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ELECTRICITY

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—IN—

MEDICINE AND SURGERY

—BY—

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PREFACE.

The object of this work is to furnish the medical student with a book containing the principal practical facts embraced by the subject of electricity and electro-therapeutics. We have aimed to make everything as plain and simple as possible, so that a mere novice may, with the aid of this book, commence the use of electricity in the treatment of disease. We hope it may supply a want expressed by country practitioners generally.

GEO. C. PITZER.

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Electricity in Medicine and Surgery.

ELECTRICITY AND ELECTRICAL APPARATUS.

Electricity is a force or mode of motion, which may be generated by friction or by chemical action. No chemical change can take place without the evolution of more or less electricity.

The application of this agent, in some form, to the relief and cure of disease dates back many years. At one time frictional or Franklinic electricity was very popular, a number of accidental cures resulting from its use. We say *accidental* cures because they resulted from the empirical use of electricity, no regard being paid to any law upon which the cures were wrought.

An interesting treatise on Franklinic electricity, written by Rev. John Wesley in 1759, gives the reader a very good understanding of the position of electro-therapeutics more than a hundred years ago. Medical men at that time seemed to be inclined to turn away from this new agent; this placed it in the hands of the laity, where it was resorted to for all kinds of ailments. This indiscriminate use of a potent agent, chiefly by men and women who knew but little about it, could but result in failure. Because electricity did not, in the hands of quacks, cure everything, it was denounced entirely by many, and rapidly fell into disrepute; and to this day, while it has many able advocates, in and out of the profession, there are not a few who entertain strong prejudices against it. It is a fact that electricity will not cure everything, no matter in what form, how used, or by whom it is applied. While it is indicated in some form in a wide range of disorders, and while many distressing ailments are speedily relieved and others rapidly and radically cured, it fails in many instances. But where we have cases to which this agent is adapted and we rightly apply it, nothing equals it.

Like everything else, electricity has its place and its power, and

in its place it is prompt and positive in its effects. It is scarcely worth while to say that the principal reason of many failures in the use of electricity is to be found in the fact that many who try to use this agent do not understand the instruments they undertake to operate. They know but little about the principles of their workings, and they too frequently know even less about anatomy, physiology and pathology. It is folly to hope for good results from any therapeutic agent in the hands of an ignoramus, unless it be by accident. A successful electrician must be an educated physician. He must understand physiology and pathology; then he may commence the study of electro-therapeutics and the use of electrical instruments. Taking it for granted, then, that our readers are all physicians, we hope to make our lessons interesting, instructive and practical.

Electricity, in the abstract, is always the same, no matter where or how generated; but its effects upon the human system are greatly varied, and wonderfully modified by the different modes of application and through the instruments used in generating and conducting it to and into the body. For example: By the judicious use of Franklinic electricity a stimulating and tonic influence is imparted, the nutrition of the part is improved and the nervous system is invigorated. By the application of the Faradic, or induced current, we stimulate or excite with the negative pole, and soothe or relieve excitement and pain with the positive pole. With the simple galvanic current we excite or soothe, as in the case of the Faradic current; but we may do even more than this. We can, by using this current properly, actually separate the constituents of the tissues, the acids and oxygen of the part going to the positive pole, while the alkalies and hydrogen go to the negative pole. This is called electrolysis, and in this way enlarged glands, indurated tumors and soft tumors are frequently dissolved and rapidly carried away. Again, if we close a galvanic current with a platinum wire, and apply the wire to a part, we may speedily burn it to a crisp. Or, by surrounding a part by this wire, we may remove it entire. This is called the galvanic cautery, by which we frequently remove tumors. The operation is bloodless, and the healing process rapid. But these are mere hints illustrating the different results of electricity, as applied in different forms and through different means.

Before going further, we can best serve our purpose and that of the reader by presenting a short description of the different forms of electricity and a few brief illustrations of some of the most practical batteries and instruments used in electro-therapeutics. As we become familiar with the different forms, and the instruments used in generating and conducting electricity, we are better qualified to understand its therapeutic application.

Electricity is manifested in three general forms: Magnetism, Franklinic electricity and Galvanism.

Magnetism is that form of electricity found in loadstone. Loadstone is an iron ore, which, as above intimated, is permanently charged with electricity, and is called a natural magnet. Ordinary steel bars may be charged with electricity, when they become artificial magnets. They may be charged or magnetized, as it is called, by bringing them in contact with a natural magnet, or they may be magnetized by the galvanic current, to be hereafter described. In either case these steel bars are only artificial magnets, and in time lose more or less of their electricity, or magnetic influence. But good, hard steel will retain its magnetic power for a long time. If pure soft iron bars are magnetized by a natural magnet, or by the galvanic current, while they remain in contact with the natural magnet or with the galvanic current, they are magnets themselves; but when these bars thus made magnetic are removed from the natural magnet or the galvanic current, they at once lose their magnetic power.

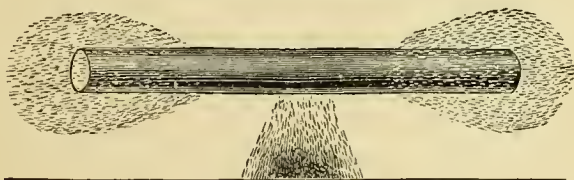


Fig. 1.

There is a property belonging to magnets called polarity. The ends of a magnetic rod of steel attract iron and iron filings, as illustrated by Fig. 1. But this same iron, or iron filings, placed upon the center of this magnet, immediately fall off, as above illustrated. It is evident that two opposite kinds of magnetism are manifested in this rod; one kind at the ends of the magnet and another

at its center. These points, manifesting opposite kinds of magnetism, are called poles. This property, polarity, belongs to other forms of electricity, and is a peculiarity of this *mode of motion*. More might be said here about magnetism, but this is quite enough to serve our purpose for the present. When we come to describe the Faradic current, this form of electricity will be referred to again.

Franklinic electricity is obtained by friction, cleavage and pressure. Quite a number of machines are in use for the generation of this kind of electricity, but there are exceedingly few cases in therapeutics where this form of this force is equal to others more rapidly obtained; and there are many cases where other forms are far superior. For these reasons Franklinic electricity is but little used in therapeutics at the present day.

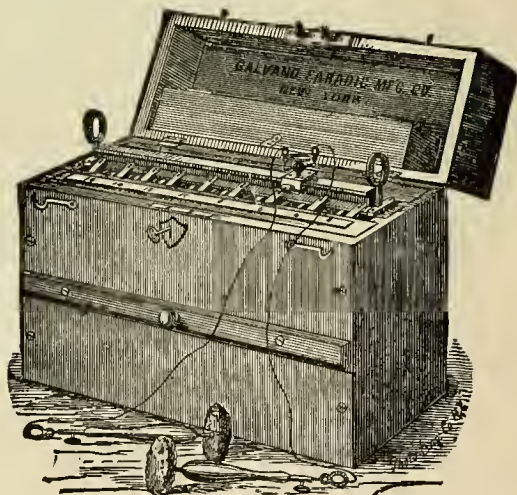


Fig. 2.

Galvanism, or electricity generated by chemical action, is the form in which this great force can be best utilized in therapeutics, and to this form does electricity owe its great popularity. For the evolution of electricity by chemical action, a galvanic battery is required, and we can make this part of our subject more intelligible by taking a battery in common use for illustration. Stohrer's famous galvanic battery, as made by the Galvano-Faradic Manufacturing Company, of New York, will answer a fine purpose.

Fig. 2 represents Stohrer's galvanic battery. It consists, altogether, as we see it, of a number of elements and battery cells, as they are called, 16 or 32, as the maker may decide. A galvanic battery may be made with one single cell, but for good reasons, hereafter to be given, a number of cells are required. But for illustration of this, as well as other batteries to be described, we take it for granted that one cell only is used. Fig. 3 represents this

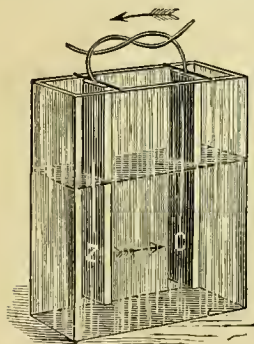


Fig. 3.

single cell, made of glass or hard rubber, as may be desired, with a capacity sufficient to hold about two fluid ounces. For further illustration we now fill this cell about two-thirds full of a battery fluid, made as follows: To five pints of cold water add eight fluid ounces of commercial sulphuric acid, and, when perfectly cool, add thereto eight ounces of finely pulverized bi-chromate of potash. When this is well dissolved, and before using, add one ounce of bi-sulphate of mercury.

