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ON THE USE OF ELECTRICITY IN DISEASES
OF THE THROAT.

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IN all branches of medicine and surgery the use of electricity, in one form or another, is becoming more frequent, and laryngeal surgery proves no exception to the rule. A glance at the text-books in use will convince anyone that this agent is so frequently used, and in such serious conditions, that everyone making use of it should understand the principles upon which the treatment is founded. In this paper we have been led to recall some of the more important, although probably well-known principles, because, now and again, it is evident from the writings of some authors that not only is it difficult to understand what they mean by the currents used, but the description of these currents is quite insufficient to enable another to repeat their experiments. We will, therefore, firstly, refer to the physical laws which bear upon the subject, with a special view to the currents required in our department. We will next refer briefly to the apparatus which interests us, and thirdly, we will say something about the application of electricity in several affections of the throat and nose.

Electricity, however difficult to define, is made manifest to us in the forms of heat, light, chemical and physiological actions. No definition has yet been received with anything like satisfaction by physicists, but

if we cannot definitely say what electricity is, we know sufficient of the laws concerning it to place a thoroughly reliable agent in our hands, if properly understood ; but, on the other hand, a powerful agent for evil if it be imperfectly understood. It is customary with some writers to begin by describing the form of the elements used in a given case, and so one author speaks of the Bunsen, a second recommends a Daniel, and a third will have nothing but a Leclanché element. Suppose, instead of this, we look at the subject from a wholly different standpoint, viz., that of the various ways in which electricity can be produced, and let us select the generator, because of its suitability for a given piece of work. It is evident, in these days of dynamos, that as long as we get a current of electricity of a given strength it matters little from whence it is obtained. The best possible example of this is the admirable supply got recently from the companies for lighting the houses in the Metropolis. But, as others are less favourably situated, we have to fall back upon some of the ordinary means at our disposal for its production.

Electricity may be produced by friction, say by the well-known action of rubbing a piece of amber with a piece of flannel, and, on the same principle, friction produces it in such complicated apparatus as the Voss and Winter machines. These machines are used to a limited extent in medicine for the treatment of hysterical and other nervous affections, and they are spoken of as machines for the production of static electricity. Secondly, we make use of a number of chemical batteries to produce electricity, and of these we have an infinite variety. Thirdly, we have the dynamo, and from it secondary batteries, or accumulators ; and, lastly, the thermopile. To the consideration of these points we will now direct our attention, and in order to do this it is necessary that we should explain two states in which electricity is known, called respectively the static and dynamic, although they are but two phases of the same force, acting under different circumstances. By static electricity we mean electricity in a state of rest ; dynamic refers to it in a state of motion, or rather what we suppose to be a state of motion. The former, as we have said, constitutes what is known as static, and it is also called Franklinic electricity. Some writers, such as Dr. Tibbits, have found the static form of use in hysterical cases, but as yet no one has paid much attention to its use in throat affections, and hence we need not refer further to it. It is just possible that in hysterical affections of the throat it might be found useful, and if anyone wish to experiment, the Carré, Winhurst, Winter, Holt, and Voss machines are the best at present at our disposal.

Passing to the consideration of dynamic electricity, three terms now in common use must be made clear. These are (1) electro-motive force, written E.M.F. ; (2) current, written C. ; and (3) resistance, written R. Without a knowledge of these terms, it is impossible to understand what is meant by a current, or its measurements ; and further, unless we understand these, it will be impossible to correct errors in the construction of apparatus, or devise new instruments correctly. To give a familiar example of the use of these terms, we might compare it with the flow of water through a pipe. Given a tank of water and a pipe leading from it

to a lower level, the water flows down the pipe because the pressure above any point is greater than that at any point below it. The pressure is at its maximum at the inlet, and falls to zero at the outlet. Further, a certain quantity of water flows per minute, depending upon the friction and upon the flow of water in the pipe. Three ideas are clearly to be understood here—firstly, the pressure producing the flow; secondly, the rate of flow, or the current; thirdly, the friction or resistance opposing the current. To compare these with the electrical phenomena, the E.M.F. is likened to the aqua-motive force, or water pressure, or gravitation. The current is comparable with the rate of the flow through the pipe, and the friction to the resistance which all bodies more or less offer to the passage of the current. The above factors in the calculations are measured in authorized units established by the British Association.

