtheritis, these wounds also become covered with the characteristic exudation. The case under the care of Mr. Maunder, reported in 'The Lancet' of 1864 (vol. ii. page 464) illustrates that fact. But the most interesting and most decisive cases are the two narrated by Dr. Sturges ('Lancet,' 1864, vol. ii. page 222), which clearly show that it is not the local affection which in diphtheria conveys the danger, but the general state of the disease. The first of these two cases, says Dr. Sturges, "occurred in a child about two years of age, to whom I was called on December 23, 1823. At the onset, the throat symptoms were urgent, and the breathing stridulous. The tonsils, the arches of the palate, and the uvula were seen to be more or less covered with the greyish-white exudation of diphtheria, and the submaxillary and cervical glands were enlarged. Hot linseed poultices were kept constantly to the throat, and the child was made to inhale the vapour of hot water from time to time. An aperient powder was administered, and the tincture of the muriate of iron given every four hours. Under this treatment, the throat gradually improved, the breathing became natural, and I was hopeful of my patient's recovery. The aversion, however, to the wine, milk, and beef-tea, manifested from the first, continued.

There was no rejection of food, but great perseverance was required to induce the child to take it, and the beef-tea had to be abandoned. Nevertheless, a considerable quantity of milk was taken daily. This state of things continued until the seventeenth day, the child each day becoming almost imperceptibly weaker, when almost as imperceptibly it sank out of existence."

The second case was that of a little girl. The symptoms at first were by no means urgent. The exudation appearing to spread, a solution of nitrate of silver (half a drachm to the ounce) was applied for several consecutive days, and had the effect of limiting it, but nevertheless death occurred on May 14, the child having been seized on April 24.

Not less importantly bearing on the question are the cases reported by Alderson, Greenhow, Gee, Wade, Gibb, and others, showing that palsy and other nervous affections have been observed as such consequences of diphtheria as could have originated only in a disease—the cases in which paralysis have been the natural consequences of loss of substance excepted — in which a morbid condition of the blood existed.

Dr. Lewin, who has made extensive researches into the nature of the diphtheritic process, thus describes the difference between the general characteristics of croup and diphtheria (Klinik der Krankheiten de Kehlkopfes). "*Croup always sets in* with

great inflammation of the larynx, and with the tendency to deposit upon the free surface of the mucous membrane a fibrinous exudation investing the epithelia. Close observation will always show the existence of this inflammatory stage of croup, which sometimes lasts for a considerable time. The general signs of inflammation—*viz.* high temperature, a full, accelerated pulse, and increase in the number of respirations, will never be absent. The greater sensibility, the hyperæmic condition, and the swelling of the mucous membrane of the larynx point to the direction in which localization has taken place. The fever, at the onset of the disease almost a *Synocha continua*, resumes only in later stages a remittent character. The hot epidermis is dry, the patient's countenance ruddy, turgescent; the urine mostly somewhat saturated, inclined to form deposits of urates. The exudation, when localized at the larynx, by narrowing the passage, causes suffocating phenomena. But if the muscles of the glottis have imbibed the serous fluid, palsy of the larynx ensues."

"*The character of diphtheritis* appears, as soon as the insignificant and transitory febrile and inflammatory phenomena have disappeared, as adynamic or asthenic, with the constant tendency to putridity. Instead of the ruddy countenance of the children attacked with croup, in patients suffering from diphtheria the face is, mostly at the beginning,

already pale, which paleness is not uncommonly of a dirty kind, here and there discontinued by red spots. After a short time the dull eye gets likewise a lead-coloured rim. The pulse, at the outset somewhat accelerated, becomes soon empty, small, feeble, and decreases to fifty and even to forty in the minute. The heat of the skin, at first heightened, soon sinks below the normal state. The urine mostly remains pale, sometimes soon forms phosphatic deposits, and still oftener contains albumen. Thirst is seldom increased. Instead of uneasiness, the patient exhibits striking languor. Though in croup, the long-existing stenosis of the larynx in the last stage of the disease causes coma, through defective decarbonization, yet in diphtheria the soporous stage, caused by dissolution of the blood, often appears at the outset of the disease or a short period after."

Not less characteristic in both diseases is the local affection, which in croup almost invariably commences in the larynx, whence it often progresses to the trachea, and sometimes to the pharynx. But in diphtheria, the starting point for the localization is invariably the pharynx, particularly the soft palate, the tonsils, the uvula, the arches, whence it creeps into the nose in one, and descends over the hinder wall of the pharynx into the larynx in the other, direction. There are other symptoms, as swelling of the submaxillary glands, the nature of the exudation, the consequences of the disease, &c., to show the

entire difference of both diseases, but I think the observations just alluded to enable us sufficiently to say *that diphtheria is a morbus sui generis, and perfectly different from the affection, called croup.*

The discrimination of both diseases being of the highest importance, not only as to the prognosis, but as to the treatment to be adopted, and, having been present in medical societies of this metropolis when some members proposed, but without being successful, that the identity of croup and diphtheria should be acknowledged also by the profession of this country, I consider myself justified in having dwelled somewhat more extensively upon this important question.

In respect to the treatment of diphtheria, inhalations of oxygen are the best means to prevent or to remedy the septic condition of the blood, while the application of certain atomized fluids, on the other hand, as for instance, hot water, lime water, tannin-solution, nitrate of silver—enables us to master the local affections. Of fifteen cases of diphtheria which came under my care, I have in three applied inhalation, and have seen therefrom infinitely more benefit than I have from any other mode of treatment. All three were apparently desperate cases, but recovered, and sometimes the effects of the inhalations were so immediate and so marked, that they were noticed also by the parents of the children, who considered them also to be due to the inhalatory treatment.

Case X.—*Child six years old; bad condition of general health; advanced stage of diphtheria. Cure by means of inhalation of oxygen and perchloride of iron.*

L. C——, six years old, the son of a cobbler, who lives in very poor circumstances. Patient was poorly since his birth, and had scrofula, which was marked by eruptions on the skin, swelling of the glands, and other similar signs; in the last two years he was tolerably well, but was badly nourished, potatoes and bread being the principal nourishment, and once a week only having a small piece of meat. On April 8th, 1864, he was nearly all day with his playfellows in the street, but complained in the evening of a sore throat. In the night he could not sleep, being feverish, and very thirsty. On the following day he became worse, and his bowels having been confined for a few days, he took aperient medicine, which had no effect.

April 12, patient came under my care. He lies quietly in his bed, without taking the slightest interest in anything passing around him. He is rather emaciated, but the heat of his body is lower than normal; respiration laborious, stertorous; pulse small, sixty in a minute. The pharynx is dark red, velum, left tonsil and uvula covered with diphtheritic exudation; extremely disagreeable odour from the mouth; complexion greyish-yellow; the visible mucous membranes livid; appetite impaired,

sleep disturbed; last night great excitement, followed by coma.

Ordered;—Inhalation of oxygen morning and evening, one gallon each time; inhalation of perchloride of iron.

℞ Tinct. ferri perchloridi min. x.
Aquæ, ℥i.
Mane nocteque inhaland.

After the first inhalation of oxygen, a remarkable alteration in the patient's condition was perceptible. His eyes became brighter, the pulse rose to seventy-five, the comatose state disappeared for several hours, and the bowels acted freely. After the fifth inhalation of that gas, the coma vanished entirely, and the countenance assumed a ruddy colour. Appetite returned. Patient was well fed, and on April 25 the pseudo-membranes of the pharynx had disappeared; patient continued the oxygen once a day, and used pure atomized water for the pharynx. The fœtor had disappeared likewise, and on May 12th the patient was discharged perfectly cured.

Case XI.—*A very severe case of diphtheria, after small-pox; participation of the larynx; attacks of suffocation; relief through application of ice; calomel administered, yet no progress towards restoration of health. Cured by inhalations.*

D. L——, son of a cabinet maker, ten years old, has from his infancy enjoyed good health, has a

strong frame, and is well nourished. Although successfully vaccinated, was five months ago attacked with small-pox, from which he recovered after about two months. There are no scars left on the skin, but dark red spots, which are disappearing. A fortnight after he was permitted to leave the room, he complained for a few days of wandering pains in his body, want of appetite, and restlessness during night. On the morning of the fifth day, the parents noticed that breathing was performed with difficulty, and with "a peculiar noise." The voice had become hoarse, the throat painful, and the angles of the lower jaw extremely sensitive to the touch. In the afternoon of the same day, he was attacked by extreme pain in the throat, at the same time a want of breath prevailed, so that the parents feared the patient would perish by suffocation. Patient was obliged to remain in bed, and on the next morning a similar attack recurred. Both times ice was applied around the throat, whereby he felt great relief. Calomel was administered for six days, but no alteration of the disease was visible.

On the fourteenth day of the illness, August 9, 1865, I first saw patient, who laid quite apathetically in bed; face livid, eyes dull, skin covered with clammy perspiration; breathing difficult, whistling; voice hoarse in a very high degree, larynx not very tender to pressure, submaxillary glands swollen, pulse feeble, very small, 130 in a minute. Tongue

covered with a dirty-brownish fur, the whole pharynx lined with a thick, yellowish diphtheritic membrane, which, upon trials to separate it from the mucous membrane, made the latter bleed; appetite entirely disappeared, bowels confined. An emetic was administered, which acted upon the bowels, but did not cause vomiting.

I ordered inhalations of oxygen gas twice a day, one gallon each time, and spray of hot water to the pharynx and larynx. Here the oxygen likewise produced very marked effects, inasmuch as the patient's senses became clearer, the cold clammy perspiration ceased, and the pulse was lowered to 118.

August 12.—Last night a suffocating attack recurred again, but was greatly relieved by immediate application of oxygen. Lime-water was henceforth inhaled instead of pure water, and the pharynx, after about eight inhalations, began to clear, starting from the uvula, progressing to the soft palate and the hinder pharyngeal wall.

August 18.—On the hinder wall of the pharynx and the tonsils patches of pseudo-membranes are still visible. Yesterday evening, a suffocating attack recurred, followed by vehement cough, whereby some pieces of exudation were expectorated.

August 25.—The mucous membrane of the pharynx has become quite clear, but is red, inflamed, sore; some loss of substance of the uvula

and soft palate. Voice still hoarse, laryngoscopy not possible, from the sensitiveness of the pharynx. General health much improved, appetite fair, sleep sound, respiration little impaired, pulse eighty.

℞ Tannini, gr. ii.
Aquæ, ℥i.
Tinct. opii, ♏ss.
Bis die inhaland.

On September 17, the patient was discharged in perfect health. The voice only remained hoarse, though not in a high degree. A similar loss of substance as described in the pharynx could be seen by means of the laryngeal mirror on the upper surface of the glottis. Vocal chords normal.

The third case, occurring in a child of fourteen months, was of a milder character, and was cured by the same means in about three weeks.

Barthez, Lewin, Trousseau, and others have also reported cases of diphtheria treated by inhalations, but I am not aware of cases in which such a combined application of atomized fluids and oxygen, as just described, has been tried, the results of which are undoubtedly encouraging for further trial.

CHAPTER XII.

II. DISEASES OF THE BRONCHI AND LUNGS.

DISEASES of the parts I am about to describe are not uncommonly marked by some alteration, which, in course of time, takes place in the shape of the thorax. More, therefore, than in any other affection is the physician, by a mere ocular general inspection of the thorax, or of its particular parts, as prominence of the clavicles, breadth, convexity or concavity of the intercostal spaces, movement of the walls, enabled to form an idea of the state of the organs enclosed by the thoracic walls. In a similar manner mensuration may assist in forming a strict diagnosis. But mensuration of the chest should at all events not be neglected, as being indispensable for spirometry. The question is, to find out fixed points at the chest suitable for measurement. I have found the following to be the most appropriate for the purpose ('Lancet,' 1864, vol. i. page 119):—

1. I call the *upper circumference* of the chest that found by measuring directly below the armpit.

2. The *middle circumference* is that gained by measuring at the level of the nipple.

3. The *lower circumference* at the level of the lower end of the sternum.

4. The *front length* of the chest—from the incisura jugularis to the point of the processus ensiformis sterni.

5. The *side length* is measured by a straight line from the middle of the clavicle through the nipple to the lowest border of the ribs; and finally—

6. The *acromial breadth* is the distance of one acromion from the other.

I measure at the height of expiration with a band divided into centimetres. It is understood that particular attention be given to the band being everywhere at an equal level.