Now, we put the required amount of this fluid in the cell. In this cell we also suspend one zinc and one carbon plate, as seen in illustration, Fig. 3. The zinc and carbon are called the elements of the battery; the solution, the battery or exciting fluid; and the container, the cell. The zinc is called the generating element; the carbon, the conductor. Right here allow us to remark that electricity, when generated, may be transmitted by conduction or operate through induction. Conduction is the transmission through intervening metals, called conductors. Some metals are good conductors—copper is good; platinum, poor. By induction we mean the operation of electricity through the intervening molecules of air. This principle will be fully explained when we reach the Faradic current.

In the galvanic battery the electricity is transmitted through conductors, and, as above stated, the carbon in the battery cell is the conducting element, and to complete the circuit we connect the zinc and carbon, outside of the fluid, by intervening wires, as seen in Fig. 3. Now, here is represented, in this single cell, the principle and construction of a galvanic battery. When the electrically op-

posed metals, zinc and carbon, are immersed in the battery fluid and united at their ends, either directly or by wires, chemical action immediately begins, and in proportion to the amount of zinc surface exposed to the exciting fluid will be the quantity of electricity generated. The zinc attracts the oxygen of the fluid, is rapidly oxidized, and gradually destroyed. The hydrogen of the fluid is appropriated in another direction. The result of this chemical action is a *mode of motion*, called a current of electricity. This current passes from the zinc or generating plate to the carbon or conducting plate in the fluid, and outside of the fluid from the carbon, through the intervening wires, to the zinc. Now, let us, while this current is running, separate the ends of the wires connecting the zinc and carbon. Let us hold the two separated ends of the wires, one in each hand, and this same *mode of motion*, or current of electricity, is passing through the body, from one hand to the other, entering at the hand holding the wire attached to the carbon, which, outside the fluid, is called the *positive pole*. The current leaves the body at the hand holding the wire attached to the zinc plate, which, outside the fluid is called the *negative pole*.

This illustrates the working of a single cell galvanic battery. But we frequently want more quantity of electricity than we can get from one cell of this size, and we more frequently require a more forcible current—a current of greater tension—than we can get from a single cell like this. Where the quantity of electricity is small, but more especially where the tension is low, the current passing slowly, but little change takes place in the tissues to which the electricity is applied, and the current is not felt or appreciated in any way. Where the tension is high, the current strong and running rapidly, then we observe redness of the skin, twitching of the muscles, and the patient complains of disagreeable sensations. In such a case the fluids of the tissues are rapidly separated, the acids and oxygen rushing to the positive pole of the battery, while the hydrogen and alkalis are attracted to the negative pole. A very small quantity of electricity may accomplish a great deal if the tension is high; but for the purposes of galvano-cauterics, quantity is positively required. How are we to increase tension, and how are we to get more quantity? As already stated, the quantity of electricity generated in a galvanic cell is dependent upon the amount of sur-

face exposed to the exciting fluid by the generating plate; and when it is required to increase the quantity, the elements must be enlarged, or the generating plates of several cells must be connected directly, and the carbons must also be directly connected. Where we want an increase of force, or desire to increase the rapidity of the current—in other words, when we want more tension—we connect alternately the generating and conducting elements, the zincs and the carbons, of two or more cells, as illustrated by Fig. 4, where the

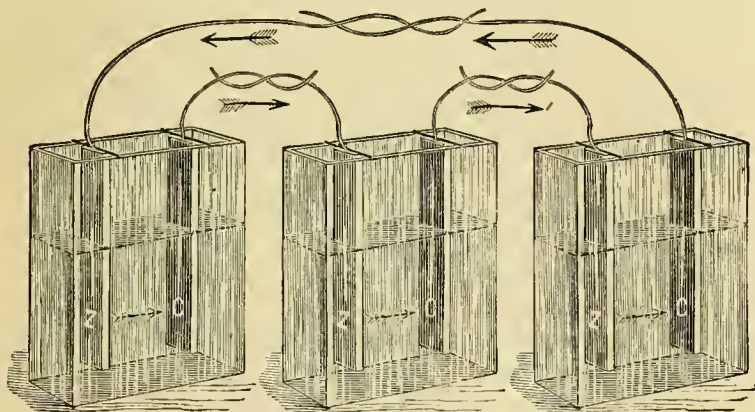


Fig. 4.

zincs and carbons are connected alternately, and the direction of the current plainly shown. Increasing the size of the elements always gives a proportionate increase of quantity, but it does not increase the tension or rapidity of the current. On the other hand, while a combination of two or more cells, as above described, the elements connected alternately, increases the tension in proportion to the number of cells thus connected, the quantity of electricity passing any one point at the same time is no more than when one cell is used. Enlarging the elements or directly connecting several generating plates, and in like manner as many conducting plates, increases quantity.

In the galvanic battery of Stohrer, used in this illustration, the combination of cells is for the purpose of increasing the tension, a property of the current particularly required in electrolysis. The instrument shown in the illustration has sixteen cells. Assuming

that they are all properly filled with fluid, and the elements suspended in them and alternately connected, as illustrated by Fig. 4, we may undertake to operate the battery. For the purpose of convenience in conducting the electricity from the battery to and through the body, we use cords, called conductors, constructed of copper wire and covered with silk. The covering is called the insulator, because it is a non-conductor. The ends of the cords have exposed metallic tips, for the purpose of connecting them at one end with the commutator of the instrument, and to the handles of the electrodes at the other ends. Remember, the commutator is that part of this instrument which we slide along the beam of wood at the top of the apparatus. This commutator is so arranged as to connect with a zinc on one side and a carbon on the other, and a complete circuit is made through one cell by placing it at the right. To take in more cells, we simply move the commutator to the left till any desired number of cells are taken into the circuit. The electrodes are the parts of the instrument attached to the distal ends of the conducting cords, and are directly applied to the part of the body desired to be brought under the influence of electricity. These electrodes are metallic, and may be covered with chamois or sponge. More will be said about electrodes as we approach therapeutics. Other particulars, as well as the advantages of this particular battery, are given in detail in the illustrated circulars sent with the instrument.

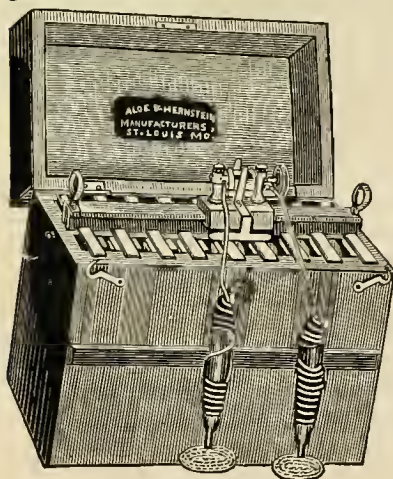


Fig. 5.

Another form of Stohrer's galvanic battery is represented below by Fig. 5. This is a very practical instrument, easy to operate and readily cleaned or repaired when necessary. Its arrangement is so simple that a mere novice may soon understand it, and any wrong in its workings can be detected at once. It is manufactured by Aloe & Hernstein, of St. Louis.

It is a sixteen-cell battery, with large elements, zinc and

carbon, the same as those made by the Galvano-Faradic Manufacturing Company. Aloe & Hernstein are making fourteen-cell batteries similar to this, with still larger elements, giving more quantity and, they claim, more power.