The E.M.F. has for its unit the volt. The current is measured in ampères, or fractions of an ampère (say milliampères), and the resistance is measured in ohms. The relation between the various units was first worked out by Dr. Ohm, and he formulated the law $C = \frac{E.M.F.}{R}$, and as there is a resistance inside the battery as well as in the wires forming the outer circuit, the law is further amplified into $C = \frac{E.M.F.}{R' + R''}$. From a practical point of view it is not necessary for us to study any of these beyond the current itself, but a knowledge of the principle by which the current is measured is necessary, if we wish to understand why we choose a particular battery or generator, or to describe accurately what we have done, that others may repeat the treatment. Let us consider here what bearing this law has in our practice. If we wish to stimulate a nerve or muscle in the throat by passing a constant current through the tissues of the body, say from the hand to the side of the neck, then it is evident the force which we wish to have at our disposal must be such as to overcome the great resistance of the human body between these points. In other words, we require a high E.M.F., possibly thirty to forty volts, but a very small current, a fraction of an ampère, say five to ten milliampères only, is necessary. If we wish to light a lamp, the resistance of the small piece of carbon within the globe is nothing compared with the resistance of the tissues of the body in the last-mentioned case, and so we do not require a high E.M.F. Instead of thirty volts, five will do, but we require a stronger current, probably two to three ampères. Thirdly, suppose we wish to heat a piece of platinum for a cautery point, the small piece of platinum offers little or no resistance to the current, and so a low E.M.F., say four volts, is all that is necessary; but, on the other hand, to gain the necessary heat we may require as many as thirty ampères of current. It may be here stated that this demand for a high E.M.F. and low current at one time, and a low E.M.F. and a high current at another, constitutes the chief difficulty in supplying medical men with batteries, because, as yet, there is no universal battery, and so it comes about that one form of battery or generator is chosen for one kind of work, and another for another.

The following table may be useful in choosing a battery for throat work, and, as it covers the whole range required, anyone by its use can

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let an electrician understand what is wanted, and the choice of the means of producing the currents becomes a matter of expense and convenience only.

TABLE OF CURRENTS WHICH MAY BE REQUIRED IN THE TREATMENT OF AFFECTIONS OF THE THROAT AND NOSE.

	E.M.F.	CURRENT.
Diagnosis and treatment of lesions of nerves and muscles	1—60 volts	1—20 milliampères
Removal of nævi, cysts, &c.	20—40 volts	1—30 „
Lighting of these cavities	5—20 volts	1—3 ampères
Heating cautery points, loops, &c.	5 volts	20 „

If we can have the supply from mains on the street otherwise used for lighting purposes, it becomes an easy matter to arrange any current. But suppose we have to fall back upon chemical generators, how can we arrange the batteries so as to get the difference in pressure? We must remember that, given a store of electricity in a cell, it can be taken out in either form. If we wish a battery with a small current and high E.M.F., we take a number of cells and join them end to end; that is, we join the carbons to the zincs, or the positive to the negative poles. By this means we get the sum of the electro-motive forces, but only the current of a single cell. The arrangement is spoken of as putting up the cells in series. If, on the other hand, we connect the carbons together, and all the zincs together, we get an increase of current corresponding to the sum of the currents, but the E.M.F. is only that of one cell. To exemplify this: if we start with ten cells of the capacity of one volt and one ampère current, arranged in series, we can have a battery of ten volts, but only one ampère; if in parallel, they would give ten ampères of current, but only one volt.