6. *Bronchitis.*

The acute form of this disease we have already spoken of as part of that affection which is generally called "a cold." A few inhalations of any astringent solution—alum, tannin, iron—will suffice to cure it in a short time.

Chronic bronchitis is of a much more grave and serious character, and one of those diseases which obstinately resist medicines. Its characteristics are hypertrophy and thickening of the mucous and muscular membrane of the bronchi; whereby these membranes are deprived of elasticity, and, therefore, rendered prone to excavations. Herewith is combined a more or less severe cough and expec-

toration of mucous, clammy, adherent sputa. Fever is generally not present, and although rattling may be heard on auscultation, yet no dullness can be shown on percussion.

The advanced stage of bronchitis can, at a superficial investigation, easily be mistaken for phthisis, but close examination, respecting age, habit, antecedents, physical signs, nature of the sputa, and all those points necessary to form a scientific diagnosis, will certainly prevent one from leaping into such an error. Sometimes the cough forms the most prominent feature, whilst the expectoration remains very slight.

Case XII.—*Chronic bronchitis after pneumonia; severe cough; quantity of sputa small. Great improvement by inhalatory treatment, after other remedies had failed.*

E. H——, thirty-seven years old, is the daughter of healthy parents; married since 1858, mother of four healthy children, living in very good circumstances. She menstruated at her seventeenth year, and enjoyed good health up to August, 1855, when she was attacked with pneumonia, from which she recovered after having been treated by bleeding and internally administered medicines. Two months elapsed, however, before she was quite well again. From that time she was liable easily to catch colds, and was obliged now and then to cough a little

without expectorating any sputa. The cough gradually gained strength, became very severe in 1861, and since that time remained so. It is especially in the morning, when she exerts herself by fearfully coughing, and then she feels a soreness along the sternum. She expectorates still but little, and it requires much coughing before she is able to bring up the sputum. In every other respect she feels well, with the only exception that she is losing flesh, and, therefore, is afraid of suffering from consumption.

On *April* 23, 1864, patient came under my care. She is rather strongly built, of a healthy complexion, but the colour of her skin is somewhat yellowish; muscles not very firm, visible mucous membranes well coloured.

Thorax is of good shape and measures thus:

Upper circumference	.	89 centim.
Middle „	.	87 „
Lower „	.	83 „
Side length	.	32 „
Front „	.	22 „
Acromial breadth	.	35 „

Amount of respiration, 3,250 cub. centim.

Supra and infra clavicular region on the right side somewhat flattened, no prominence of the clavicles. During respiration all parts of the thorax expand equally; type of respiration costo-abdominal, not

laborious. Twenty-four respirations in a minute, pulse seventy-two.

Auscultation.—All over the thorax vesicular sound, which is rather rough on the right upper part; at different parts, sometimes mixed with rattlings; heart sounds normal, as well as sounds of aorta and pulmonary arteries.

Percussion.—No abnormal signs.

Laryngoscopic examination shows a slight injection of the lower surface of the glottis.

Appetite is fair, though the tongue is slightly furred; action of bowels regular; sleep often interrupted by cough.

R Aluminis, gr. ii.
Aquæ, ℥i.
Tinct. opii, min. x.
Mane nocteque inhaland.

April 25.—After the first inhalation the expectoration was effected much easier than before; no disturbance during sleep; but great cough after awaking in the morning.

May 1.—Expectoration continues easy, no cough during night; in the morning cough diminished.

May 15.—Patient has continued the inhalations, and the cough in the morning is reduced to a very slight degree, so that she considers herself quite well, and is going to the country to visit some friends.

September 4.—I saw the patient, but not professionally; she told me that, when in the country,

after remaining one evening late in the garden, she was attacked with a severe cold, combined with a heavy cough and expectoration, which she got rid of by application of the inhalation apparatus on her own authority. She now feels quite well, the only remains of her former illness being a very slight cough after awaking in the morning. She easily expectorates a small quantity of sputa, and remains undisturbed from cough or any other inconvenience till the next morning.

In other cases different phenomena may be observed. There is either expectoration of enormous quantities of sputa with comparatively little cough, or both cough and expectoration prevail in a very high degree, weakening and exhausting the patient, not only by the exertion of the cough, but by the quantity of expectorated matter and the consequences of impaired nutrition. These cases are particularly liable to be mistaken for consumption, because the respective patients are very often extremely emaciated, and present, in several other points such an aspect as to induce superficial observers to diagnose phthisis. The following cases may serve as illustrations.

Case XIII.—*Chronic bronchitis, lasting several years. Great improvement by inhalation.*

S. G——, merchant, in very good circumstances, 55 years old, married, father of seven healthy

children, no chest diseases traceable in his family, has been well till three years ago, when on a journey he "caught a cold." He coughed much and expectorated red tinted sputa; after five weeks he was, however, cured, but the recovery did not last long. He was attacked in the same manner, with the only difference, that the expectorated matter was not tinged as before, but of a yellowish colour. He again took medicine and was relieved again; but the same affection recurred in intervals from three to eight weeks, during which he was not quite free from cough. For about fourteen months the affection became permanent, and weakened the patient very much, so that he lost in the first three months about 28 lbs. of his weight. The quantity of sputa expectorated during twenty-four hours, he thinks to be a pint. Cough is troublesome in the morning only, and sometimes during the night, but slight in the course of the day. The sputa were about three or four times tinged with blood, and then only after they were brought up by a severe cough, which was followed by spitting. Patient feels extremely weak, so that he is obliged to rest several times when ascending a staircase. Appetite is much impaired, sleep sound, if not interrupted by cough; no night sweat, no pain in the chest. Patient was the whole time under constant treatment; took great quantities of medicines, but did not derive any benefit.

On *August* 3rd, 1865, he consulted me. He is a well-grown person, standing six feet, but looks extremely weak, pale, and—in spite of his good living—very emaciated; muscles flabby, visible mucous membrane slightly coloured, transparent veins visible all over the skin, voice rather hoarse.

Thorax covered with hair, clavicular regions rather hollowed, intercostal regions broad, but all parts of the thorax moving alike, respiration rather short, difficult, 21 in a minute.

Upper circumference	.	90 centim.
Middle „	. .	87½ „
Lower „	. .	86 „
Front length	. . .	23 „
Side „	. . .	35 „
Acromial at breadth	.	37 „

Amount of respiration, 2,800 cub. centim.

Laryngoscope shows the mucous membrane of the larynx to be rather pale, vocal chords covered with mucous.

Percussion: no abnornal signs, all over the chest a loud sound, resistance of the walls rather decreased.

Auscultation: on the front distinct, though rough vesicular respiration, and then whistling noises audible; over the left scapular region bubbling noise. Tongue clear; urine normal, as to amount of uria, but increase of phosphates. Pulse 81 in a minute. Bowels act well. Patient has

always been ordered to live on a small diet, and to abstain from any wine or beer, which diet was not altered, though he felt constantly weaker. I ordered him to inhale three times a day,

℞ Tannini, gr. iii.
Extr. hyoscyami, gr. ii.
Aquæ dest. ℥i.

Besides this a nourishing diet, morning and evening a glass of port wine, and half-a-pint of stout to dinner.

August 7.—Feels stronger since he has been permitted to eat heartily. Expectoration in the morning much more free than before the inhalations; voice much clearer.

August 15.—Has never been disturbed during the night. Quantity of expectoration very much diminished, cough very slight, appetite very good, visible improvement of his general health. Asks whether the fluid for inhalation could not be altered, as he objects to the taste. He was then ordered,

℞ Sulphatis ferri, gr. iv.
Aquæ ℥i.
Mane nocteque inhaland.

August 26.—Continues to improve, has gained more than twelve pounds in weight, walks quickly and much easier up the staircase; expectorates in the morning, but not the fourth part of the former quantity.

The treatment was continued to October 1, when the expectoration was reduced to a very small quantity, about a spoonful during day and night. The appearence of the patient was thoroughly changed; his voice was clear, and no abnormal sound could be heard on the chest; his strength was increased, he walked well and felt better than he had done for years. He went again to business, which he had been unable to attend to for more than a year, and continues up to this day in the same good condition.

Case XIV.—*Severe case of chronic bronchitis after small pox. Great improvement by inhalation.*

J. M——, engineer, 38 years old, married, has no children; his parents are alive and well; his two brothers and sisters also enjoy good health; he was scrofulous when a child, but had continued well since about his tenth year up to 1857, when he was attacked with the yellow fever, in India, from which he made a good recovery. In 1860 he returned to England, and in 1862 was attacked with the small pox, whereby his face became densely spotted. From the first day of the attack he began to cough, and never got rid of this symptom. After he had recovered, the cough became associated with expectoration, which by and by became so copious that he was thought to suffer from consumption; this opinion was confirmed by some physicians, while

others told him that the disease was bronchitis. At all events he became much emaciated and very weak. He generally expectorated more in the morning than in the evening; but sometimes was attacked several times in a day, so that he thought he should die of suffocation. Then an "enormous" quantity was expectorated, and followed by relief. Appetite remained during the whole time very fair; but he lost flesh rapidly, though he enjoyed hearty meals. He took no wine, and satisfied his thirst with soda-water. Bowels now and then confined, but generally regular. Patient could walk but very slowly, and was entirely unfit to do anything. For the last few months he lived in the country, whence he came to consult me, on March 3, 1865. He speaks very slowly, and pauses every few seconds. His spirits are much depressed, as he thinks that he will never get well. He is extremely pale and lean-faced, jugular arches very prominent.

Thorax expands well and uniformly.

Upper circumference	82	centim.
Middle „	80	„
Lower „	76	„
Front length	21	„
Side „	29	„
Acromial breadth	36	„

Amount of respiration, 2,900 cub. centim.

I must here add, that the very low capacity of the

lungs did not proceed from the state of the lungs, but from the extreme weakness which rendered him unable to blow into the spirometer with such strength as he ought to do.

The Sputa were of a dark yellow colour, confluent, consisting, as seen by the microscope, of pus and mucous-corpuscles; in spite of careful search no elastic fibres could be detected.

Physical examination renders the diagnosis of chronic bronchitis certain. Respiration, 19; pulse, 80.

Patient was ordered to take some glasses of port-wine during the day, and about half-a-pint of stout—which quantity was increased in the course of treatment—at dinner. Inhalations of tannin, with extract of hyoscyam. (Tannini, gr. iv., Hyoscyam. gr. i., Aquæ, ℥ i.), to be used three times during the day.

March 5.—Very severe cough during the inhalation, which makes the patient weaker still; but after the inhalation, the expectoration easier.

℞ Aluminis, gr. i.
Aquæ, ℥i.
Tinct. opii, min. x.
Ter die inhaland.

March 8.—These inhalations do not cause any cough: yesterday, at 5 o'clock P.M., patient was attacked, but soon relieved by bringing up about a teacupful of matter. He describes the sensation

during the inhalation as "very pleasant;" feels the vapour penetrating into the lungs, and expresses, therefore, his great confidence in the mode of treatment. Continuation of the inhalation, but increased to three grains of alum to the ounce of water.

March 14.—Reports the amount of expectoration to be considerably diminished, and more easily brought up. Expresses his particular satisfaction for the allowance of the wine and stout, as giving him strength. He coughs very little during the day.

March 22.—Since the commencement of the treatment, patient has gained five pounds in weight, respires easier, and feels stronger; the amount of expectoration has very much diminished, and the general health greatly improved. The treatment was continued to May 15, when the patient considered himself better than he ever expected to be. He never coughs, and only in the morning expectorated a little; he walked steadily, and weighed over twenty pounds more than before the commencement of the treatment. The amount of his respiration, as shown by the spirometer, was 3,200.

7. *Asthma.*

There are many diseases—Bronchitis, Emphysema, Diseases of the Heart, Affection of the Larynx—in the course of which attacks occur resembling

those of asthma. But these attacks are parts of their respective diseases, and do not belong to the affection now under discussion.