The bottom of the box in these batteries is a movable tray in which the glass or hard rubber cells are placed. This movable tray is controlled by two hinged rods which are fastened to it, and these by two screw lifting rings. These rings, being screwed tightly down, hold the cells firmly against the cushioned board, which is pushed through a slot in the front of the

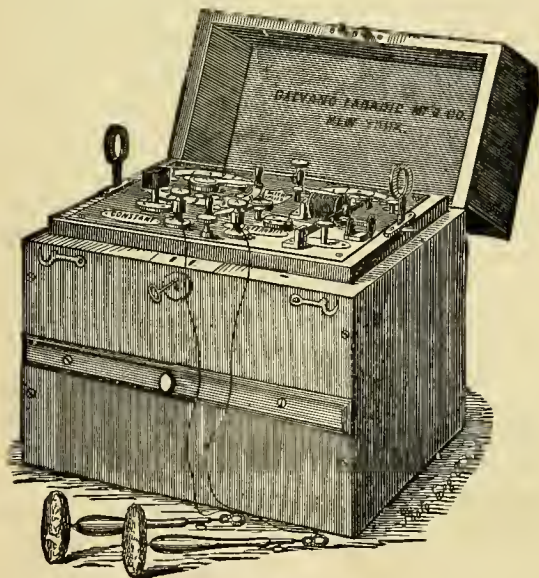


Fig. 6.

box, and covers the cells. This cushioned board is called the hydrostat, because it securely closes the cells and prevents spilling of the fluid in moving the battery from place to place. The rings referred to also serve as handles for lifting the tray of cells to which they are attached, and when raised to the proper place the rods are turned on their hinges and the tray of cells held in place, with the elements in them. When done using the battery, the rods are straightened, the tray of cells lowered, and the hydrostat, which

was removed before lifting the tray of cells, is now replaced, the screw-rings turned a few times, and all is secured.

The commutators, conductors, etc., are the same as in the first battery described. For all ordinary purposes, such as central galvanism, electrolysis, etc., these batteries are exceedingly well adapted.

Fig. 6 represents the Bartlett galvanic battery, manufactured by the Galvano-Faradic Manufacturing Co., of New York. This is a thirty-six-cell battery, the elements zinc and carbon all arranged in very compact and neat style. The tray holding the cells is controlled by lifting rods, the same as the Stohrer battery. The commutator works with a lever or crank, and from one to thirty-six cells may be brought into the circuit at pleasure. This is a fine appearing instrument, and being provided with an automatic rheotome, current reverser, etc., it is a very desirable battery.

The following cuts represent the galvanic and galvanic and

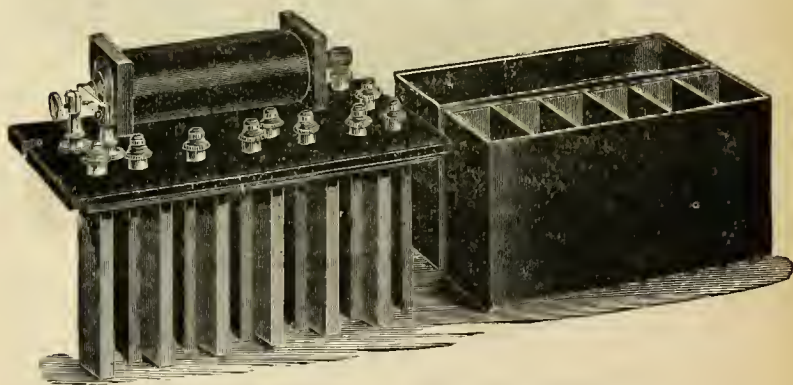


Fig. 7.

Fig. 8.

faradic batteries combined, as manufactured by the M'Intosh Galvanic Belt and Battery Company, of Chicago, Ill. These batteries are constructed on an improved plan. The elements are zinc and carbon, and are arranged in couples, and securely clamped to hard rubber plates with thumb-screws. Any of the couples can be removed by simply loosening a screw. In this battery the plates are brought very near together, thus preventing the great internal resistance unavoidable in many other batteries. The cells are made in sections of six, composed of one solid piece of hard rubber. By

this arrangement one section can be handled, emptied, and cleaned as easily and as quickly as one cell. A hard rubber drip-cup is placed by the side of each section of cells to receive the zinc and carbon plates when removed from the cells.

Fig. 7 shows the hard rubber plates of a section of elements. Fig. 8 shows a section of six cells made of one piece of hard rubber, and a drip-cup of the same material to receive the zinc and carbon couples when not in use.

The hard rubber on which the couples are clamped projects over on one side enough to cover the cells, when the zinc and carbon plates are reversed and placed in the drip-cups. The under side of this projection is covered with soft rubber. When the cells are not in

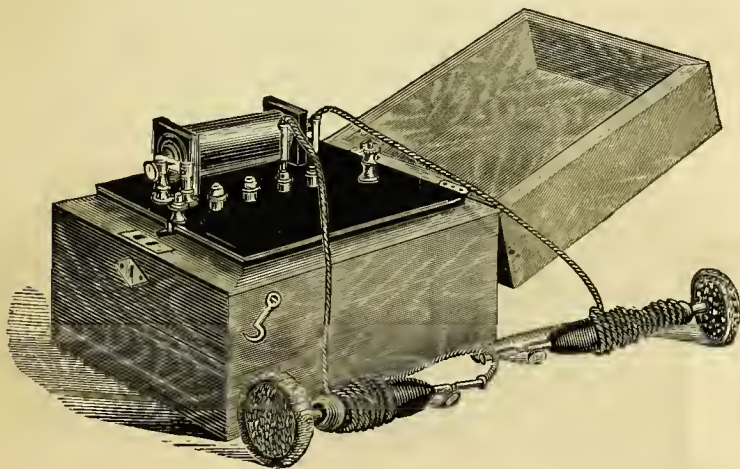


Fig. 9.

use, this is clamped over them by means of thumb-screws and spring bolts. By this arrangement the cells are made water-tight, and the battery may be carried from place to place without danger of spilling the fluid.

Fig. 9 represents a faradic battery of this make, which we will refer to again when we reach the construction and workings of faradic machines. In this illustration is shown the famous cable conducting cords used in these batteries. They are made with a spiral copper wire, insulated, inside of which is a bundle of small copper wires surrounding a strong cord. The tips are securely fas-

tened to the spiral wire, which makes the connection perfect. In using any of the M'Intosh batteries, these cords are attached to the posts on the battery, the distal ends being fastened to the electrodes. One of these conducting cords is bifurcated, or forked, either division of which may be attached to the battery. This forked end is for the purpose of preventing a shock while changing to a less or greater number of cells while using the galvanic current. For example: Suppose you are using six cells. One of the bifurcated ends would be connected with cell No. 6, and the other end hanging loose. If you wish to use, say, twelve cells, you can take up the loose end of the bifurcated cord and connect it with No. 12, and then pull the other end out from No. 6. Thus all

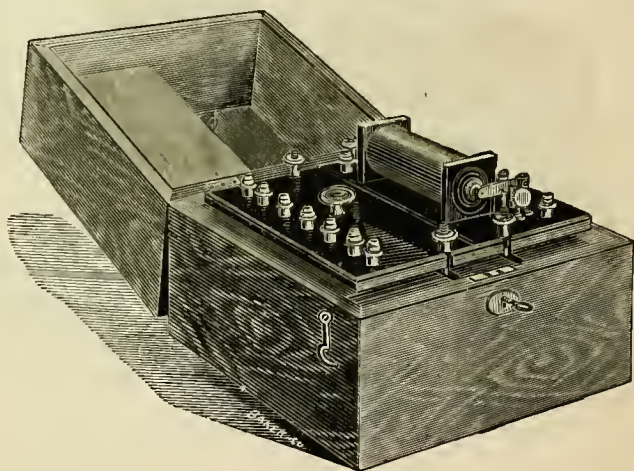


Fig. 10.

shock is avoided. This arrangement takes the place of the commutator which was referred to in the Stohrer and Bartlett batteries. This is a simple arrangement, and could not be more satisfactory in any way.

Fig. 10 shows a twelve-cell combined galvanic and faradic battery of the M'Intosh make. The case is polished black walnut, $8\frac{1}{2}$ inches long, 8 inches wide, $7\frac{1}{2}$ inches high, metal work all nickel-plated, lock and handle, sponge electrodes, and cable conducting cords, as above described, all put up in the very best of workmanship style.