Understanding the above principles, it is easy to choose a cell for any purpose. For the stimulation of a muscle or a nerve, or electrolysis in nævi, cysts, &c., the ordinary Leclanché cells are excellent. They are clean, compact, non-fuming, have no local action when not in use, and require little attention. The disadvantage is, the current rapidly falls owing to the internal resistance in the cell, and, as the current is small at the best, they are useless for a cautery. The bichromate of potash has many forms, nearly all of them badly designed. Its advantages are: powerful current, cheap material, and non-fuming. Its disadvantage is that the cells do not last long; in many cases this is owing to the carbon splitting up, or the acids corroding the zincs, especially when we get to a terminal. There are many other forms of cells now in the market, the Bunsen, Daniel, and chloride of silver, but nearly all of the last mentioned have been proved useless instruments, although those recently put in the market by Schall are said to be good. However, as no chloride of silver cell has yet given satisfaction, we prefer to reserve our opinion.

In addition to chemical batteries we have other means of producing electricity, such as the dynamo, which, for medical purposes, could be made to do anything, but its cost and other disadvantages put it beyond the reach of practitioners. Nevertheless, any electrician with the above given table could construct a dynamo suitable for our work, and, it might be added, that a dynamo turned out by one of the well-known makers of modern times would be by far the most convenient generator. There is one means, however, by which we can gain all the advantages of the dynamo, which costs less, and does away with the difficulties of primary batteries.

We have said that in the Leclanché cells the fall of the current is rapid when in use. This is mainly due to what is termed polarization. By this we mean the opposing E.M.F. set up by the disengaged bubbles of hydrogen on the carbon plate due to splitting up of the water into its constituent gases by the passage of a current. Now what constitutes the great trouble in primary batteries is really the basis of polarization batteries, otherwise called accumulators or secondary cells. Grove, in 1860, showed that a voltameter in which water is decomposed between platinum electrodes could be made to yield a polarization current in a reverse direction to that in which the current flowed from the electrolyte.

A little later Kirchoff, in 1862, improved upon Grove's idea by substituting lead for platinum, and this invention was brought prominently to notice about the year 1870. Ever since that time improvements have been going on, and now the company manufacturing secondary cells (for they are all manufactured by the same company in England, the Electro-Power Storage Company) can give us a reliable and neat storage cell for almost any work required. The great advantages are compactness, non-fuming, exceedingly high E.M.F., non-polarization, great capacity, and no plates nor cells to clean, and no local action. Lastly, with them we can predict before beginning an operation the amount of current at our disposal. At first the specific gravity is about 1.300 Twaddle, and it falls to 1.145. By taking its specific gravity at any time, we know exactly what current remains in a cell. The disadvantages of this cell are that it has to be re-charged from the dynamo, and its cost.

The last generator to which we will refer is that recommended by Dr. Ogston, of Aberdeen. This generator has not come into general use, and experienced electricians are not very hopeful of it. Hammond and Noe have worked in this department, and something may yet come of it. Edison, too, has been working in this direction, although on different principles. The machine on which he has been engaged is termed the pyro-magnetic dynamo.

To sum up our views on this question, we would say that to those fortunately placed in the position of having electric wires passing their door nothing can be better than to have their supply direct from the main. Failing this it might be said that for throat work in the stimulation of nerve or muscle, or in electrolysis, a good Leclanché or Daniel battery of about 40-50 cells, or it may now be a smaller number of chloride of silver cells, should be chosen. For the cautery or lighting, or both, a suitable form of the accumulator should be used by those who can

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have them re-charged at a dynamo, and failing this a well-constructed bichromate of potash battery is the next best.

Before passing to the consideration of the accessories required in medicine it is hardly necessary to refer to the distinction which is always drawn between the negative and positive poles. Chemically and physiologically, the two poles differ in their action. The whole formula of the electrical stimulation of normal muscle depends upon the action which the latter shows to the negative or the positive pole. When muscles or nerves are tested they either show the ordinary normal polar formula, or if they be diseased they depart somewhat from it, showing quantitative irregularity, *i.e.*, excess or deficiency in amplitude. Again, they may show qualitative abnormalities, such as in the order of appearance, the relative amplitude, response, mode of reaction or alternation in the relation between Kathode or Anode. By combination of these the ordinary reaction of degeneration is got. But it is quite unnecessary here to enter into the electro-physiology of the subject, because, after all, the normal reactions and departures therefrom are the same in the throat as in other parts of the body.