Asthma is an affection of the vagi nerves, and consists in spasmodic contractions of the muscle-fibres of the small bronchial ramifications, and of the lung vesicles. An asthmatic attack, though very alarming, is never fatal. Constriction of the throat, suffocating sensation, vehement action of all respiratory muscles, the highest degree of dyspnœa, constitute the attack; which generally arises suddenly, when the patient is asleep, lasting from a few minutes to about an hour, and generally recurring several times in twenty-four hours. In the intervals the patient generally feels perfectly well, unless the disease is combined with bronchitis, and other affections. In such a case the patient may become extremely emaciated and weak. The inhalatory treatment has to be directed both upon the attack and the intervals. I have seen severe cases, which have been treated by every imaginable medicaments, in which both professional men as well as quacks have been consulted, or in which the patients were recommended to make long and costly journeys, without seeing the power of the attacks diminished, while the administration of oxygen inhalation has immediately afforded great relief.

CASE XV.—*Suffocating asthmatic attacks, the intervals becoming shorter; suppression of the attacks by inhalations of oxygen; alternate application of oxygen and atomized fluids. Cured.*

E. E., clergyman, aged 42, married, father of four children; a brother of his died from epilepsy. The patient was only once in his life ill, when fourteen years old; he was then attacked by pneumonia. Ten years ago he had his first asthmatic attack, after performing a burial ceremony, and preaching on a cold February day in the open air. He felt very cold and chilly, and was obliged to go to bed when he returned home. In the night he awoke with great suffocation, laborious breathing, dusky face, which was covered with heavy drops of perspiration. A medical man was sent for, who ordered opium, without any effect. The attack lasted for about an hour, then he was relieved for about half-an-hour, when another attack, but of shorter duration, came on. From that time the attacks recurred every five or six months, in such a manner as to appear three or four days in succession, several times in twenty-four hours. Then the patient was free for some months. In the last two years the intervals lasted only from a fortnight to four or six weeks, and never extended over a longer period. After having taken enormous quantities of different medicines, and having been ordered to undertake a

voyage, the patient went to Australia and back; then lived in Italy, and visited some continental spas, with only the temporary benefit that the intervals were sometimes prolonged.

On *June* 12, 1864, he came under my care: he is a well-built gentleman of great intelligence, his appearance seems healthy, but the visible mucous membranes are rather livid. Voice clear but feeble. *Thorax* well arched, freely expanding, has the following measurement:—

Upper circumference	.	91 centim.
Middle „	.	88 „
Lower „	.	85 „
Front lengths		25 „
Side „		34 „
Acromial breadth . .		34 „

Amount of respiration 3,800.

No abnormal signs on *percussion*. *Auscultation* at the left clavicular and at the scapular region of the same side, ronchi, intermixed with whistling noises, are audible. Respiration is performed quietly, eighteen in a minute, the pulse is rather excited, small, thready, ninety-one in a minute; appetite fair, tongue, however, furred; bowels often confined. Patient passes great quantities of urine after each attack, the urine is of light colour, 1.021 spec. grav., no notable alteration in its chemical composition.

Patient was ordered to take an aperient, and to inhale

R Liquor. arsenical. potassa, min. v.
Aquæ, ℥i.
Ter die inhaland.

June 15.—Last night patient was attacked in the usual manner, he thinks that he will be disturbed for several following nights. Inhalation continued; besides this, inhalation of two gallons of oxygen in the morning, and to keep the apparatus ready for use in the evening, if patient should feel the slightest sign of an approaching attack, consisting in headache, so as to use it immediately, should the attack rouse him from sleep.

June 17.—In the night of the 16th at 2 o'clock, he was alarmed by an attack, and immediately put the oxygen inhaler into action, the effect of which he describes as extremely beneficial. The attack was checked almost instantaneously, he never suffered so little, and for so short a time only, the whole attack not lasting more than one or two minutes, after which the patient immediately fell asleep, and awoke in the morning.

June 21.—On the 19th, at about 10 o'clock, an attack came on, which, as patient says, scarcely deserves that name; for when breathing began to become difficult, inhalation of oxygen was resorted to, and nothing more occurred.

June 28.—No attacks. Continuation of the inhalations, both of the gas and fluid.

July 25.—Patient has preached again several

times, which he had not dared to attempt for more than eighteen months.

August 2.—Was severely attacked on the 28th last, after having over-exerted himself, and the oxygen inhaler not being in readiness, patient had to suffer much. Continuation of inhalations (Sol. art. Potass. min. viii to the ounce).

Patient has continued that treatment up to December 19. At the beginning of that month he caught a cold and coughed much, from which he was relieved by inhalations of common salt. No attacks recurred. He feels much stronger, his voice is powerful, pulse regular; patient considers himself quite well.

Case XVI.—*Asthma by inheritation; attacks occurring almost every night. Successful application of oxygen, and atomized fluids.*

P. F., a merchant, of thirty-seven years of age, seems to have inherited asthma from his father. A younger brother of the patient suffers from the same disease. Patient has coughed during his lifetime, till he was twenty years of age, when the cough disappeared for more than a whole year. But all at once he was seized by asthmatic attacks, which recurred about every month, but in the last year increased, as well in frequency as in intensity. Scarcely one night passes without an attack, which lasts for about an hour. Sleep is, therefore, much disturbed, and

patient fears the approach of the night. He is very weak, and has tried several medicines without any effect.

On the 21*st April*, 1864, he solicited my advice. On examination, I found him to be of a very weak constitution, possessing only very little power. His chest is, corresponding to his frame, narrow, flat. On auscultation and percussion, upper and hinder part of the left lung is found to be in a state of emphysema, which is yet not extended enough to render breathing very difficult. Pulse rather accelerated (87), feeble, easily suppressable by pressure of the finger; appetite not good; bowels sometimes for five or six days confined. Patient feels very weak and not able to attend to his large business; ordered to inhale every morning and evening two gallons of oxygen, and four times in the day a pulverized solution of five minims of liquor arsenicalis to an ounce of water.

May 1.—After a few inhalations, a great change was perceived by the patient. The attacks, of which he had not more during that time than three, became rare and feeble, and his appetite is improving daily. He says that he feels as if new life were brought into his body, and hopes that he will be cured and be fit again for his business.

May 16.—In irregular intervals slight attacks occurred, about once, or at the most twice, during a week. Patient has much improved in his general

health, his previously livid lips and yellowish face are much better coloured. Bowels act not quite regularly, and must be acted upon by aloe pills. Continuation of the inhalations.

May 27.—No attack since the 25th of last month. Strength very much improved, and patient feels better than he remembers to have felt at any time of his life. He is occupied in business during the whole day, and does not feel the slightest inconvenience.

CASE XVII.—*Asthma by hereditary taint; cessation of menses, followed by asthmatic attacks. Cured by inhalations.*

M. G., a lady aged fifty-seven, seems to have inherited asthma from her father, who was subject to it for "many years." She gave birth to eleven children, four of whom died in their childhood—it seems, from spasmodic affections; the four sons and three daughters living are in good health, the youngest being a daughter, ten years of age. The last confinement was very difficult, and rendered the application of the forceps necessary. Yet she had a good recovery, and menstruated six months after, but never more since. About two months after her confinement she was first attacked by an asthmatic fit of great vehemence and about two hours' duration. Since that time, the attacks recurred in irregular intervals, the longest not exceeding three

weeks, but sometimes lasting only two or three days. The attack is nearly always preceded by tickling in the throat, then laborious respiration sets in, combined with whistling noises and suffocation, lasting sometimes for hours. The only thing which the patient can derive momentary relief from is chloroform. She pours, as soon as she feels the approaching attack, a quantity of chloroform over a handkerchief and inhales it. Then the attack is sometimes entirely suppressed, sometimes only for so long as the chloroform lasts. If free from attacks, she feels perfectly well.

On *January* 9, 1865, I first examined her. Nothing particular is to be said about the state of her chest; but thinking that there might have been any lesion of the uterus at her last confinement, which was followed by the attacks, I considered it necessary to use the speculum. Nothing whatever could be detected, and inhalation was ordered, as in the former cases, of oxygen and liquor arsenicalis potassa. She began with four minims to the ounce, which number was increased in the course of the treatment to ten. The oxygen inhaler was constantly kept ready for use in case an attack should occur. Treatment was continued for nearly three months. First, the attacks would not yield, but they were very much relieved, almost checked, by inhalations of oxygen. Only when the dose of liquor arsenicalis was raised to ten minims, the

frequency was diminished obviously. In April we left off inhalations, and in July the patient went to the sea-side, whence she returned in very good health.

8. *Emphysema.*

In this disease, affecting mostly the upper lobes of the lungs, the lung vesicles are enlarged and have lost their elasticity; the intersticial tissues shrink, and in consequence a very great number of capillary vessels, waste; sometimes a number of vesicles are totally deprived of their walls, and form large hollows, a sort of infiltration of the lungs, with the difference, that the infiltrating matter consists of air—a kind of "air tuberculosis." In the more advanced stages of the disease the size of the lungs is increased, whereby neighbouring organs are pushed out of their natural position. The thorax assumes a shape characteristic to all diseases in which respiration has been impaired for a long time; but as this shape is particularly often met with in the disease in question, it has been denominated the *emphysematous thorax.* I have described it (Beigel's 'Balneologische Natizen Erlangen,' 1863) thus: the sterum is curved like an arch, and the anterior sides of both halves of the thorax have a similar shape. The bulging commences generally immediately below the clavicles, sometimes higher; the lower part of the thorax is only altered when the disease has become very severe. The ribs have such a position

as to be elevated at their upper end, and the angle which they form with the cartilages approaches a straight line. From the exertion through laborious breathing in such persons, certain muscles of the neck, such as the sterno-clerido mastoids, the scaleni and trapezii, are generally hypertrophized. The dorsal part of the vertebral column is generally strongly curved, the intercostal spaces are wide. Through the obliteration of the capillaries of the lungs, the exchange of gases in the vesicles becomes deficient, the circulation of the blood impaired, and consequently dilatation and enlargement of the right ventricle, cyanosis, dyspnœa, and many other symptoms ensue. According to Waters, of Liverpool ('Lancet,' 1864, vol. ii. p. 546), "in the advanced stage of the disease the heart is felt and seen to beat in the epigastrium, beneath the ensiform cartilage, the cardiac region becomes resonant from the overlapping lung, and the lower site, at which the sounds of the heart are best heard, is altered;" and according to the same author, "hyperthrophy does not only take place in the right ventricle, but as has been shown already by Gairdner, Lebert, and others, the form of heart disease most frequently associated with emphysema is a general hypertrophy and dilatation of the ventricles;" for Waters has never seen a post-mortem examination of a case of extensive and long-standing lobar emphysema, in which the left ventricle, as well as the right, was not affected.

The signs which are revealed by means of physical examination, are very characteristic; and if a somewhat larger portion of one lung, or of both lungs, has become emphysematous, the diagnosis can be formed very easily. The boundaries of normal percussion are entirely altered, and although great exertions are made by the patients in order to breathe, yet the physician's ear, when put to the chest, scarcely perceives the sounds of respiration, instead of which rattlings and other noises may be heard, not only by the physician, but also by the patient himself.

The movements of the Thorax during respiration are neither regular nor complete, and the ribs scarcely elevated; the inspiration, as well as the expiration, is incomplete, and in advanced stages of the disease, the thorax seems not to move at all.

Emphysema often being the consequence either of mechanical lesions of the walls of the thorax, or of pus or other fluids in the pleura, such cases are not apt for the exclusive treatment by inhalations.

In respect to the treatment of that disease, inhalations can, as little as any other method, boast to cure its advanced stages; and though by different authors cases have been reported in which cures have been effected, I am little disposed to believe in them; since a close examination of those cases shows that the patients were rid of asthmatic attacks, or bronchitis, which were coexistent with emphysema;

and in this respect the inhalations deserve great confidence, for by them we are much more able to alleviate the patient's suffering, by curing disagreeable symptoms, than we can by medicines administered internally. Where lesion of the structure of the lung-cells, or the intercellular tissues, has taken place, there we must be satisfied to treat symptoms, and the reports that such lesions have been restored to their normal condition by compressed air, must be proved more conclusively than has been done hitherto. The following chemicals have been used:—Common salt (ʒ ii.–iv. to ℔ i. of water, sometimes with the addition of Tinct. Opii, one to four minims to one ounce of the fluid), *Waldenburg*. Sulphate of Zinc—*Treber*; Tannin and Ammonia—*Wedeman*; Ol. Terebinth. and Ol. Juniperi—*Leiblinger*; Salt and Fowler's solution (Salt, ʒi., Solut. arsenic. ℈ss., Aq. dest. ℥xii.), *Lewin*; Liquor arsenicalis (minim. v.–xx. to the ounce), Tannin (gr. i. ad ℥i.), and Extr. Turion. Pini. (min. xxx.), *Wistingshausen*; Alum with morphia (Alum, ʒi., Acetat. Morph. gr. i.—ii., Aq. dest. ℔ i.), *Schnitzler*; Tannin and Morphia (Tannin. gr. ii., Morph. $\frac{1}{20}$ gr. to the ounce), *Siegle*.