Fig. 11 represents another form of a twelve-cell combined galvanic and faradic battery made by M'Intosh. This is a beautiful battery, too, same size and finish as Fig. 10. These are exceedingly fine instruments for a general practice. They are safely carried

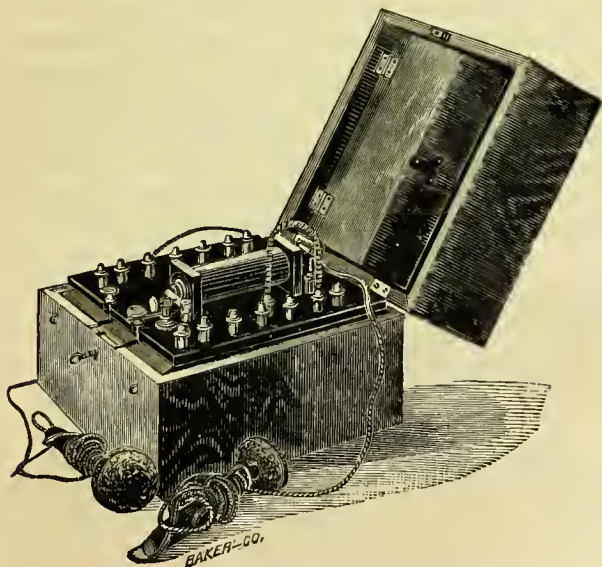


Fig. 11.

about, and you always have with you a faradic and galvanic battery at the same time.

Fig. 12 represents a twenty-four cell combined galvanic and faradic battery of the same manufacture. Size, 15 inches long, $8\frac{1}{2}$ inches wide, $7\frac{1}{2}$ inches high, with lock and handle; weighs less than eighteen pounds. This battery gives a galvanic current of great intensity, sufficient to treat almost any case coming in the range of a physician's practice. And the beauty of this instrument is, we can reverse one section of elements at a time when no more is needed, thus saving the elements of all other sections for future use. But where one section does not give us sufficient intensity, we reverse another section, lifting it out of the drip-cup and placing it in the battery fluid in the cells. This arrangement is certainly a commendable feature.

Special instructions, well illustrated, are sent out with all these instruments, so that a mere novice can operate them without a



Fig. 12.

teacher. We have used these galvanic batteries and know them to be what they are represented to be—simple, efficient, and practical in every regard. When we reach therapeutics, these different instruments will be referred to again, and careful instructions regarding their use will be clearly set forth.

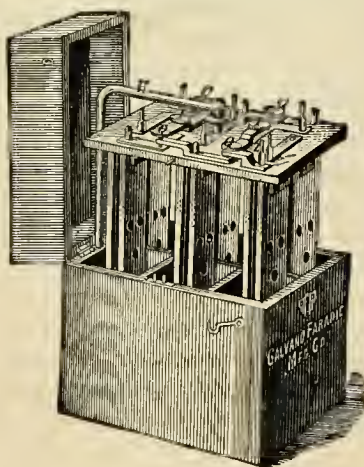


Fig. 13.

Fig. 13 represents the Piffard galvano-cautery, as made by the Galvano-Faradic Manufacturing Company, of New York. For the purpose of cauterizing, galvanic batteries are constructed with reference to quantity. The elements are zinc and carbon, and the battery fluid the same as in ordinary galvanic batteries described in the first part of this monograph. This battery of the Piffard style is composed of large zinc-carbon elements, which are contained in cells of vulcanite, and can be suspended on a mov-

able arm screwed into the box. When lowered into the fluid, the top of the elements, which is made of hard rubber, contains two lateral bars supporting them, and which permits of a rocking motion to keep this exciting fluid agitated. This is a very efficient galvano-caustic battery, a complete and reliable instrument, powerful, portable, compact, and so free from complications and easy of management that any physician can understand it and operate with it. It is adapted to meet all cases usually treated with this class of instruments. In its construction each element is utilized to the fullest extent. The parts can be easily replaced, and the surgeon living at a distance can duplicate them and adjust them without difficulty. Size, 9 inches long, $6\frac{1}{2}$ inches wide, and 10 inches high. Weight, 15 pounds.

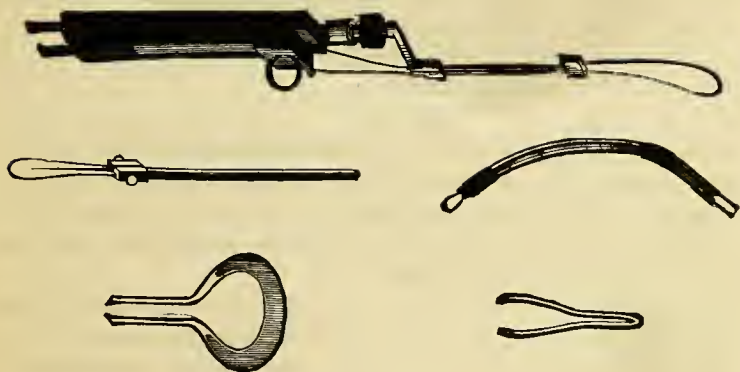


Fig. 14.

These cuts (Fig. 14) represent the instruments used in galvano-caustic operations. Universal handle; handle for cutting loop when one hand only is at liberty; burners of various shapes.

The use and application of this battery will be fully explained and clearly illustrated later in the work.

So far as a description of galvanic batteries is concerned, we think we have shown a sufficient variety, and with what may be said about them incidentally in using them upon different patients and in different cases, we think the reader should finally have a very good understanding of them. Faradic machines will next engage our attention.

FARADIC MACHINES.

The chief object sought in the construction of faradic machines, is to obtain a current of electricity or mode of motion that will excite nervous and muscular functions. The simple galvanic current excites these functions to a limited degree, but its great merits depend more upon the changes wrought in the structures, fluids and solids of the parts by the passing galvanic current. The faradic current influences, mainly, the nervous system. The galvanic current produces a change in all the tissues, but its direct influence upon the nervous system is comparatively limited; but, indirectly, wonderful changes in the nervous system frequently result from the use of galvanism. All this will engage our attention further on. What we particularly desire to place before the reader now is this: The faradic current or the current coming from electro-magnetic machines, is the great nerve stimulant and tonic: under its influence upon the nervous system the processes of waste and repair are increased, nutrition is improved; "the strengthened brain sends more nervous force to the stomach, by which the latter is enabled to send better blood to the brain."

The galvanic current is a direct and continuous current, as fully described in the foregoing pages. The faradic current is an indirect or *induced* current; and it is an interrupted current. The electricity producing the faradic current is the same as that of the galvanic current, and may come from the same battery, but through intervening machinery the current or mode of motion is greatly modified before it reaches the patient. In the production of a galvanic current we may use a single cell, or we may unite the force and influence of many cells, which we find positively necessary in the successful use of galvanism. We may use two or more cells, with the faradic current, but one cell with the proper elements and exciting fluid, is generally quite enough for all practical purposes, and nearly all the faradic machines in the market are constructed with one cell. The elements may be zinc and carbon, and the exciting fluid the same as that used in the galvanic batteries heretofore described. Or the elements may be zinc and platinum, and the exciting fluid dilute sulphuric acid,

These are called Smee's elements. Or the elements may be zinc and carbon, and an exciting fluid produced by the use of bi-sulphate of mercury and water. Gaiffe's celebrated French pocket batteries are of this construction. The following illustrations will serve to give the reader a very good idea of the battery cells and elements referred to:

Fig. 15. Shows a battery cell where zinc and carbon are used as elements, and a solution of bichromate of potash, and sulphuric acid as the exciting fluid.

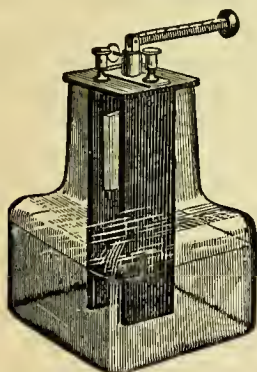


Fig. 15.

—one part acid to two of water.

The physician's improved electro-magnetic machine, manufactured by Aloe & Hernstein, of St. Louis, is operated by this cell. And the famous electro-magnetic machines of Kidder are constructed with this cell, only the shape of the cell, and management of the elements differ a little.

Fig. 17. Shows Smee's elements and cell as manufactured by Kidder. The elements are suspended from rubber stopper in round jar, $\frac{3}{4}$ inches in diameter. In all these batteries, the zinc-carbon and zinc-platinum, the elements have to be removed from the fluid when the instruments are not in use, else the fluid would destroy the zincs. In the zinc-carbon cell the elements are raised by a hinged rod which is turned down when the elements are raised out of the fluid. In the

In principle this is the same as the cells of all zinc and carbon galvanic batteries; the only difference is in the shape of the single cell, which is so constructed as to adapt it to the accompanying machinery.