One more form of electric apparatus remains to be referred to—that is the so-called interrupted or Faradic current. This is best known to us in the form of the small Spammer battery, or in the more elaborate form of a large coil, such as that made by Du Bois-Raymond. In this form of electricity the ordinary current is interrupted and alternately reversed, and by the rapid series of shocks transmitted at the make and break of the current the motor nerve or muscle can be strongly stimulated. Elaborate arrangements have recently been made giving a current in one direction only, but, from a practical point of view, we are unaware of any great advantage to be derived from the same. A good deal of mystery surrounds this instrument because the current which is induced in the secondary coil can be given to the patient, or the interrupted current from the primary coil can be administered. The latter is stronger than the former and will certainly cause some of the muscles to react when the weaker current will not. As a rule, we use the secondary current, say, in cases of hysterical aphonia, and only resort to the primary when the secondary is too weak. In throat affections, at least, we know of no other rule to guide us in choosing one current in preference to another. As yet no easy method of measuring the interrupted current has been devised, but Schall promises to do this in a convenient form. At present most operators have to content themselves with testing the strength of the current on their own muscles, or some less sensitive part of the patient than the throat, say the neck.

A word or two about accessories. In every case one ought to be able to measure the current; hence a good galvanometer is necessary, so that we may register exactly what current the patient is getting. Secondly, the cells should be connected with a good collector, so that we can increase or decrease the number of elements in the circuit, and so regulate the strength of the current at will. Thirdly, all terminals should be large and kept scrupulously clean, and it is well to have some means

of reversing the current so that the negative pole may become the positive, and *vice versa*, at a moment's notice. All wires to and from the battery should be insulated, and of sufficient diameter to carry the current employed without heating. It is necessary to have some means of throwing in resistance when using the cautery; hence a rheostat is advisable, that we may keep our platinum point at a constant heat for a given period. If the cautery handle, or any part of the apparatus except the piece of platinum, becomes heated, it should be rejected. We have known as much as one-sixth of the current lost in a cautery handle, owing to the conductors through it being insufficient to carry the current.

ELECTRIC LIGHTING OF THE CAVITIES OF THE THROAT AND NOSE.

When the incandescent lamp was first produced it was thought it might prove useful in the illumination of these cavities. In the "Glasgow Medical Journal" for January, 1885, an article appeared by the writer of this paper, giving a number of drawings of an electric laryngoscope and rhinoscope, which had been shown at the Glasgow Medico-Chirurgical Society in November, 1884, and shortly afterwards Dr. Felix Semon brought out an electric laryngoscope on the same principles. While a number of these have been used, it cannot be said that the instrument has proved as popular as was anticipated, possibly on account of the obstruction caused by the small lamp placed in front of the mirror, and it may also be because the lamps are not perfectly made and soon burn down. Be the cause what it may, as a general rule we find either the gas or lime-light made use of in the consulting rooms of specialists in this country. There can be no doubt, however, that the electric laryngoscope has its advantages, and as the instrument improves it may become more popular; as yet, however, it shows no tendency to displace the ordinary laryngeal apparatus. It is different with the large incandescent lamps which some London specialists now employ, because with them a sufficiently good light can be got to take the place of the ordinary Argand burner. Attempts have recently been made on the Continent to illuminate the larynx from without, by sending a strong electric light through the tissues of the neck. Voltolini described a method of trans-illumination of the larynx in this way, and hoped by this method that we might be able to bring sub-glottic structures into view which are out of range of the ordinary laryngoscopic mirror, and that it would permit of the differentiation of lesions of the vocal bands and other structures by the variation and amount of translucency then exhibited. Freudenthal, Heryng, and Gottstein have been working in this direction, and more may yet be heard of the subject. The currents required for any of these methods of illumination can easily be got by combination of the Electro-Power Storage Company's accumulators. All that is required is a note of the number of volts and ampères required for the illumination of the particular lamp, be it great or small, and secondary cells can easily be made to do the work. For small lamps about five volts and one to two ampères suffice.