Case. XVIII.—*Great shortness of breath; coughing attacks; extreme weakness. Great improvement by inhalations.*

A. L., glass manufacturer, 41 years of age, married, father of three healthy children; both

parents died, the father by an accident, the mother of consumption, in the 45th year of her age. Patient has since his birth been delicate, but did not cough till about fifteen months ago, when he began all at once to cough severely, without being able to put a stop to it by medicines. After about four months he was spontaneously relieved from it, but it appeared to him as if he could not breathe so easily as he did before. This difficulty increased gradually, and in the last six months assumed a dangerous form. He breathes with great difficulty, and has, as he describes it, "no satisfaction in breathing;" is often subject to suffocating attacks, returning nearly every two or three days, occurring generally during the night, lasting for about three hours, and very much alarming his family. Of these attacks he is very much afraid. He is not able to walk a few steps without being obliged to stop and rest; his appetite is very bad, sleep interrupted; cough exists, but is not at all troublesome; he feels a very unpleasant dryness in his throat, and expectorates great quantities, particularly in the morning and after each attack. I examined the patient on the *4th February*, 1864, when I found the following state:— Patient is of a slim, graceful stature, length of the body 175 centim.; his face has that reddish colour which is often observed in persons suffering from emphysema, capillaries in great numbers visible through the skin of the cheeks; mucous membranes

livid. Neck thick, the contour of the sterno-cleido mastoids very marked at each inspiration. Thorax presents, at the upper part, the emphysematous appearance.

Upper circumference	87	centim.
Middle „	86	„
Lower „	78	„
Front length	23	„
Side „	29	„
Acromial breadth	35	„

Amount of respiration 2,150.

But there was a difference in the measurements in the right and left side of the thorax, namely:

Right Side.

Upper circumference	46	centim.
Middle „	46	„
Side length	30	„

Left Side.

Upper circumference	41	centim.
Middle „	42	„
Side length	28	„

The movement of the thorax was accordingly greater on the left than on the right, where it was, particularly at the upper part, scarcely perceptible. With each inspiration, of which twenty-seven were performed in a minute, an expression of exertion and anxiety was shown in the face, the type of respiration being almost abdominal.

On auscultation a rough vesicular inspiration could be heard at the front of the left side, while at the back it was much less distinguished, but on both sides ronchi could be heard. On the right side, from the clavicle down to the fifth intercostal space, no sound, except rattlings and whistling noises; but from here laterally towards the axillary line rough inspiration was heard.

Percussion.—Besides some dulness in the clavicular region, no abnormal sounds on the left side; all over the right, loud lymporitic sound which could be heard at the whole front of the chest, but at the back to about the angles of the scapula.

Heart.—No enlargement detectable, the sounds distinctly audible, the second particularly so, beating over a large visible area; aortic sounds very strong, those of the pulmonary artery feeble. Vehement throbbing of the carotides and of the left jugular vein. Pulse ninety-three in a minute, excited, large.

Tongue covered with a yellow fur, appetite impaired, bowels regular, urine brown, 1·032 spec. grav., distinguished by its amount of Urophain.

Treatment was commenced with inhalations of oxygen gas, of which the patient inhaled one gallon every three hours.

February 9.—Patient feels great alleviations by the inhalations; for the first time for a long period he slept all night without being disturbed by attacks

of suffocation. His appetite has improved, and he respires more easily.

February 20.—Patient has much improved in his general appearance; respiration is much more readily performed; but the dryness in the throat still exists, and is highly disagreeable. He was ordered, besides the oxygen, to inhale once or twice a day a solution of common salt (gr. ii. to the ounce).

March 4.—Expectoration in the morning diminished in quantity: the patient can walk for five or ten minutes without great want of breath, feels only tired, and can continue walking, after having rested for a few minutes; no alteration of the dryness in the throat. Inhalations of pulverized pure water instead of the solution of salt.

March 25.—Further progress in convalescence; breathing, though not entirely free, yet with comparatively little inconvenience only; and if it becomes more laborious, which seems to be after mental excitements or bodily exertions, or after exposing himself to cold air or to sudden change of temperature, then inhalations of oxygen afford the desired relief; expectoration existing only in a very slight degree after awaking in the morning. Can walk a considerable distance without being tired. Dryness in the throat had disappeared, but an abnormal sensation still exists.

Continuation of oxygen inhalations; besides this,

Tannin, gr. ii.
Acetat. morph. gr. i.
Aquæ dest. ℥i.
Bis die inhaland.

April 16.—Patient has for some time returned to business, and considers himself cured, although the attempts to leave off the oxygen inhalations have been followed a few days after by oppression of the chest and difficult breathing. Respiration cannot be considered entirely free, though the patient is able to move, walk, and perform the duties connected with his business. The throat is free from any sensation, and a small quantity of sputa is brought up in the morning. On auscultation and percussion, no other change can be revealed but that now and then only rattlings which formerly have been very frequent, are heard; on the right side, even in the upper part, penetration of air into the lungs, though the sound is not very distinct, can be heard, the latter never having the normal expiratory character. No alteration in the dimensions of the thorax.

On June 23, 1865, I was consulted by the patient for another affection, on which occasion I again examined the thorax, and found that the upper and the middle circumference of the right side measured 85 centim. each; but the prominence of the right upper part of the thorax was still

obvious. Yet the inspiratory sound was, though feebly, audible. The area of the tympanitic sounds was much decreased; on the whole left side normal conditions, and the capacity of the lungs raised to 3,200 cub. centim.

I have reported this case in full length, as I think it a good specimen of the influence and efficacy of inhalation; for the latter has not only reduced the bronchial catarrh to a very insignificant degree, but it has really diminished the area of the emphysematous parts of the lung, and placed the patient in an infinitely better condition than he was before, so much so, that he considered himself quite cured.

Dr. Leiblinger reported on three cases of Emphysema ('Allgem. Wiener medic. Zeitung,' 1863), which he has treated by means of Ol. Terebinth (one minim to the ounce of water), or by Ol. Juniperi (two minims to the ounce); in all three cases, after twenty sittings of one hundred and fifty deep inspirations each, improvement and alleviation was obvious, *viz.*, the laborious respiration had vanished, and did not recur during heavy work or ascending staircases, and the cough had become shorter and scarcer. As a proof that volatile oil had passed into the blood, the urine had the characteristic violet smell. In the first sittings the symptoms exacerbated, but gradually became weaker.

Leiblinger also does not pretend to have cured

the emphysema by inhalations, but assures that the latter are much more effectual than ammonia, lobelia, &c., when administered through the stomach.

Dr. Schnitzler has published a case of emphysema associated with bronchitis in an out-patient of professor Oppolzer in Vienna. The disease had lasted for many years, and the patient was ordered to inhale a solution of Alum and Morph. (Alum, ℥i., morph. gr. i., aq. ℔ i.) The cough by which the patient was incessantly tormented from morning to night, and which rendered the night restless, decreased daily, the copious expectoration was diminished, the sensation of weight and choking vanished, so that after twenty days' treatment, the patient considered himself well, and did not return.

There are a great many cases on record, in which emphysematous patients have greatly improved by inhalations; and, in conclusion, I may be permitted to quote one observed by Dr. Fieber ('Allgem. Wiener medic. Zeitung,' 1862).

Case XIX.—*Bronchorrhœa and dyspnœtic attacks in an emphysematous patient. Application of the pulverisateur.*

J. K., forty-six years old, cabinet-maker, married, had suffered for five years from rheumatism and bronchitis, causing copious expectoration. In child-

hood he was well, except that he was subject for some time to piles. When thirty-six years old he was seized by typhus fever, and last year he was ruptured when lifting a heavy load. He could, neverthelesss, do hard work; but was then attacked by shortness of breathing. Since February last, 1864, these attacks became stronger, and the expectoration more copious. I saw the patient on the 21st March in the following state:—He is not very tall, his frame is not strong, body emaciated, the general texture pale yellowish. The thorax is barrel-like in shape, beating of the apex of the heart not perceptible, and best to be heard in the fifth intercostal space near the nipple. The first sound is associated with an insignificant murmur, the second is normal; sound of the pulmonary artery is accentuated. Respiration on both sides, in front as well as on the back, rough; vesicular, mixed with various rattlings. On percussion the sound is heard equally loud, tympanitic all over the chest, no dullness of the heart. Epigastrium sensible to pressure; pulse small, soft, eighty-four in the minute; the cough is painful, yet the expectoration easy. The sputa are yellow, elastic, and show no traces of blood. The nights sometimes restless; from time to time difficulty of breathing, which renders every movement impossible, lasting from five to fifteen minutes, and disappearing after the

patient's remaining motionless during that time. Tongue furred, appetite nearly disappeared.

On previous experience that persons who breathe only with difficulty atmospheric air, are the more apt to inspire atomized fluids, I ordered inhalations, which consisted of Sulphat. zinci, grs. v., to the ounce of water. Patient began on the 22nd March, and did not change the solution to the end of the treatment; he positively ascertained, feeling that the cloud penetrates equally into both lungs; he perceives at first a certain irritation, but not so strong as to cause cough. On the next day I heard with pleasure that the expectoration was already diminished. Patient inhaled as yesterday, *viz.*, one hundred inspirations.

On the 24th, patient states that he coughs less, and that he slept much better than he did before. Sputa lessened in quantity, and the dyspnœal phenomena accordingly reduced in intensity; but the rheumatism more painful: ordered, Liniment. camph., and a hundred inhalations again.

On the 26th, a considerable improvement was perceptible. Difficult breathing seldom occurred; cough slight, quantity of sputa moderate; last night no disturbance at all; towards morning a slight cough. Treatment the same.

On the 31st, the patient inhaled the last hundred inhalations, since his health was in such a state that they could be set aside. In ten sittings one

thousand inhalations were made. The cough was painless, and reduced to a minimum. Quantity of sputa very small. Dyspnœal attacks and the rattlings during inspiration had entirely disappeared, and not only the general appearance, but also the depressed spirits of the patient, improved considerably.

9.—*Hæmoptysis* (*Spitting of blood*).

This is not a disease itself, but a symptom—and sometimes a fatal one, too—of many diseases, and can, of course, originate in any part of the organs both of respiration and circulation. The bleeding may proceed from the larynx, trachea, bronchi, lungs, large vessels, and the heart. If the organs of circulation are the source whence hæmoptysis originates, as breaking of an aortic aneurism, wounds of the heart, and the like, the case is beyond reach of medical assistance, and in a very short time proves fatal.

Hæmoptysis originating in any part of the respiratory organs is commonly of a capillary nature, arising in the minute vessels of the lining of the mucous membranes, of the channel of respiration, and the lungs; and here inhalations, according to the reports of all authors on the subject, have proved of very great value; which is the more undeniable, as the number of such cases published is a very considerable one.

Great acuteness of mind has been exposed to distinguish hæmoptysis from hæmatemesis. In my former position as physician to a continental spa (where exclusively patients, labouring under pectoral diseases, and especially under consumption, resorted), I have paid great attention to this point. But I must confess that I do not remember one single instance in which the diagnostic part was connected with any difficulty. And the same observation holds good still, when the number of patients I see during a week in the Metropolitan Free Hospital is a considerable one, the majority being afflicted with pectoral diseases, in which sanguineous expectoration forms a common occurrence. It is true, in many cases, the patients are not able to tell whether the blood is brought up by retching, coughing, or vomiting. But close examination, and a strict inquiry, will without fail lead to the very point of our interest, namely, to an existing or a former diseased state of the stomach or œsophagus, or to diseases of the organs of respiration and circulation, which will render our diagnosis certain. And should some uncertainty remain, then the microscopical or chemical examination would destroy every shade of doubt; for there is always an admixture of the contents of the stomach, if the ejection of blood has been effected by that organ.