Fig. 16. Represents the Smee battery cell the elements being zinc and platinum, and the exciting fluid dilute sulphuric acid

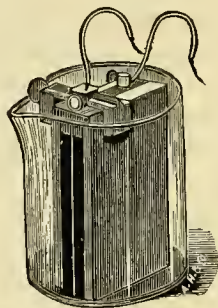


Fig. 16.

cell containing Smee's elements, a drip cup is provided, and the elements lifted out of the fluid and placed in the drip cup when the instrument is not in use.

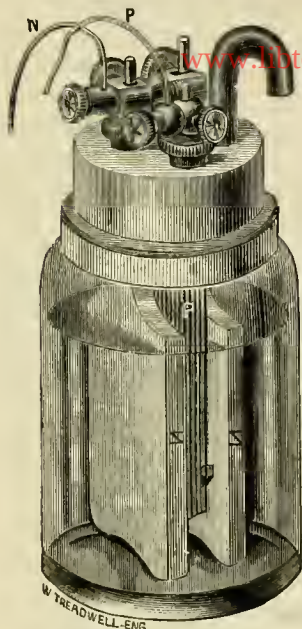


Fig. 17.

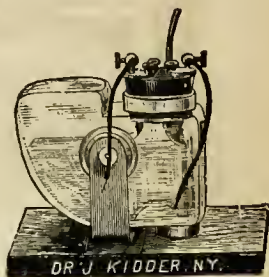


Fig. 18

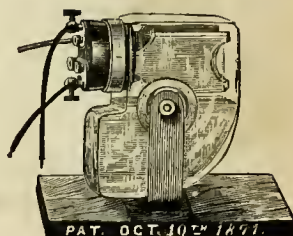


Fig. 19.

Figs. 18 and 19 show Kidder's improvement upon this plan. He has constructed a cell that when turned right end up keeps the elements immersed in the exciting fluid; when it becomes necessary to stop the action of the instrument, a simple tip describing a quarter circle elevates the elements and lowers the fluid so that they are entirely separated.

This is a great convenience, and all of Kidder's tip batteries, as he calls them, are furnished with this cell.

Zinc and carbon elements with an exciting fluid made of bisulphide of mercury and water are used with various pocket electro-magnetic machines in the market, and will be referred to under the description of these instruments.

So far as cells, elements and exciting fluids are concerned the above should be quite sufficient, and we now introduce a variety of electro-magnetic machines complete.

Fig. 20. Represents a fine instrument of this class, manufac-

tured by the Galvano-Faradic Manufacturing Co., of New York. The elements are zinc and carbon, suspended by hinged rod, as heretofore described. libtool.com.cn

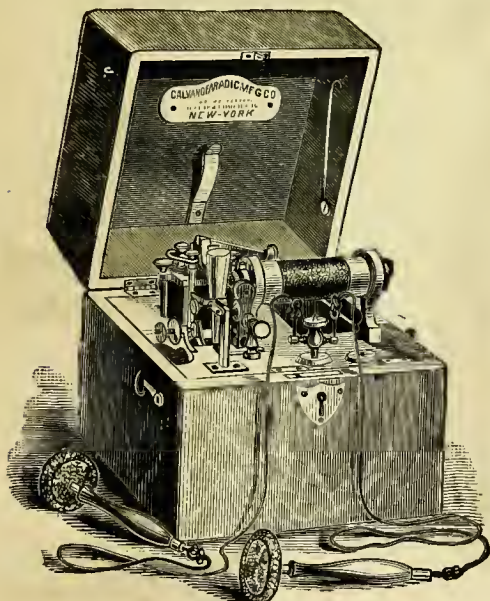


Fig. 20.

the introduction of electricity; that the carbon in the cell attracts and conducts this electricity out of the fluid as it is generated; that if a wire is attached to the upper end of the carbon outside of the fluid, and connected with another wire attached to the upper end of the zinc outside of the fluid, we have a simple galvanic current—a continuous direct current.

Now in the construction of a machine to produce a faradic or induced current, instead of attaching a short wire to the carbon, a longer wire is used, ten to twenty feet. This is insulated and wound upon a hollow spool, or bobbin, one round upon another. Then a still longer and smaller wire, perfectly insulated, is loosely wound upon this bobbin, and when all wound up we call this the faradic coil, or helix of the machine. The rounds of wire composing this helix or coil are parallel with each other. Now, if the current in the first wire is broken, a current is generated in

The introduction of this instrument calls for a description of the machinery placed in the circuit of the galvanic current, which converts it into a faradic current. And now, let us keep in mind that we have before us a single cell, like that in the galvanic batteries already described; that the battery fluid coming in contact with the zinc excites chemical action, which results in the

the second wire by induction, the electricity passing through the intervening molecules of air. If the current in the first wire is again closed or caused to flow, another current is generated in the second wire, by induction, but in an opposite direction; hence the current in the second wire, which is an induced current, is not a continuous current, but a succession of currents, resulting from breaking and opening the main current. And this induced current is a to and fro current. For the purpose of breaking the main current, and producing the induced current, the wire conducting the current from the battery cell is so connected with an automatic hammer that the current is rapidly broken and renewed, which results in a rapid succession of to and fro currents in the second wire. The spool upon which the coils of wire are wound is hollow, and in this a bundle of soft iron wires, each carefully insulated is placed. The currents flowing through the wires surrounding this bundle of iron wires magnetizes this bundle, and, while thus magnetized it reacts upon the coil and greatly strengthens the current in the wire. In this way the faradic coil is greatly dependent upon magnetism for its force. Being wonderfully strengthened by the bundle of wires that become magnetic under the influence of the galvanic current. we say *electro-magnetic* when speaking of these instruments.

From the above it will be seen that the simple galvanic current, in passing through different coils of wire parallel with each other, strengthened by a magnetic core, and rapidly broken, causing to and fro currents, must be greatly modified when it reaches the patient; and so it is. While the to and fro character of these currents destroy, almost entirely, the electrolic force of the currents, the power of exciting the nervous system and producing muscular contraction is wonderfully increased; and this is further strengthened by the magnetic influence of the core or bundle of iron wires in the helix.

Fig. 21. Represents the Physician's improved electro-magnetic machine, as manufactured by Aloe & Hernstein, of St. Louis. It has two cells, (acting independent); in case one gets broken or exhausted, the other is in reserve; the two cells can be united when extra power is required, as in case of suspended animation. It has a three section coil, and is therefore well adapted for the

medical profession, as a tension and quantity can be obtained, which are very essential for the electric treatment. When the



Fig. 21.

pole cords are connected to Post 1 and 2, and the switch is turned on the No. 1 Switch Post, a mild current without quantity is obtained. By placing the switch on the next post, (or No. 2), the current is stronger and some quantity is obtained. By placing the switch on the next or last post No. 3), a powerful current which contains quantity and tension combined is perceptible. Remove the switch entirely from all of the posts, place the pole cord which is in No. 1 into No. 3 post, and you will obtain a strict primary current. This battery is perfectly portable, as the elements are removed and placed in separate cups, while the cells which hold the fluid are each closed with a well fitting rubber stopper. Switch 4 is for breaking the current by removing it from the post on which it rests; it stops the working of the

battery. The helix, or coil, which is one of the main parts that constitute an electric machine, should be well guarded against dampness or impure atmosphere; we have therefore taken the precaution in this battery (so that nothing of the kind can happen) to place a hard rubber jacket over the helix, which is the best insulator that can be had. COMPLETE WITH SPONGE HANDLE ELECTRODES, BATTERY NICKEL-PLATED.

Fig. 22. Represents Kidder's No. 1, Physician's office electro-medical apparatus, large size having four coils of wire in the helix, and ten currents.



Fig. 22.

of quantity and intensity, when used in combination with all the other coils as will go *beyond* the range of the greatest effect on the muscles, and *into* the range of soothing electricity, and with mild power, it will exercise the function of vision showing glimmering light, without producing pain. The power of these currents is increased or diminished at pleasure. Full directions for use accompany the instrument.

Fig. 23. Represents a four coil apparatus of Kidder's make, and intended for a physician's visiting machine. It produces ten

There is sometimes a demand for a large range of effect, and to meet this Dr. Kidder has furnished a four coil helix, developing ten currents from the different combinations produced by ranging the two posts selected for the positive and negative. The fourth coil is conditioned to produce electricity in such a ratio

currents, the same as No. 1. It is of compact form, constantly ready for use many weeks without attention.