THE GALVANO-CAUTERY.

In referring to the use of the galvano-cautery in diseases of the upper respiratory passages, it may be advisable to speak in the first place of the construction of the apparatus now at our disposal. In his work on "Growths in the Larynx," published in 1871, Sir Morell Mackenzie gives an accurate description of the instrument as in use at that date. He says, "In addition to the inconvenience it causes to the patient, the galvanic cautery gives a great deal of trouble to the practitioner. As the wires have to be carefully isolated, the electrode is of course rather bulky, and the necessarily unwieldy covered wires, which are attached to the handle of the electrode, prevent the operator using the instrument with that delicate precision which is essential in all manipulations in the larynx. When to this is added the employment of strong acids, and a special electric apparatus which requires some experience in its use, and the presence of an assistant at each operation, it will be seen that the employment of the electric cautery introduces a number of complications and difficulties in the way of the operator. Further, as an instantaneous white heat ought to be produced, the wire at the extremity of the instrument must be exceedingly fine, and it is therefore constantly destroyed by combustion. Hence it happens that the instrument is continually in the hands of the instrument maker."

Now there can be no doubt that to-day a perfectly reliable instrument can be had with the aid of the dynamo, or secondary battery, and with a rheostat to govern the current, and the exercise of ordinary care, all the difficulties and disadvantages above mentioned may be said to have disappeared. When our experiments were first made, the currents actually employed in the galvano-cautery were not known, but it may be here said that after careful measurement it was found that at least twenty ampères of current should be at our disposal, and never less than ten. The voltage is comparatively small, five volts at the most being all that is required. Looking back upon the history of the galvano-cautery, and the splendid work which has been done by many in the improvement of the apparatus now at our disposal, it is impossible to avoid noticing that here and there symptoms of reaction are evident. For example, many surgeons refuse to put the heated wire within the laryngeal cavity, and others, who at one time thought the best treatment for the removal of nasal polypi was by the galvanic loop, now content themselves with the cold snare, and afterwards touch the part from which the tumour sprang with the cautery point. Even in the treatment of granular pharyngitis, Dr. Smyly of Dublin prefers the instrument devised by him for the cutting out of the granules, and in larger operations, such as the removal of the tongue, many surgeons who have paid considerable attention to this subject are by no means enthusiastic, and this in spite of the perfection to which the apparatus has now been brought. Wisely used, there can be no doubt that the galvano-cautery is a most useful, permanent, and—with the use of cocaine—practical form of caustic. In destroying hypertrophied tissue, and in arresting hæmorrhage, there can be no doubt about its value. We have frequently snared the tongue from side to side without seeing blood

Nevertheless, we confess to a feeling of satisfaction that this tendency to the less frequent use of the galvano-cautery is being expressed, because it is not at all impossible that it has been too extensively employed by some. The apparatus for its application need not be complicated nor expensive. A simple key which the operator can press with the foot is all that is necessary to make and break the current, and a piece of vulcanite, with two wires thick enough to carry twenty ampères of current passing through it, is all that is really required in the construction of a handle. Into the ends of the conductor, holes can be drilled for the reception of the various points at present in use. A rheostat should never be omitted in working the instrument, so that the exact heat required may be maintained during the application.

APPLICATION OF ELECTRICITY IN TUMOURS OF THE THROAT AND NOSE.