So far as the inhalatory treatment is concerned, we have only to consider the capillary bleeding of

the respiratory organs, be its origin whatever it may; as, for instance, anomalies of menstruation, congestion of the liver, consumption, or other affections. Pure cold water, solution of tannin, alum, and, above all, sesquichloride of iron, are the fluids which have been applied, and in many cases, after the first inhalation, have put a stop to the bleeding, or to the expectoration of blood-tinged sputa. In others the same effect was produced after a number of inhalations; then the sputa gradually became pale, till they had assumed their former appearance. In others, again, the attack of hæmoptysis recurs after a few days, but in a lesser degree; these recurrences may be repeated till the source of bleeding becomes entirely locked up.

Hæmoptysis being an occurrence not less frequent than alarming to the patient and the persons around him, the number of observations published, and the experience gained in cases which were treated by inhalations is, as far as I am aware, larger than that of any other disease or symptom of a disease. The local treatment has been successful even in hæmoptysis, occurring in the most advanced stages of consumption. I mean to say, that if hæmoptysis had occurred in such cases, which, by the nature of the stage shortly afterwards have proved fatal, yet the alarming symptom had successfully been stopped, and at the post-mortem examination the iron was found to have penetrated the very diseased part of

the lung, as shown in the following case, published by Zdekauer. ('Wiener medic. Wochenschr.,' 1861.)

Case XX.—J. B., an invalid soldier, was subject to Bright's disease and albuminaria, followed by dropsy. A close examination revealed that there co-existed hypertrophy of the heart, and either insufficiency of the mitral valve or atheromatous excrescences of the aorta. The diagnosis was difficult, because the diaphragm was pushed up by ascites, and the short, but rough, respiratory murmur was so loud and difficult to arrest for a few seconds, that very seldom only a systolic heart's-sound could be heard, whilst on percussion an obvious enlargement of the heart could be detected. Milk, diuretics, nitric acid, aperients, were tried without result. The dropsical exudation increased rapidly; the patient could only breathe when sitting in an arm-chair; his legs and scrotum were tremendously swollen. We made little openings by thrusting needles into the cellular tissue, which alleviated the breathing in a slight degree. On one day of very sudden change of temperature the patient was attacked by suffocation, followed by a vehement hemorrhage, which seems impossible to be stopped.

Matthew's apparatus was at hand, and accidentally a solution of chloride of iron also, so that we could immediately proceed to the application of both.

The patient with great difficulty merely gasped for breath, and in two minutes he became insensible. The face was sprinkled with cold water, whereby he was brought to consciousness. We made him inhale the solution, and in two minutes the hemorrhage was as if cut off. But it had consumed the last powers of the patient, who died two days after under suffocating phenomena.

Post-mortem examination. — In the right pleural cavity, serous, bloody exudation, on which the right lung was swimming. In the right lung were infiltrated several solid blood-clots, which, when cut, were not bleeding; in the left lung, similar clots of a smaller size. The heart hypertrophic, covered with blood. In the ascending aorta, atheromatous depositions; and the bicuspid valve also insufficient. The left kidney much degenerated, the right less. Everywhere serous infiltrations. *Dr. Holm examined the clots, and in all parts of the tissues of the lungs discovered much larger quantities of iron than is generally contained in the blood.* The most important fact concerning our purpose is, that even such a hemorrhage as this was, caused by very great stagnation and regurgitation of the blood in the vessels of the lungs, could be overcome by the inhalation of a cloud of a pulverized solution of chloride of iron, *and that the penetration of the fluid into the bleeding tissues of the lungs could be demonstrated after death.*"

From the cases of hæmoptysis which I have

observed—in all about twenty—I have derived the experience that the inhalations must not be continued, if they make the patient cough ; but here it must be remarked that the mere fact, that a certain fluid, say perchloride of iron, causes cough, must not be taken as a proof that the patient does not bear styptic inhalations at all. If the mucous membrane is not tolerant to the one, it may bear the other medicated mist well, and if there is a possibility for the application of inhalation, we shall always rid the patient of that symptom in a way much shorter and more certain than we can by any other means ; and in urgent, exhausting cases, the preservation of the patient's life may depend herefrom.

Case XXI.—*Attacks of cough connected with infiltration of the apex of the left lung ; a great quantity of blood expectorated, but stopped after the first inhalation.*

C. D., a merchant from Lima, advised by his physicians, left that country and came to England (1864). His sufferings consisted in severe attacks of a very troublesome cough, which came on every eight or ten days, lasted for a day or two, and then ceased. During that time the sputa were abundantly tinged with pure blood. After each attack the patient felt very exhausted. When he came under my observation he was very pale and emaciated ; his voice was coarse. The result of physical examination was infiltration of the left

apex; otherwise the conditions were normal. Three days after the examination he had a severe attack, coughed frequently and very severely, and was not ten minutes without coughing; the sputa consisted more of blood than of mucus, and were very copious. The quantity of blood he ejected in the day was about two teacupfuls. I ordered immediately an inhalation of tincture of sesquichloride of iron. The cough did not decrease, but the sputa after the first inhalation were not tinged any more. The patient inhaled twice a day, and had altogether thirty inhalations. The intervals between the attacks were in the meantime much prolonged. Blood never appeared during the cough, which altogether disappeared when extract of hyoscyamus was substituted for the above-mentioned liquor. The appearance of the patient had very much improved, and after six months' stay in this country he again returned to Lima, whence he has repeatedly written, assuring me of his perfect health.

Case XXII.—*Miliary tubercles, repeated attacks of hæmoptysis. Successful application of atomized fluids.*

L. F., 27 years of age, dock labourer, unmarried. His father died of consumption; mother is alive and suffers also from shortness of breath; has two married sisters, who are older than he is; but three brothers, two younger and one older than himself, died also of phthisis. His health was never

impaired with the one exception that he was never free from a very slight, dry cough. Ten months ago he was working in very stormy wet weather, and when he left off, began to cough and to expectorate, but was very much alarmed to find the sputa mixed with blood. From that time the cough never ceased entirely, but the least exertion was sufficient to make him perspire much, to increase the cough, and to tinge the sputa with blood. But even without cause the last symptom did alarm him, and about four weeks ago he all at once perceived as if a warm fluid were moving from the "heart towards the mouth," and then spat about two tablespoonfuls of pure blood. He never had pain in the chest, never a particular difficulty in breathing, could walk well, enjoyed a good appetite, but noticed, nevertheless, that he became thinner in the last five or six months.

On *October* 19, 1865, an attack of hemorrhage occurred again, so that he expectorated about half a teacupful of blood in twenty-four hours, and still without much coughing brings up sputa, which consist mostly of blood. On the 21st, he was admitted an out-patient to the Metropolitan Free Hospital. He is of a slender shape and fair complexion, rather pale but ruddy cheeks, mucous membranes not well coloured; his voice is rather hoarse, when speaking, he coughs slightly and brings up copious red-tinged sputa; his neck is long and thin, length of the body 180 centim. (about 5 feet 11 inches).

Thorax.—Though narrow yet well arched, equally expanding, but the movements not being very powerful ; left infraclavicular region somewhat depressed ; intercostal spaces normal. Measurements of the thorax :—

Upper circumference	.	86	centim.
Middle „	.	85	„
Lower „	.	82	„
Front length	.	23	„
Side „	.	39	„
Acromial breadth	.	32	„

Amount of respiration 2,300 cub. centim.

Respiration more abdominal than usual, 22 in a minute, prolonged expirations.

Auscultation.—All over the chest a weak vesicular noise can be heard, now and then mucous rattlings.

Percussion.—Slight dullness at the left clavicular region, but on the rest normal conditions.

Heart-sounds and sounds of the large vessels normal; pulse quick, small, soft, easily suppressible, 87 in a minute.

Laryngoscopic examination reveals a swelling of the arytenoid cartilages and of the rim of the glottis; the mucous membrane of the larynx much congested.

On microscopical examination, the sputa are shown to consist of pure blood and mucus, the blood not being mixed with the mucus, but forming a clot

consisting of corpuscles, part of which are intact, part destroyed.

Tongue clean, appetite good, all other functions normal.

Patient visited me at my private residence twice daily, and was ordered to inhale a solution of sesquichloride of iron.

October 23.—After the first inhalation no pure blood could be seen in the sputa, which were slightly brown-tinged, but even this hue disappeared after the third inhalation. Patient, without being asked, described the feeling of penetration into both lungs.

October 28. — The sputa continue not to show the slightest trace of blood, but it seems as if the cough were stronger. Inhalation of

℞ Sodii chlorid. gr. iii.
Extr. hyoscyam. gr. i.
Aquæ, ℥i.
Bis die inhaland.

November 10. — The cough has nearly disappeared, the voice has become much clearer, and the general appearance improved; pulse stronger, slower (78), and fuller. Patient went to his usual work.

Case XXIII.—C. H., a lad of fifteen, works daily nine hours in a shoe-factory, without having sufficient food; has no parents, and does not know from what disease they died; of this one fact only he is

aware—that his mother did cough as long as he can remember. As a child, he was scrofulous and weak, and up to his tenth year he had sores on the skin; he was always subject to cough and expectoration; though the sputa had sometimes a brown colour, yet he has never noticed them to be mixed with blood—only for the last three weeks he saw a red hue, and was coughing severely. Yesterday evening, when going home from the factory, he was obliged to breathe a very cold air, and soon after his coming home was attacked by a spasmodic kind of cough, which ended in bringing up about three tablespoonfuls of pure blood. This morning a similar attack occurred, and blood was again expectorated. But besides these attacks, his expectoration is copiously mixed with blood when he coughs.

On the 4th November, 1865, he was admitted outpatient to the hospital. He looks extremely pale and emaciated, and the physical examination leads to the diagnosis of tubercular infiltration of both apices of the lungs. He inhaled, twice a day, a solution of chloride of iron; and after six inhalations no trace of blood could be seen in the sputa. After inhaling another week a solution of salt and extract of hyoscyamus, the cough was much diminished and the patient went to his work again, promising to call immediately, as soon as blood should be expectorated again. Up to February, 1866, he did not return to the hospital.

Case XXIV.—A. R., clerk in a large warehouse, where he is sitting nearly the whole day, occupied by writing. He is forty years of age; his parents are alive and healthy. One of his five brothers is subject to asthmatic attacks, from which he had likewise suffered six years ago, but was restored to health, after living for about two years in Italy and Switzerland. Soon after he was freed from these attacks, he began to cough, though not in a very troublesome manner. From the twentieth year of his life he suffered much from hæmorrhoids, in consequence of which he has lost immense quantities of blood, but his general health is always better when the hæmorrhoids are fluent. Unfortunately, they have not been so for about three months, when the action of his bowels became very difficult, and at the same time the cough very troublesome. Three weeks ago the expectoration, hitherto scarce, became frequent, copious, and mixed with blood. Last night, July 19, 1864, when sleeping, he felt as if hot water were poured over his chest; this awoke him, but he had scarcely time to sit up, when a vehement attack of cough took place, and a dash of blood rushed forth from his mouth. I was sent for, and hearing from the servant the state of affairs, I visited him, and took with me an atomizer and a solution of sesquichloride of iron. I found the patient very much exhausted, coughing severely, and bringing up each time about half a teaspoonful of

pure blood; his respiration was accelerated, pulse much excited, and throbbing 106 times in a minute; the patient's mental excitement very great. I made him at once inhale pure cold water, which, in the first place, took a very good effect upon the patient's mind, who recovered from his being so alarmed. He made ten inhalations, and rested a minute; then ten inhalations again, and rest again—and so on till a hundred inhalations were performed, during which no cough came on. The patient then slept all the morning—about seven hours. After awaking, he began to cough again, and expectorated brown sputa. He now inhaled regularly three times, one hundred inhalations of an atomized solution of sesquichloride of iron each time; and after two days the sputa did not contain the least traces of blood. On examination of the chest, consolidation and impermeability of the upper hinder part of the right lung was found. The cough was then treated by inhalations of extract of hyoscyamus, and after three weeks the patient did not cough at all.