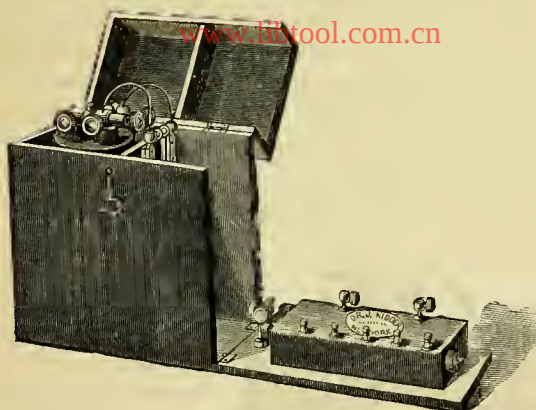


Fig. 23.

The coil-box stands upright in one end of the case where it is hinged. By springs underneath the hinges that fasten the coil-box to the case, the battery is connected to operate the coils when turned down to a horizontal position, as seen in the figure. If ever desired, the coil-box can be detached and connected with any other battery by the two screw cups on the back part. This machine is about 6 inches long, $3\frac{1}{2}$ wide, and six inches deep, and has a metallic handle on the lid for carrying.

Fig. 24. Shows Gaiffe's Pocket Electro-Medical Apparatus. This is a fine machine, and is very popular with all electricians.



Fig. 24.

This battery is put in motion by putting a half a teaspoonful of bi-sulphate of mercury in each of the carbon vats or trays, and adding a little water, then immersing in the vats the zincs belonging to the battery.

This battery runs, without being recharged, during a sitting of

an hour, or for two sittings of a half hour, and gives three currents. 1st, The extra current. 2d, The inductive current. 3d, A combination of the two, in greater intensity. Though the results of these currents may be the same physiologically, yet they present a series of increasing effects which may be varied at will, beginning with a current so mild as scarcely to be perceptible, and being gradually increased to one of great intensity. When the battery is charged with the bi-sulphate of mercury and water, it gives rise to no odor. All its parts are perfectly adjusted, and do not readily get out of order. Extra troughs may be obtained at a small cost, thus enabling the physician to leave one with each patient whom he treats by electricity. This arrangement also diminishes the weight of the apparatus. The whole machine is in form of a case, $7\frac{1}{2}$ inches long, 4 inches wide and $1\frac{1}{2}$ inches thick, weighing only 24 ounces, including therein the electrodes, etc., contained in the case. Nothing protrudes from the exterior. It is, in fact, a pocket instrument, combining with compactness and durability all the qualities of superior electro-medical apparatuses.

Fig. 25. Represents Kidder's pocket induction apparatus, which he claims to be superior to anything of the kind.

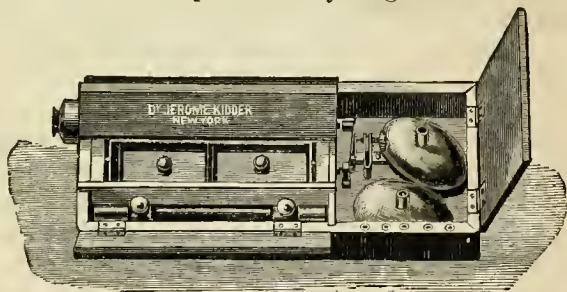


Fig. 25.

This apparatus has very expensive coils so as to get the desired ranges in the qualities of currents, in a very small space. It operates by means of a very little bi-sulphate of mercury, gives very strong power, and is very satisfactory in its operation. Two handles and sponge-clasps with conducting cords accompany each apparatus.

Fig. 26. Represents Dr. Hathaway's Electro-Magnetic Chair.

The object of this invention is to provide a simple and convenient apparatus for the transmission of electrical currents through all parts of the human body and in different directions. It consists of a chair (or a bed, lounge or water bath may be used) provided with a suitable battery, wires and switches, by means of which currents of electricity may be passed through the body of the patient sitting therein, such currents being under the absolute control of the attendant, who can send them at will, first in one direction, and then in another, as desired.

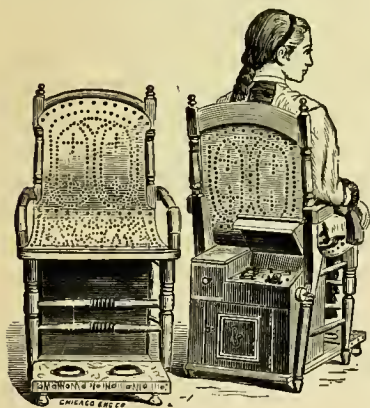


Fig. 26.

The special application of this powerful remedial agent to any particular portions of the person has, thus far, been attended with great inconvenience. So far as known to me, it has never been done without the removal of the patient's clothing, and the passing of the current by means of a sponge or like substance over the surface of the body.

In using this apparatus, it is only necessary that the hands and feet should be bared. The patient sits comfortably in a chair, and when the switches are placed in a proper position, the current is made to enter the right foot, pass up the right leg, cross through the pelvis into the left leg, and down out of the body by the left foot. If now the switches be changed, the positive current enters the left foot, makes the circuit, and goes out of the right. In this way I am enabled to pass the electricity through the pelvic portions of the body, which heretofore it has been almost impossible to reach.

In a similar manner, the proper connections being made, the currents will enter the body by either hand, pass up the arm, cross the thorax to the other arm, and leave by the opposite hand. The switches may also be placed so that the electricity will enter both hands, pass through the entire system, and out by both feet.

The management of this apparatus is easily learned, and as the changes are made at intervals of five minutes, one attendant can, without difficulty, attend to four chairs at the same time.

I know this to be a convenient invention for the administration of this powerful therapeutic agent without giving the patient any trouble whatever. When in Chicago, at the National Convention, I took the pains to call at Dr. Hathaway's office, and examine this Chair, as he had it in operation. I wanted one immediately, for it is so convenient. Many people are benefited by electricity, but the use of it, as ordinarily applied, requires so much time and care that the busy practitioner can hardly afford to appropriate it. But this invention does away with the objections. It is easily managed, pleasant to the patient, and in many cases where electro-magnetism is required, it is *THE* thing. I am greatly pleased with it, and will freely give any information I can in regard to it; or I will take pleasure in showing the chair to anybody who may take the trouble to call at my office where it may be seen in operation.

Of course we do not pretend that everything in the way of faradization can be done through this chair, for we sometimes desire to localize the faradic current, and where this is the case we resort to a Sponge electrode. But in the scores of cases of nervous exhaustion that come to us, where general faradization is *the* therapeutic agent, then this chair is a real luxury. I would not be without it and engage to treat diseases of the nervous system.

Having described and illustrated a variety of galvanic batteries and faradic machines, we now present some important attachments used in connection with galvanic batteries for special and important purposes.

Galvanometers, or Galvanoscopes.—These are instruments used for ascertaining the presence and direction of a current, and for measuring the strength of the same. They are constructed on this principle: A magnet is freely hung so as to be deflected by the passage of a current through a coil of insulated wire.

Fig. 27 is an illustration of a very fine galvanoscope. It may be readily attached to any battery; and if a current is running, the needle will be deflected in the direction of the current. If the needle turns to the left, we know the negative pole is on that side; if to the right, then we know the negative pole is to the right.

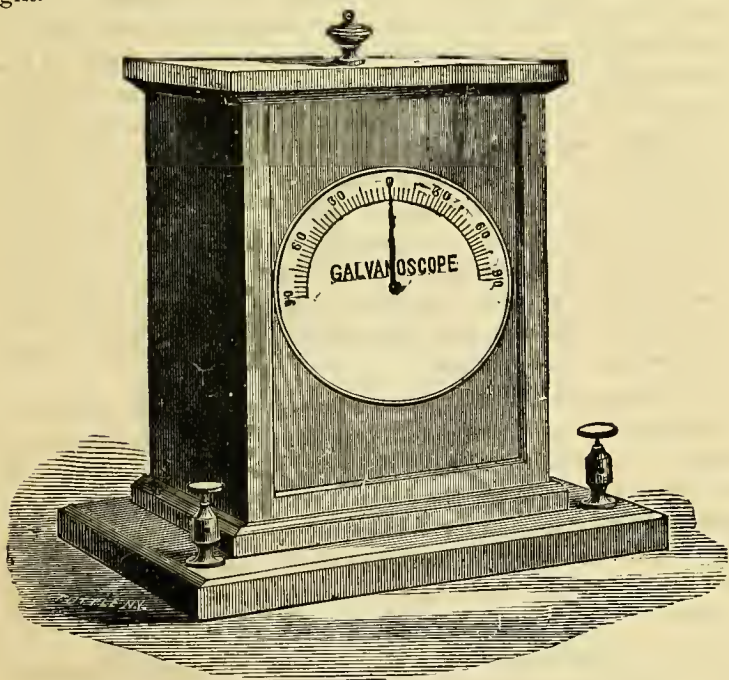


Fig. 27.