Some surgeons have tried electricity in the recurrent form of tumours, with what success we are not prepared to say. Theoretically it is difficult to say what could be obtained by so doing. The size of the electrodes, the pole to be applied to the tumour itself, and the current to be employed, are but a few questions which would naturally suggest themselves, and they are difficult to answer. Further experiments and light are required in this department. In other tumours of the neck, say goitre, something more can be said for the use of electricity. In a number of cases we have been successful enough in treating these swellings, but it must be confessed that in a number of other cases the treatment was quite unsuccessful, or at least a comparatively small reduction only was got. In two cases of cystic goitre the result in the fluid portion of the tumour was most successful. A platinum needle was introduced into the sac attached to the negative pole of a battery. A number four Erbs standard electrode was placed in the back of the neck attached to the positive pole. Currents from three milliamperes, and increasing to eight and ten milliamperes, were passed between these two points. In one case, as many as six sittings were required, and the cystic portion of the tumour certainly disappeared. Experiments, however, in these cases are still wanting. Aneurismal varix, which sometimes occurs in the upper respiratory tract, can be successfully treated by electricity in the same way as nævi in other parts of the body. In one well-marked case, where the tumour was about the size of a sixpence, situated on the posterior wall of the pharynx, about the level of the uvula, two long platinum needles were introduced, lying parallel with each other, and about a quarter of an inch apart, one attached to the negative, and the other to the positive pole of the battery. A gradually increasing current of from one to ten milliamperes was passed through the tumour; consolidation of the contents soon took place, and in four sittings of about four minutes' duration each the tumour was reduced to a mere hardened nodule on the posterior wall of the pharynx. Great care has to be exercised in the manipulation, because over-stimulation of the part might induce death of the tissues with consequent hæmorrhage. This I have seen occur in a case of nævus, situated on the side of the face and nose, and, although

the tumour was cured, the remaining scar was very bad. In another case of this aneurismal condition occurring in the palate, a quite successful result was obtained by repeatedly introducing a cautery point at a dull red heat into the substance of the tumour ; the punctures were first made at the periphery, and then in the centre. No hæmorrhage took place during the operation, which was finished at one sitting, and was performed without pain after brushing the parts with cocaine.

TREATMENT OF NERVOUS AND MUSCULAR LESIONS OF THE LARYNX AND PHARYNX.

It is impossible to lay down definite rules which will include the treatment of all nervous and muscular lesions occurring in the upper part of the respiratory tract, but in the first place we would say regarding applications of electricity, that it becomes the duty of the surgeon to mention the size and exact sight of the electrodes—that is to say, the plates, sponges, or other apparatus which come in contact with the body. Erb has done a good deal for medicine in placing a number of standard electrodes at our disposal. Secondly, it is very desirable that the exact current used should be registered, and for this purpose, Hirschmann, Edelmann and others have proved that sufficiently reliable instruments for medical purposes can be made, and hence the use of the galvanometer as part of the accessories which are recommended in a former part of this paper. Doubtless these instruments are not perfect, and currents do not act the same way on different patients, but in using such an instrument we have at least the satisfaction of knowing that from day to day, as we administer a current, we have reduced our errors to a minimum, and established a method of comparison by means of which the case can be judged in its progress.

In seeking to frame a few rules it will be found that the difficulties are at least four in number. Firstly, whether we should use the negative or positive pole ; secondly, what dose should be given ? thirdly, what should be the duration of the sitting ? fourthly, whether we should use a constant or an interrupted current.

With regard to the pole to be used, it may be said that the older ideas of ascending and descending currents are not now considered of such importance, and, indeed, the more we get to know of the action of the two poles, the less we are able to define their action. For medical purposes the practical issue seems to be that we are to be guided by what we know to occur when the current is applied in health. We know from this that the negative pole is more irritable than the positive, and the formula for the stimulation of normal muscle shows that muscular contraction takes place on closing with a weaker current if the negative electrode be applied to the muscle and the positive placed at a distance.