Case XXV., L. P., a married woman of thirty-three years of age, and mother of seven children. Many members of her family were subject to "chest diseases," in which cough and expectoration took a prominent part. She herself, and two brothers, were exempted, and enjoyed always good health. At the age of eighteen she regularly menstruated;

married at twenty-one, and a year after became mother of a healthy child. Since that time, she has, at different intervals, given birth to six more children. Her last delivery was much prolonged, and the medical man thought it at last necessary to apply the forceps, and extracted a living infant. She recovered but slowly, but was able again to assist her husband in earning their living, by doing a little weaving. Before her last confinement she looked well and healthy, but after that she could "not regain flesh." Besides this, a short, frequent, dry cough made its appearance. For the last three months she has expectorated yellow, thick, sticky sputa, which, on the last six or eight days, consisted of more blood than phlegm, and weakens the patient in a high degree.

On the 6th December, 1865, she was admitted an out-patient to the Metropolitan Free Hospital. She has the appearance of a weak, lean-faced woman; the thorax narrow, the upper part slightly expanding during respiration, the intercostal spaces distinctly visible. By means of physical examination, infiltration of both apices can be revealed. She coughs every few seconds, and produces bloody sputa. Inhalations of sesquichloride of iron were administered twice daily at my private residence; when, after five days, the sputa had assumed their former colour, and the cough was in some degree diminished. She was satisfied with the condition of

her health and resumed her work again, from which she had abstained for a week.

10.—*Phthisis* (*Consumption*).

If there are diseases which can be acquired by hereditary transmission, phthisis is, no doubt, such a disease. But hereditary taint is not the only means for its acquisition; it may also, from causes neither known nor controllable, happen to individuals in whose ancestors no trace of phthisis can be detected. Descendants of tuberculous parents are almost invariably very delicate as children, and not uncommonly scrofulous, yet many years may pass before that series of phenomena becomes obvious which constitutes consumption. The theory which looks upon the blood as the intermediate bearer of the disease in, as it were, a latent state, seems to me the most probable. Sooner or later changes occur, which induce the blood to act locally, and deposits are made in the lungs, brain, or intestines, and upon the extension of these deposits, as well as upon the rapidity of their recurrence, depends the length of life remaining to the patient, if the efforts of medical science prove unsuccessful.

The deposits may be very numerous, each having the size of a millet seed (Miliary tubercles), and gradually increase or become confluent, thus rendering the part of the lung, occupied by those deposits

impermeable to air (Tuberculous infiltration). These tubercles undergo certain changes, destroying the tissue of the lungs, and forming caverns, all which changes have been minutely explored by morbid anatomy.

In a similar manner, as by the "scrofulous habit" in children, often so characteristic, that the diagnosis can be made at the first glance, in consumption, the physician, who is well acquainted with the disease in all its stages, cannot seldom foresee the approaching danger, when no one suspects the individual to be in an unhealthy condition.

But the "tubercular habit" is worked out on the patient's frame in the course of the disease, and becomes in its later periods apparent even to the lay observer. The thorax, very much altered in shape, is worthy of particular notice. The *phthisical thorax*, also called the *tubercular*, is just the reverse of the emphysematous one. The anterior surface forms a straight plane, the sternum may also form a straight line, no curvature exists; on the contrary, in the last stage of consumption, the surface is rather depressed. There is a peculiar position of the shoulders and clavicles. A line drawn from the neck of the shoulders is very much inclined towards the horizon, while in the normal thorax it is straight, and the same is the case with the clavicles. The shoulders are therefore lower than usual, so that the neck appears longer. The

angle which the ribs form with their cartilages is somewhat considerable. The upper intercostal spaces are considerably dilated, the lower ones much narrowed; this is probably owing to the muscles which elevate the thorax having lost their tone. The firmness of the muscles and texture alter, the colour of the skin and mucous membranes change, the organs of vitality participate in the process, but the mental integrity may be, and generally is, preserved in phthisis to the last moment of the patient's existence. The state of nutrition is abnormal from the very first commencement, and according to some authors, is the actual cause of the disease. *In accordance with that fact, Louis, as well as Rokitansky, have always found a small size of the heart and thinness of its wall as the only cause of the disease in persons who died from inherited tuberculosis.* This fact must be borne in mind, in order to know that through this condition of the heart the blood is conducted to the particles, constituting the body, by an abnormally feeble action, and in abnormally long intervals, the consequence of which is the reception of an insufficient amount of oxygen into the blood, and an increase of abnormal nutrition of the body.

The knowledge of this fact is of great importance when we are to determine on a consumptive patient's diet, which, according to my experience, is a matter of very great consequence; or if we have to

determine where to send the patient if "change of air or climate" is considered necessary. If many physicians would bear in mind that from that decision not seldom the prolongation of the patient's life, if not life itself depends, they would take much more care in the study of climatology and dietetics than is generally done. How irrationally are these poor sufferers sent from one place to another; how unjustly are they advised to undertake long and troublesome journeys to "warm climates," when they would do much better by resting at home, and if the case be hopeless, die amongst their relations and friends.

We generally hear the "warm climates," "the mild temperatures," hailed as particularly apt for consumptive patients, whilst close examinations have sufficiently shown the temperature of a district to be of a very secondary nature in the course of consumption; nay, that in hot climates consumption has a much more rapid and dangerous course than in mild regions; and *Casper has proved by a great number of cases, that the vast majority of tubercular patients die when the barometer stands high.*

Good observers have rightly remarked that the first requirement of a place where consumptive patients are to be sent is, that phthisis should be unknown there as an endemic disease. That there are such regions in different parts of the world, is familiar to everybody who is versed in the geogra-

phical distribution of the disease over the surface of the earth. It does not, however, pertain to my present task to dwell upon this point; and I intend to make this highly important question the subject of a separate treatise.

In respect to the treatment of consumption in general, much is to be said of its present state, and the innumerable remedies, and even methods, recommended, prove best what amount of uncertainty there exists in this respect. Nevertheless, much good can be done, even to phthisical patients, and it is not exclusively due to medical science if less is done by the physician than could be; it depends, also, upon the ignorance in which parents indulge, having children with a hereditary taint of the disease; and if the public were sufficiently instructed on these points, thousands of lives and the happiness of many families would be spared.

When are we generally consulted in consumption by the patient or his parents? When cough has already set in—when the sputa, which were few and considered as a matter of no consequence, grew either copious or tinged with blood, when respiration is becoming difficult, when the patient loses flesh, or becomes exhausted from colliquative secretions: in one word, the patient comes generally into our care when, to our eye, the footprints of death are already perceptible, and when the most valuable period has passed away—that period, in which the

disease has existed in its latent state, but has now become operative, and tubercular depositions have already occurred. And even then an intimate acquaintance with the disease places us in a position in which we are able to do much more for the patient than is generally believed.

But the question which concerns us in the present moment is, that of the application of inhalations in consumption. Their efficacy will depend upon the stage in which we begin treatment. I have no doubt, that in delicate children who are predisposed to phthisis, regulation of their dietetic regimen on rational principles, and the administration of oxygen inhalations, would delay, or even prevent, the outbreak of the disease, as the reception of that gas into the blood would enable the latter to establish a better nutrition of the nerves and muscles, and finally to render these organs more fit to procure the necessary and standard supply of oxygen which is necessary for the body's healthy existence; and that this is a very important link in the chain of conditions, constituting the "latent stage" of phthisis, follows from the fact, that many investigations have shown the amount of respirations in delicate persons, predisposed by hereditariness to consumption, to be far less than in others of the same physical conformation, in whom no similar hereditary conditions exist.

In the later and more advanced stages of consump-

tion, the inhalatory treatment must, like all other methods, rest satisfied in acting against the most distressing of the symptoms, and, if possible, try to assist the nutrition of the body and to prevent further deposits. For this purpose, inhalations of oxygen sometimes render astonishing services; and it is known that, in recent time, the administration of that gas by charlatans has made their names known to great numbers of patients, and that, in many cases, they have really arrived at certain good results.

In the course of consumption, some very exhausting symptoms appear, which can be much more readily suppressed by inhalations than by other treatment. I mention only the distressing cough which deprives the patient of his refreshing night's rest; the quantity of expectoration, which is sometimes enormous; the attacks of suffocation, which deprive the patient of the rest of his power; and a symptom, of which I have already spoken—*viz.* the morning vomiting. As an illustration of the benefit derived from atomized fluids, even in such more advanced stages, I shall communicate the following two cases:—

Case XXVI.—C. O., forty years of age, teacher, married. His parents are dead; they arrived at a high age, and did neither suffer nor die from consumption. He had three brothers and two sisters;

the former died, but not from phthisis; patient has one child only—a boy, twelve years old—who enjoys good health; patient was always well, till, after exposing himself, two years ago, to a very strong, cold air, he began to cough a few days after, and was not relieved from the same until after several months. But in the following autumn the cough occurred again, and has not ceased since. For the last fourteen months the expectoration has become very copious, viscid, sometimes intermixed with streaks of blood. Every night, at about three o'clock, the patient is attacked by a severe cough, which lasts for about ten minutes. The appetite at first was impaired, but then improved, and is now good; but as soon as the patient takes the least quantity of fluids—tea, coffee, or beer—he immediately begins to vomit, and all contents of the stomach are ejected. Voice for the last twelve months hoarse—sometimes even complete aphonia. During the same period, a rash has sometimes appeared and disappeared on the skin; then the voice became clearer, and the spirit of the patient, generally depressed, became better.

On the 15*th October*, 1865, I was first consulted, and found the patient in the following condition: he is slender, thin; muscles soft, mucous membrane moderately coloured, conjunctivæ yellowish, complexion pale.

Thorax—not arched, left clavicular region hol-

lowed, clavicles very prominent, but less on the right than on the left side. Pectoral muscles very thin; intercostal spaces well marked; the lower ones narrower than the upper.

Measurements:—

Upper circumference	. .	85 centim.
Middle „	. .	84 „
Lower „	. .	82 „
Front length	. . . .	21 „
Side „	. . . .	33 „
Acromial distance	. .	32 „

Amount of respiration, 1,900.

Auscultation.—No respiratory sounds to be heard at the upper parts of both sides; at about the third left intercostal space, tubular; lower down a feeble rough vesicular sound begins, and becomes only slightly stronger towards the lower arch of the ribs; the same condition exists in both sides and at the back, rattling, whistling, snoring noises can be heard all over the chest.

Percussion.—Dullness at the left clavicular region, from the second to the fourth rib tympanitic sound; dullness at the left clavicular and scapular region.

Heart sounds feeble, but regular; pulse large, but not full—100 in a minute; breathing laborious when the patient is walking quick, or ascending stairs; chest and back are covered with a herpetic rash, partly already dried, partly being still filled

with a limpid fluid; tongue clean; bowels regular; voice hoarse.

The patient was ordered to inhale, in the morning and evening, a solution of salt and morphia (Sodii chlor. gr. ii., acet. morph. gr. ss., aq. ℥i.).

October 31.—Patient reports that he has perceived no alteration in the cough, but that the voice became much clearer, the expectoration easier, and that no traces of blood have been seen in the sputa. Continuation of the inhalation, but the dose of morphia increased to a grain.

November 7.—The voice is nearly perfectly clear; cough not diminished; expectoration rather enlarged in quantity than before the inhalations, yet not mixed with blood. After each inhalation, according to his description, the patient perceives a very agreeable sensation of warmth in the chest, for which he is longing when the time for inhalation approaches. Inhalations to be continued.

November 14.—Cough not diminished, but the quantity of expectoration is much less. The patient is able to take fluids without retching or vomiting. Cacao is the only exception; he generally takes a cup of it at 7 o'clock P.M., and it generally makes him vomit. One ounce of the following solution to be inhaled morning and evening:—

℞ Tincturæ opii, ℥ii.
Aquæ font., ℥xx.

November 22.—General appearance has greatly

improved, as the patient not only learns from his friends, but also feels by his strength. Cough considerably diminished; expectoration easy; the bowels were confined, and acted only once in about two days; feels a soreness in the chest. Inhalations of the following solution:—

℞ Sodii chlor. ʒss.
Aquæ, ℥xx.
Tinct. opii, ʒss.

One ounce to be inhaled in the morning and one in the evening.

November 28.—The patient was not once during the night in the last week disturbed by cough, and slept soundly; but the soreness of the chest still exists. Inhalation discontinued for a few days.

December 5.—Soreness of the chest has disappeared; patient was very uneasy without the inhalations; the cough was more troublesome. Inhalations of salt and opium resumed.