The number of degrees of deflection shown by the needle indicates the strength of the current. In this way, we can know exactly what we are doing; know the direction of the current, its strength, etc.; and this is very important in many cases of galvanotherapy. Other varieties of galvanoscopes are made, and in use, but this is a good one, and easily managed by anybody who can operate a battery. To use it, we simply attach the conducting cords of the battery to the posts of the galvanoscope and the electric current is closed.

Rheotomes.—A rheotome is a contrivance for interrupting the electric current. Without something of this kind we could not have an induced current, for this is only present in the secondary coil, at the opening and closing of the primary current. By means of the rheotome, the primary current is broken and closed rapidly, so that the induced current seems almost like a continuous one. We also use the rheotome on galvanic batteries. By interrupting the galvanic current, we can frequently excite muscular contraction more perfectly and powerfully than can be done by applying the faradic current. But the interrupted galvanic current is not like the induced faradic current—a to-and-fro current—but a succession of straightforward currents.

Fig. 28 is an illustration of Powell's rheotome. These in-

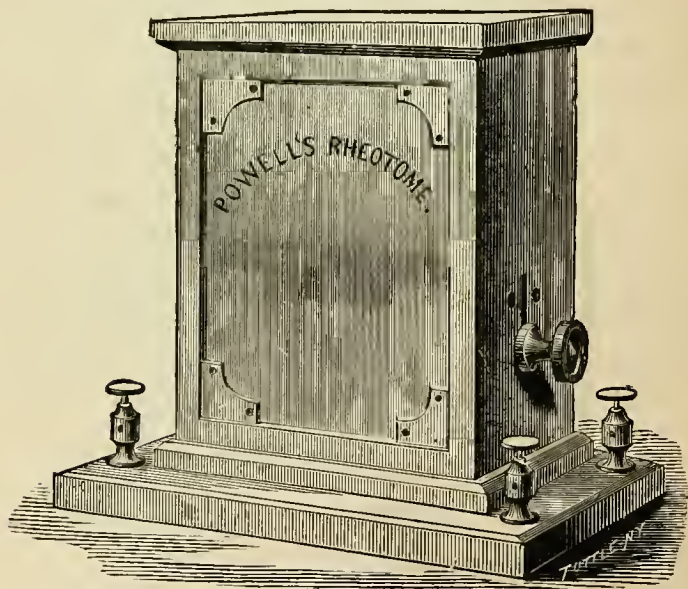


Fig. 28.

struments—any of them in the market—may be attached to any battery; and some galvanic batteries are provided with them as permanent attachments. See the illustration of Bartlett's galvanic battery, and it will be observed that the rheotome is per-

manently fixed on it. Their use is very simple. In all faradic machines, they are essentially a part of the instrument, and run whenever the battery is put in motion. In galvanic batteries, they have to be properly connected, placed in the circuit of the current every time we use the battery. This is readily done; and all batteries are accompanied with specific instructions regarding the manner of operating them and applying the attachments.

Rheostats.—Rheostats are used for the purpose of modifying the current of electricity. They are placed in the circuit of the current, in the course of the conducting wire leading from the carbon of the battery to the patient, in the positive pole, while the negative pole of the battery is continuous, nothing intervening between the battery and the patient but the negative pole of the battery.

Fig. 29 is a form of rheostat called a hydro-rheostat.

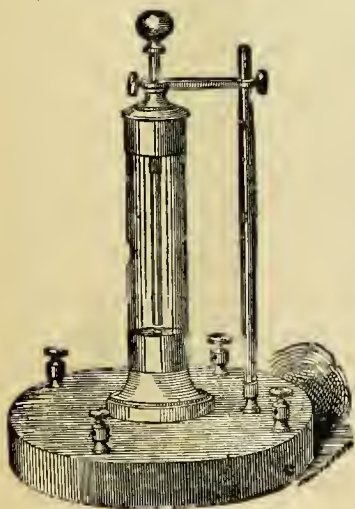


Fig. 29.

This is a very reliable rheostat, and is easily managed. The glass tube seen in this illustration is filled with water, and the construction is such that the current may be made to pass through the water in this tube from bottom to top, or but a limited portion of it may be traversed by the current. In this way we may greatly soften the current and produce exceedingly delicate shades or grades of sensation. Other forms of rheostats are used; but this is as good as any, and is so easily managed.

The general practitioner may not see the necessity of such instruments as these; but when we

have nervous diseases of all varieties to handle, and sensitive organs like the eye, ear and brain to treat, it sometimes becomes positively necessary to resort to rheostats before we can employ

electricity at all. While rheotomes are used to increase the exciting power of the current, which is sometimes necessary, rheostats are used to soften the current, or produce delicate grades of sensation. This will be referred to again, when we reach therapeutics.

ELECTRO-THERAPEUTICS.

Electricity is simply a force, and like all other therapeutic measures, must be rightly applied if we expect to accomplish much good with it. To be sure, a mere novice may relieve and cure people with electricity, knowing but little about what he is doing. But this is accidental, and such ignorant practitioners are liable to do as much harm as good. Before we undertake to apply this potent agent to the cure of disease, we should study its physiological effects, that we may be able to use it as we would any other therapeutic agent, for a direct and definite purpose. It is not sufficient for us to say our patient is nervous, and that electricity is a remedy for nervousness. No, this is not a satisfactory conclusion to rest and practice upon. We want to know *how* our patient is nervous. Is the nervous system, or that part of the nervous system supplying the diseased organs in a state of hyperæsthetic excitement, accompanied with pain? or is there a high state of irritability, giving rise to physical and mental distress, dependent upon exhaustion or mal-nutrition? or is there a semi-paralytic condition, with diminished sensibility and loss of muscular motion? The condition of our patient must first be understood, then we may turn to our batteries for a possible remedy. Well, what may we expect from batteries? Our answer is this: It has been found that electricity may be employed in medicine and surgery for the accomplishment of various ends. While its general effect is largely manifested upon the nervous system, its sphere of action is not limited to the nervous system alone. For its local effects, or for a general influence, electricity may be applied so as to act as a stimulant, a tonic, and as a sedative. Indeed, these three properties — stimulant, tonic and sedative are appropriately given to this agent. These

properties, singly or in combination, are secured only by and through the proper manipulation of the instruments used in generating and conducting electricity to the body. For example: if we desire to stimulate any part of the nervous system, we may apply the negative pole of an electro-magnetic machine directly to that part. The negative pole of the induced current is a powerful stimulant, exciting muscular contractions, increasing sensibility, and when frequently applied for several minutes at a sitting, nutrition is improved, and lasting tonic effects result; the parts are invigorated. Again: if it be desirable to produce sedation, or quiet nervous excitement in a part, or relieve nervous irritability in weak and feeble people, we apply the *positive* pole of the faradic machine to the diseased, excited or irritable parts. Where there is great excitement a mild current applied with a large sponge electrode, attached to the positive pole, will give the desired results at once. Where there is more exhaustion, yet unnatural nervous irritability, a stronger current, through the positive pole, should be used, and soothing effects will result, while the parts are at the same time greatly invigorated.

When the faradic or induced current is applied to any particular part of the body, *local faradization* is the term used in expressing the measure employed. Where the whole body is brought under the influence of the induced current, *general faradization* is the term used to express it. As above instanced, local faradization may be had resort to where we desire to apply a direct stimulant; in which case, we apply the negative pole to the diseased part, and allow the patient to hold the electrode attached to the positive pole in the hand; or the positive pole may be placed over the course of a nerve, or over the site of its origin, while the negative pole is applied to the part to be stimulated. On the other hand, when a soothing, sedative influence is sought, we apply the electrode of the positive pole to the part, while the negative is held in the hand, or placed upon some unimportant part of the body. This is all local faradization, so called. Of course the current is not positively confined to the diseased parts, neither can it be. We may, however, by placing the electrodes of the positive and negative poles near each other on the body, confine the action to a comparatively small spot.