But after all it is a matter of degree, because if contraction of the muscle be the object in view the positive pole would do the same work with an increase of current. Secondly, with regard to the dose ; this can only be tested by experience in a given case, but for the guidance of those using the above instruments we would say that mild currents are best—we seldom require more than ten milliamperes. Thirdly, the

duration of the application must also be a matter of trial with the individual patient, but, as a general rule, we prefer to give mild doses with longer applications rather than strong currents of short duration. Fourthly, the difficulty in choosing between the interrupted and constant current is not so difficult as it at first appears. Examination of the physical results of the poles shows that many facts are common to both currents, and this is, as might be expected, because after all they are the same agent under different conditions. Nevertheless, in pathological conditions we know that the currents react unequally. Take, for example, the condition known as the reaction of degeneration. In treating such cases we simply use that current to which the muscles will respond, then the other is used until the muscles regain their normal electrical reaction. To apply the above rules, let us grant that the current is capable of influencing nutrition, can produce a sedative or stimulating effect, and that it will cause muscular contraction. In a case of anæsthesia, when we wish to restore the function, a number three or four electrode should be bent so as to fit the neck and attached to the positive pole of the battery. The negative pole is to be attached to a small brush or sponge, and by this means the part affected can be stimulated with a mild current, say something between one and ten milliamperes as the patient can stand it. If, on the other hand, in a nervous affection, a sedative action be required, the reverse of this polar arrangement would be tried with the same apparatus.

Again, we know that the conductivity of a nerve may be increased by the passage of a current through it. For example, in some cases a muscle will not respond at all, or will possibly only respond after the nerve has been subjected to a current of electricity for some time, and so we find in deficiency of nervous stimulus the mere passage of a mild current in any direction does good. Take, on the other hand, the case of a muscle which has lost its power of contraction, as in any case of motor paralysis; then the positive electrode should be applied towards the central end of the nerve as described above, and the negative applied to the muscle or group of muscles affected. By gradually increasing the current we can easily find what is necessary to cause the muscles to respond as we close the circuits.

In carrying out the above treatment we have found the well-known single electrode of Sir Morell Mackenzie of the greatest advantage, although we are not in the habit of using his double electrode.

There is one affection about which we have not said much, because the application of electricity in it is so well known and so very successful, viz., in hysterical aphonia where the use of the interrupted current is of undoubted benefit. We may make one remark to the effect that we do not always consider it necessary to put the electrode inside the throat, as the same effect can often be got by passing the current through the skin.

We think it right to bring this matter of electrical stimulation of nerves and muscles before those specially engaged in throat work, because we are convinced that the currents employed, particularly the interrupted form, are often too strong, and indeed, on making inquiry, one is sometimes at a loss to understand why electricity has been employed at all. There can

be no doubt that in medicine and surgery electricity has been blindly made use of to a much larger extent than it ought. Disappointment naturally has been the result, and not a little discredit has often been thrown upon the operator as well as the agent. It becomes us, therefore, to be able to give some reason why we apply the current in a particular case, and if an accurate record of the exact currents employed were furnished by each operator, a correct knowledge of the true value of electricity in these affections would soon be acquired.

In conclusion, we give a drawing of an electrical switch table designed by the writer, and made for him by Schall in London. It is intended to combine everything which is necessary for the application of electricity in diseases of the throat.

ELECTRICAL TABLE FOR CURRENTS EMPLOYED IN DISEASES
OF THE THROAT.

A A, Terminals in connection with forty large Leclanché cells (these may be situated anywhere, and are best out of the consulting room); S, Schall's double selector, by means of which any one or any number of cells can be put into the circuit; Rh, Rheostat with 5000 ohms to regulate the strength of the current, and to measure resistance; G, Edelmann's galvanometer, measuring from 1 to 250 milliamperes; I, Large coil for the interrupted current, with scale for approximate measurements of the currents employed; W, De Watteville's key, by means of which the constant or interrupted current can be given, or both at the same time; R, Rheostat for the cautery, which is worked by secondary cells, giving six volts and twenty ampères; K, Keys, by which any part of the apparatus can be put in action. In front are three sets of terminals for attaching wires for lighting, cautery, or the constant and interrupted currents.