December 12.—Feels better than he has done for a long time. The cough is not only diminished, but quite painless; before the inhalations the whole chest was spasmodically attacked and painful. He does not expectorate half the quantity he used to previously. Patient could not lie on the left side before the inhalations, and if he turned on that side during sleep, he was soon aroused by vehement pain; but now he is able to sleep the whole night on that side, and so he enjoys his night's rest better

than ever he did. Only about six o'clock in the morning, soon after awaking, he must cough a few minutes "till the tubes are cleared," and then he feels well the whole day, coughing only now and then, and easily, bringing up some sputa. Inhalations to be continued.

December 19.—The same condition as last reported; can walk faster and ascend stairs. When the patient first came to consult me, my consulting-room being on the first floor, he required from five to ten minutes before he could speak up, but now that affects him but little. No alteration in physical signs, but the rattling noises are diminished, and the amount of respiration increased to 2,300 cub. cent. General appearance much improved; no vomiting; no attacks of cough, but brings up the sputa by painless cough. At that period the patient was obliged, by family matters, to go into the country, and the treatment ceased.

The following case, though a fatal one, can nevertheless bear testimony to the value of inhalations to free the patient from distressing symptoms, even in the worst stage of consumption.

Case XXVII.—L. T., a native of Baden, hairdresser, 27 years old, and married. His two children died from consumption. His father died by an accident in the 38th year of his life; his mother when 47. Patient is not aware of the disease from

which she died, but knows that it was not consumption. He was the only child of his parents ; no traces of phthisis in the paternal line, but the mother's sister was subject to cough, and died when 30 years old. Patient enjoyed good health up to his twentieth year, when he came to London. According to his opinion, the climate did not agree with him ; he very often caught colds, and could not get rid of them for a long time. In consequence of such a cold, patient began to cough three years ago, and expectorated sputa, which were for a whole month mixed with blood ; about every fortnight great pains came on in the left side of his chest, which were alleviated by mustard poultices. It is only for the last few months that he became very weak and unable to walk quickly or to ascend stairs ; his appetite was sometimes fair, at other times very bad. The bowels acted generally well, but sometimes the patient was very much relaxed, about ten or twenty times during a day ; and this was two years ago in so high a degree, that the food passed perfectly undigested through the bowels. Sleep is very often interrupted by cough, and sometimes, when awaking, the patient feels extremely weak, and as if bathed in perspiration. He is able to follow his employment, but soon becomes exhausted, and then is obliged to leave off and sit down to rest.

I was consulted by the patient *on the* 15*th November*, 1865. He is of small growth, extremely

lean-faced and emaciated, of a pale leaden complexion, the jugular bones very prominent, the eyes deep in their excavations, and with dark circles; conjunctiva excessively pale; eyes staring. The patient was weighed several times, and has lost sixteen pounds during the last three months. Neck long and thin.

Thorax.—Clavicles very prominent; supra and infra clavicular region deeply hollowed; the thorax unmistakeably tuberculous, the right side more expanding during inspiration than the left; right intercostal spaces convex during inspiration, the left concave. Measurements:—

Upper circumference	.	81 centim.
Middle „	. .	82 „
Lower „	. .	82 „
Front length	. .	18 „
Side „	. .	32 „
Acromial breadth	.	13 „

Amount of respiration, 1,800 cub. centim.

Respiration very laborious, twenty-four in a minute. On auscultation and percussion the whole left lung is found to be infiltrated, and also the upper apex of the right lung; bronchial catarrh in a very high degree. Every second the patient is obliged to cough, whereby the heart is very excited; pulse very small, 130 in a minute; voice quite hoarse since the last six months; much blood has

been lost *per anum*. He complains that the worst symptom of all is that which invariably occurs every morning, *viz*. retching and vomiting, so that he fears to die in such an attack. He vomits about three or four times, and brings up about half a teaspoonful of a green matter, which, when not expectorated, makes him feel miserable the whole day. He was ordered to eat meat at his meals, and to take one or two glasses of port wine a-day, and besides this to inhale three times a day a solution of salt and morphia.

November 22.—The patient reports with great satisfaction that he did not vomit after the second inhalation, and nevertheless passes the day as usual. He arises with good appetite, and after having expectorated much phlegm, coughs less during the forenoon since he has been inhaling; in the afternoon the left side of the chest generally becomes painful; then he longs for the inhalation, after which he loses that pain; the same is the case when there is some matter which is impossible to be brought up by cough, then he expectorates as soon as he begins to inhale; he chooses to keep his mouth as close before the spout of the machine as possible, for he describes the penetration of the warm cloud as a very agreeable feeling.

December 6.—The cough is weaker by day, but stronger by night, the expectoration copious but easy. Patient becomes apparently weaker, and is

trembling when standing; yet he expresses his gratitude for having taken from him that vomiting struggle in the morning, and for giving him means by which to rid him of phlegm, the expectoration of which caused him formerly exhaustion.

The vomiting did not recur during the whole time he used the inhalations, but his vital powers sank more and more, and he died on the 10th of January, 1866.

To show the influence which can be gained upon phthisical patients by inhalation of oxygen I cannot do better than relate the following:—

Case XXVIII.—*Tubercular infiltration of the left apex and bronchial catarrh of the right lung; hæmoptysis; colliquative perspirations; rapid loss of flesh. Inhalations of oxygen and atomized fluids.*

G. J., 23 years old, working in the engineering line, no consumption in the family, had scrofulous skin diseases when a child, oozing from the ear and swollen glands, from the excision of which large scars are existent at the right side of the neck. Yet from his twelfth year perfectly well and strong up to Christmas time, 1863, when he began to feel a want of breath when walking quickly. At the same time he noticed that he became much sooner tired by his work than he used to, and that some nights he awoke quite wet from perspiration, which made

him feel extremely weak. Very soon he was told by his friends, and noticed it himself, that he became thinner and thinner, so that in the course of ten weeks he lost nearly one stone in weight. In January, 1864, he began to cough and expectorate yellow sputa mixed with blood. On two days—*viz.* on the 22nd and 23rd of January—he expectorated about a tablespoonful of pure blood; since that time the expectoration continued more or less to be red or brown spotted. His emaciation became worse, his weakness great, the oppression of the chest forcing him to stop every hundred yards, and giving him great pain in ascending stairs. For all these phenomena he could account in no way; he never exposed himself to cold weather or changes of temperature, never lived irregularly, and never overworked himself.

On the 2nd of May, 1864, I saw the patient, and found him in a very bad condition. He looked exceedingly emaciated and pale, his eyes deep in their hollows, his lips livid, and he represented altogether a consumptive habit. Breathing difficult, action of the heart feeble, pulse 102, small, excited; voice very low but clear, muscles flabby, no life or energy; his spirits very depressed. On physical examination infiltration of the left apex, and bronchial catarrh of the upper part of the right lung were revealed. He had been hitherto restricted to milk diet; no meat, no beer. I ordered him a strong

nourishing diet, and inhalations of half a gallon of oxygen every three hours.

May 10.—Has decidedly improved in his general appearance and feels stronger. His appetite, hitherto impaired, became much better, and the bowels, which always required some opening medicine, have acted freely since he has taken half-a-pint of porter twice daily. He was told by his friends that his face assumed a much better colour, and he is able to walk much further distances without being tired.

May 24.—In the last two days the sputa contained more blood than usual, but his strength is obviously increased, and his appetite very great, so that he likes to eat more frequently. Was ordered to inhale one gallon of oxygen twice a day, and besides that a pulverized solution of sesquichloride of iron twice a day.

June 10.—After a few inhalations of the iron the expectoration ceased to be red tinged. He has gained five pounds in weight during the last fortnight; the pale colour has vanished from his face, and his strength, as well as his general condition, has remarkably altered.

He continued the inhalatory treatment up to the middle of September; as atomized fluid a solution of salt was used to the last. When we left off treatment he could hardly be recognized as the same man; he had grown strong, his muscles were increased and more firm; he could walk without any inconvenience; in short, he feels as well as ever he could

expect, and not only was the feeling a subjective one, but on physical examination the right lung could be shown perfectly healthy, whilst on the left apex dullness remained; but with this one exception he could be considered perfectly healthy. One year afterwards I saw him again, and he assured me that he had enjoyed during the whole time very good health.

Case XXIX.—A. K., thirty-six years old, married, mother of ten living and healthy children; in her family only her elder sister suffers from cough; the patient menstruated in her thirteenth year, married when seventeen, and became a mother one year after. All confinements were regular, easy, not long lasting; but after the ninth child she never recovered that strength which she used to have, and a short, dry cough came on which was most troublesome in the first part of the night; sometimes she felt pain in the middle of the chest, yet it was never of great intensity. But after the birth of the last child, the cough became much worse, and was associated with sputa of thick, grey, viscid phlegm, several times copiously tinged with blood, which required great coughing in order to be expectorated. The voice became hoarse, and sometimes changed to complete euphonia, lasting for several hours and days. There was tickling in the throat, which also caused cough; and besides want of breath and weakness,

the patient noticed that she was getting thinner; sometimes she was obliged to cough strongly for a quarter of an hour before she could get rid of the phlegm, and then she was much exhausted and felt pain in the chest. Appetite was bad, bowels acted well. Patient had taken, besides other medicines, quantities of cod-liver oil without feeling any relief.

On October 28, 1865, I saw the patient first, and found her to be of a rather delicate nature, with very thin muscular layers. One could, at a distance of some yards, hear her breathing, yet she did not feel great difficulty in performing the act of respiration. Her complexion was pale, her neck long and thin; the chest, with the exception of the left upper part, which, on physical examination, was found to be infiltrated, well arched. The laryngoscope revealed a swollen injected condition of the vocal chords and mucous membrane of the larynx. Sounds of the heart and of the large vessels regular; pulse large and pretty full, 87 in a minute. The patient was ordered to use a more nourishing diet than she had hitherto, and to inhale in the morning and evening a solution of alum (gr. ii.) and acetate of morphia (gr. i.) to the ounce of water. After about seven days, the patient's voice became as clear as it ever was, and altogether she inhaled for six weeks. When her cough and expectoration had ceased, the patient felt much stronger, so that she was enabled again to fulfil her domestic duties, which she could

not for a long time. The inflammatory condition did not exist any longer, but the dullness of the left side had not vanished.

In conclusion of this section I cannot but communicate the following case, which is of the utmost interest, and may, perhaps, be an inducement to put inhalation upon trial in diseases of the ear. As it will be seen from the history of the case, difficult hearing commenced with certain phthisical symptoms, and gradually passed into deafness, probably by inflammation and thickening of the mucous membrane lining the tuba Eustachii. Inhalations were applied for the disease of the chest, and after using them for three weeks, the patient perceived that the deafness, then of three years' standing, had entirely disappeared.

Case XXX.—*Pleurisy followed by symptoms of consumption; restoration of health after twelve months; after about thirteen years the symptoms gradually recurred, but at the same time deafness set in. Application of inhalations, improvement of the chest disease, and cure of the deafness.*

B. S., 40 years of age, law clerk, unmarried; his father died of a disease of the brain when 49 years old; his mother arrived at the age of 84 years; one brother of 28 years died of consumption; all other members of the family healthy; no consumption traceable either in the line of his father or

of that of his mother. Sixteen years ago the patient was attacked by pleurisy, which was followed by night sweats, hemorrhage of the lungs, want of breath, copious expectoration, emaciation, and such extreme exhaustion, that he was given up by several physicians. The patient could not leave the room for nine months. He took great quantities of cod-liver oil, and at last resorted to the sea-side. After the lapse of one year from his first attack, the patient felt quite well again, and remained so up to three years ago. At that time he began to cough again, without being able to account for it; a few weeks later hemorrhage of the lungs occurred again, and lasted, with more or less vehemence, for nine days, during which patient was obliged constantly to sit upright; the expectoration was very copious, cough great, want of breath much felt, particularly if he walked long distances or ascended stairs; from time to time soreness and pain in the chest. When these symptoms, three years ago, began to develop, another phenomenon, difficulty in hearing, commenced, which gradually became worse, so that the patient could not take part in any ordinary conversation; he required to be very loudly spoken to before he could understand what was said. But the previously-mentioned symptoms seeming to be the most dangerous ones, he did not trouble much about his deafness.

In November, 1865, patient consulted for his

chest disease Dr. Andrew Clark, who recommended inhalations of an atomized solution of tannin and opium. The patient is at present still inhaling, but his sputa having lately been mixed with blood, the solution was changed accordingly. Patient expresses his greatest satisfaction in respect to the benefit he has derived from inhalation. His general health has much improved, the cough has diminished, the expectoration decreased, but the most remarkable effect was exercised upon the deafness. Immediately after he had begun inhalation the hearing improved, but this improvement was so gradual, that after using the inhalations for three weeks, the patient was quite astonished at perceiving that his power of hearing was as good and keen as it ever had been, and so it has remained up to this date, after about three months.

11. *Gangræna pulmonum* (*Gangrene of the Lungs*).

This disease originates generally from pneumonia in old people, from bronchitis, phthisis, typhus fever, and from other illnesses, which create a septic condition of the blood. The most prominent symptom, besides fever and rapid sinking of all vital powers, is the terrible fœtor, coming from the mouth of the patient, and attached to the ichorous expectoration, which makes it almost impossible for anyone to be with the sufferer. The sputa contain disintegrated tissues of the lung vesicles, black pigment, and elastic fibres.

In respect to the inhalatory treatment of gangrene of the lungs, the disease being rare, little experience hitherto has been gathered. Trousseau merely mentions that he has made use of tannin in it, and from other authors I cannot learn that they have had any experience. From that which I have seen in other diseases, associated with fœtor from the mouth, I should advise to use chloride of lime, or liquor chlori, mixed with from one to eight parts of water. In all cases in which such a condition exists as to retain mucus or pus or other similar matter in caverns, excavated bronchi, and other abnormal places, such a fœtor of the breath or expectoration can occur.

When I was physician to the Spa of Reinerz, whither a great number, particularly of tubercular patients resorted, I remember some who were compelled, not by the disease from which they had suffered for years, but by the fœtid odour of their breath, to leave their homes and to come to the springs of Reinerz, in hopes of being relieved from that very disagreeable phenomenon. In my notes of that time I find the following record of

Case XXXI.—A young man, a Russian, 21 years of age, who has been subject to phthisis for years. The disease was in an advanced stage, and large caverns could easily be shown to exist in both lungs; the patient's pulse was, during the six weeks he was

under my care, never less than 100 in a minute. The fœtor of his breath and sputa was for weeks so shocking, that he could get apartments with difficulty only, and at a much higher price than usual. I made him inhale a solution of chloride of lime (one drachm to the ounce), which did not cause any cough; though its effect was unmistakeable, I nevertheless substituted liquor chlori (one part to six parts of water), which made the patient's condition much more tolerable. He inhaled nearly every hour, and after the first inhalations the alteration was already very marked; one could well bear to be with the patient for a quarter of an hour or so, which was impossible before the inhalations were made use of. But the other symptoms did not only not cease, but made progress, so that I advised the patient to leave Reinerz and to return home, which he did. The sputa were several times microscopically examined by me, and though, when standing, they did not form some separate layers, as several authors think to be the case in pulmonary gangrene, yet disintegrated lung-tissue could readily be found; but I was not able to find crystals, though I carefully searched for them.

12. *Tussis convulsiva* (*Whooping-cough*).

Physicians are divided into two parties in their opinions concerning whooping-cough; the one consider the disease to be a chronic catarrhal one,

originated by epidemic influences and propagated by contagion, commencing in the upper part of the respiratory tract, taking its course downwards to the smallest ramifications of the bronchi, and causing paroxysms by reflex action; the other look upon it as a nervous disease, as an affection of the vagi, and particularly of the solar plexus. I think that an unprejudiced consideration of the symptoms, as presented by a new and pure case of pertussis, could not fail to show that very much can be said in favour of the latter, and very little in favour of the former opinion. Such a fresh and pure case presents nothing more than a healthy child, more or less frequently attacked by fits of spasmodic cough, lasting a shorter or longer period, and leaving intervals in which the child does not exhibit any morbid appearance whatever. These features soon become altered, because—and especially when the attacks are frequent—an abnormal quantity of carbonic acid is retained in the blood, owing to deficient respiration during the fits; the mucous membranes of the respiratory tube, as well as the lungs, become affected, and exhibit certain phenomena which do not belong to the disease, but are the consequences of it. There exists between these symptoms and the disease the same relation, as between certain phenomena, very often met with in epilepsy, and the epileptic disease itself. Alteration of the intellectual faculties, for instance, is often met with in epileptics, but, never-

theless, this alteration is not—as Russell Reynolds has shown in his classical work on epilepsy—essential to the disease. We know, again, that certain organs, or certain muscles or groups of muscles, are liable to be attacked spasmodically. We all have observed one form of spasm which is very near akin to pertussis, namely, the spasmodic laughter (Risus convulsivus). This affection can voluntarily be produced by tickling certain parts of the skin, as the soles of the feet, armpits, and other parts; and in a similar manner are we able voluntarily to produce convulsive cough by tickling certain parts of the mucous membrane of the respiratory tract, as of the larynx and trachea; the pre-existence of bronchial catarrh is not required to cause pertussis, but such catarrh will soon follow, if we repeat the irritation several times a day. The consideration of these facts ought to leave no doubt that whooping-cough is a pure nervous affection. Some ophthalmologists speak of "epilepsy of the eye;" we may as well speak of whooping-cough as "epilepsy of the organs of respiration." This opinion is powerfully supported "ex juvantibus et nocentibus." Those practitioners, namely, who consider the disease to be of inflammatory nature, aimed in their treatment, nevertheless, to act upon the nerves, and administered belladonna, hyoscyamus, &c.; but recent observers have entirely based their treatment upon the nervous nature of the disease, and have accordingly admi-

nistered bromide of potassium, bromide of ammonium, morphia, &c.; and Drs. Gibb, Harley, and other authors from these medicaments have obtained far better results than has been arrived at by the treatment of older date. Dr. Abbotts Smith—to whom I am much indebted for the kind assistance he has rendered to me when this treatise was passing through the press—has recently published a number of carefully observed cases treated with bromide of potassium or with bromide of ammonia, equally good results having been obtained with either remedy. To this kind of treatment I can add three new and striking cases, which came, a few weeks ago, under my care, in the Metropolitan Free Hospital, and which I have treated by means of hypodermic injections.

A short time ago I endeavoured to show ('Medical Mirror' of January and February, 1866) that for nervous diseases there is no treatment which is more effective and certain than that by hypodermic injections. Convinced of this truth, I tried the application in three children attacked with whooping-cough, and in all three, after a few injections, the spasmodic "whoop" was lost. It is my intention to continue these experiments, and to publish the results in due time; but the results already obtained are very much in favour of the opinion that pertussis is a nervous disease.

Concerning the inhalatory treatment of whooping-cough, I must confess that I was not successful in

inducing the little patients to inhale; they were either frightened, or otherwise unwilling to perform that operation; and if my experiments with hypodermic injections should, in a larger number of cases, prove as successful as they have done in the three just mentioned, no remedy will be able to stand in comparison with that treatment, as to the convenience of administration and the certainty of the results.

Other authors have been more successful with inhalations, and I shall, therefore, in conclusion, refer to their experience. Professor Gerhardt published the case of a girl seven years old. The attacks were scarcer towards the end of the treatment, but for the last two weeks the sputa were tinged with blood. The patient inhaled eight times, once each third day. The solution consisted of tinct. ferri sesquichlor. three minims to an ounce of water; the hæmoptysis ceased, and after the first inhalations the attacks were considerably diminished. The spitting of the blood, which was the alarming symptom for the parents, having disappeared, they returned with the patient to the place whence they came to consult the Professor.

The following case has been published by Dr. Fieber (' Allgem. medic. Contralzeitung,' 1862).

Case XXXII.—B. J——, a girl four years of age, enjoyed good health up to last winter, when

she was severely attacked by pneumonia, from which she recovered and continued perfectly well to February, 1862, at which time—according to the report of her mother—she visited a playfellow, who had the whooping-cough; from that time her present illness commenced, consisting in such severe attacks of cough as to make the child lose her breath, and turned her face quite dusky. The little patient seemed in such attacks, which, lasting from ten to fifteen minutes, recurred from four to six times during twenty-four hours, as if losing her senses, and her mother, in her anxiety, did not know what else to do, besides seizing her daughter by the shoulders and shaking her vehemently. She coughs with great difficulty, the sputa are scarce, white and mixed with blood; there comes blood likewise from the nostrils. In the intervals, the girl is comparatively well, and does not feel any inconvenience in breathing.

In this condition, the little patient remained from the middle of February to the 23rd of April. After several domestic remedies had proved unsuccessful, the mother applied for medical advice, and Dr. Fieber found the patient in the following condition. The child is, for her age, well developed and well nourished. On physical examination of the chest, no abnormal phenomena can be revealed, except some indistinct rattlings all over the thorax. Breathing roughly vesicular, expiration somewhat

prolonged. Heart sounds loud and distinct. Pulse 136 in the minute.

Since in this case the objective symptoms were disproportionate to the subjective phenomena, I easily perceived that the nature of the disease could not be an affection of the fine bronchi and of the cells of the lungs, but that it was a disease of the vagus nerve, although I had no reason to suppose that an irritation of that nerve by a bronchial gland had taken place (Romberg). I therefore thought it necessary to chose a medicament which stands in a certain relationship to the vagus. This remedy was an alcoholic extract of hyoscyamus; I dissolved it in a diluted oily emulsion, in order to act at the same time upon the somewhat inflamed mucous membrane of the pharynx. The formula was—

℞ Extract. alcohol. sem. hyoscyam. gr. iv.
Ol. oliv. ʒi.
Pulv. gummi arab. ʒss.
Aq. font. ℔ ii.

She began the inhalations on April 23, inhaling in appropriate intervals during eight minutes, and as the child sometimes performed 48 respirations in a minute, one series consisted of 380 inspirations. They were performed without resistance or cough. Although I did not observe, as Barthez did, the child during the inhalation falling asleep, yet she was not far from it, as she indicated by frequent

yawning. After each sitting, the mother noticed a kind of stupor.

On the next day, the same number of inhalations was repeated; the phenomena remained unaltered. She was attacked four times last night, but the sputa did not contain any blood. In the following night, two attacks occurred; by day, when the child is moving about, the cough is frequent.

April 25.—380 inhalations.

April 26.—Last night one attack only occurred; 380 inhalations again.

April 27.—The same treatment. Last night the child slept undisturbed.

On the 28*th*, the hitherto constant physical symptoms were altered; all over the chest, moist small rattlings could be heard; the expectoration became easier and more copious. In the night of the 29th, she was attacked once, and ejected a large quantity of sputa. 380 inhalations.

In the morning and evening of the 29th, and in the morning and afternoon of the 30th, large quantities of white fluent sputa, unmixed with blood, were easily expectorated, after which, not only the nightly attacks ceased, but also the daily ones disappeared, and the treatment could the more readily be left off, as I considered, henceforth, the avoiding of obnoxious external influences quite sufficient to remedy the insignificant symptoms still existing.

CONCLUSION.

I SHOULD not like to conclude these pages without making the following remarks on the cases contained in the second part. They were selected out of a considerable number of which I possess notes, too numerous to be incorporated with this treatise, without making it more voluminous than was intended. With a very few exceptions, the cases are such as have been cured or very much improved by inhalation, and this is just the point at which I am aiming. It was by no means my intention, presenting cases only in which the inhalatory treatment has been applied successfully, to show that such results will always be obtained by the administration of atomized fluids. That was not my purpose. Inhalation not being generally used, or even known, I, being convinced that it deserves a prominent place in the treatment of pectoral disease, was anxious to prove—particularly to those gentlemen who proclaim it to be void of any value—that a cure can be effected by the new method, and I may add, in a manner which gives, provided the case be apt for inhalations, the preference to that method over all other kinds of treatment.

The final aim of every physician is to *cure* the patient, and I do not consider that we are justified in protracting a disease or allowing a patient to die, without having exhausted every possible therapeutic means; but my intention was to show that inhalation is a source by no means to be neglected in diseases of the organs of respiration. He who expects wonders from that mode of treatment will soon be disappointed: he who recommends it as an infallible one, will prove a false prophet; but an unprejudiced application of the atomizer will lead to the conviction that the invention of Sales-Girons has been a most valuable addition to therapeutics.

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