The following examples may serve to illustrate local faradization, and local galvanization, and their uses: Mrs. K., about thirty-five years of age, married, and otherwise healthy, comes to me complaining of a partial loss of sensation, and a total loss of motion in the left side of the face. She is suffering from what we call facial paralysis, or Bell's palsy. She cannot close the left eye, in consequence of which she suffers from smarting sensations in it, and it looks red, while tears drop from the lower lid. She cannot purse up the mouth as in health, and saliva continually drips from the left side, greatly to her annoyance. No particular pain is suffered, but the inability to close the eye, or control the flow of saliva, with the distorted appearance of the countenance, together with fears of a worse and probable permanent indisposition, excite great apprehension, and lead her to seek counsel, and obtain relief if possible.

The first question coming to my mind is this: I know that facial paralysis may be of a central origin, or it may be peripheral; that is, the nerve supplying the face may be diseased at or near its origin, in which case we say the disease is intracranial; or, it may be an impairment of that part of the nerve outside of the skull, in which case we say it is peripheral paralysis. To which class does our case belong? Our decision or diagnosis in the case is of great importance; for, if the disease is of a central origin, the prognosis must be guarded, but if it is simply a peripheral paralysis, the prognosis is favorable, and a positive and permanent cure may be promised.

This is not our first case, no, indeed; and from the experience and observation we have had we have learned to make successful and satisfactory examinations in this class of diseases. Well, how are we to know whether this is a case of central or peripheral disease? First, there is no mental aberration, neither is there any signs of hemiplegia; no sign of any paralysis except of the facial nerve, whereas, in cases of central origin, there is very apt to be signs of paralysis or weakness in other parts of the nervous system. But one of the most important and certain tests for central, or peripheral paralysis, is electricity; and I resorted to it in the case of Mrs. K. I have Kidder's electro-magnetic machine,

and I tip the cup holding the fluid, attach the cords, upon the distal ends of which I attach sponge electrodes, wet with warm water. I place the electrode of the positive pole on the side of the face immediately in front of the ear, and apply the negative to the cheek, and move it about over the face. I commence with a mild current; but as no muscular contraction results, I increase the strength by withdrawing the cylinder at the side of the machine; but still there is no muscular contraction. The muscles do not respond to the action of the faradic current; and this is one of the best evidences we have that the case is one of peripheral origin, for if it was of central origin the response would be prompt, but little different from health. I am pretty well satisfied. But I have a galvanic battery on my table, with a rheotome or current interrupter attached, and I change the cords and electrodes from the electro-magnetic machine to this, turning on twenty-four cells, and connecting the rheotome. I now place the electrode of the positive pole immediately in front of the ear, as in the case of the faradic current, and place the negative electrode on the cheek, between the ear and the mouth; and as I move it about over the cheek I observe a drawing of the face. The left corner of the mouth moves toward the ear, and as I move the sponge toward the temple, the eye closes. All this convinces me that we have a case of simple peripheral paralysis, and we so announce it, and commence treatment at once. While we value electricity highly as a therapeutic agent, it will be seen from the above that it is a valuable resort in the diagnosis of nervous diseases. This may be fully and clearly established in the examination of various cases.

Having made out our diagnosis, we next proceed to the treatment. In this case, local faradization is of but little use at first; at least, the improvement will be slow and the cure tedious if it be the sole dependence. But the interrupted galvanic current which takes a deeper effect than the faradic current, will, from the very first, improve the condition of the patient; and with the addition of small doses of strychnina, $\frac{1}{32}$ of a grain three times daily, a speedy cure may be expected, as was really the result in the case of Mrs. K. In such cases, the galvanic battery should be used

daily, at first, then every two or three days, each sitting occupying from ten to fifteen minutes. As the case progresses, it will be found that the muscles will readily respond and contract under the influence of the faradic current when it may be substituted for the galvanic; in fact, it is better now than the galvanic current.

The above tests and treatment involve both local faradization and local galvanization; and it should be observed that while the faradic current is a powerful stimulant, there are conditions where the interrupted galvanic current has more influence in producing muscular contraction than the faradic current.

About the middle of September, 1881, Mrs. A., about thirty years of age, and married, applied to me, complaining of a lameness in the right hip, and a numbness of the right arm. I diagnosed the case as one of a rheumatic nature, and prescribed accordingly. On the fifth of October following, she came to me again; and upon careful inquiry and examination, I gained a correct history of the case, and found her in the following condition: The remedies prescribed for the supposed rheumatic trouble had done her no good; she had not been sick, neither had she been exactly well. A few days previous to her calling upon me, she had been attending the Fair; and while on the ground she experienced a peculiar sensation in the right side of the neck, as she expressed it. Upon examination, I found the location to which she referred as being the spot where the peculiar sensation was felt, to be just back of the petrous portion of the temporal bone, and extending to the foramen magnum. This was as nearly as she could point to the location. She said the sensation was likened unto the report of a pistol, and was immediately followed by a peculiar numbness on the left side of the face, and an inability to close the left eye, or draw up the left side of the mouth. As she gave me this history I observed that her speech was somewhat impaired, and that she did not wink the left eye. She also walked lame; could not handle her right leg and arm as well as she could the left. She was evidently suffering from a facial paralysis, and threatened with hemiplegia. She suffered from no pain; there was no tenderness under pressure anywhere along the spine, or about the base of the brain. Her

appetite was good, bowels regular, sleep undisturbed and refreshing.

Now, this is another case of facial paralysis. The same question, is it peripheral, or is it of a central origin? presents itself. As hinted in the history of our first case, the accompanying symptoms of weakness in the other parts of the nervous system, especially the evidence of hemiplegia, lead us to suspect that this is a case of central origin. But we resort to electricity again. We apply the faradic current to the cheek, and we observe that the muscles contract readily under its influence. As we move the electrode toward the eye the lid comes down, and the eye is closed. Here is another case where electricity aids us in confirming our diagnosis. But what can we do for the case? is the question. We know we have a serious case. We are guarded in our prognosis, and only promise to do what we can. We resort to local faradization, as in our first case. We give our patient strychnia and iodide of potassium, with other remedies having a tendency to counteract any rheumatic influence that may be present. We resort to local galvanization, alternated with local faradization. We use counter irritation over the right side of the cerebellum, and along the cervical portion of the spine. In the use of the electricity we always applied the negative pole to the cheek, and the positive over the petrous portion of the temporal bone, and over the cerebellum. Mild currents only could be borne. We treated this patient about six weeks without any improvement. But, upon the whole, she grew no worse. She got discouraged and went to another physician, and I have not learned the result.

We report this case to show the value of electricity in confirming our diagnosis and helping us to announce a correct prognosis. It also proves, to some extent, the comparative uselessness of electricity in the treatment of some cases.

Early in the spring of 1881, Mrs. G., a married lady, about twenty-five years of age, called upon me for what she called a swelling and stiffness of the right side of the face. Upon examination, I found it to be a case of facial paralysis. The face was not swollen, as she thought, but the paralyzed condition of it

made it appear so, and gave the feeling of stiffness. No other nervous symptom was apparent. The faradic current produced but little impression upon it; but under the influence of local galvanization and the use of strychnia and phosphorous, she recovered completely in about two weeks.

In the early part of the year 1879, a young lady, about eighteen years of age, was suddenly stricken with facial paralysis. It came on in the night, she knowing nothing about its approach. When she got up in the morning she discovered her distorted countenance; and, although she suffered from no bad or painful feelings, she was apprehensive. It was not so that I could treat the case at the time as seemed to be required, so she applied to another physician. He resorted to the faradic current—nothing else; and for several weeks she remained about the same thing—no better. Finally, however, she began to improve, and made a complete recovery; but the cure was very tedious. Had the galvanic current been used at the commencement, and strychnia administered daily, the cure would have been rapid.

No disease coming under our observation is more satisfactorily and successfully treated by electricity than facial paralysis. But we need both currents, faradic and galvanic. It is true, we may succeed occasionally with the faradic current alone, in which case the pocket instruments of Gaiffe, or Kidder, illustrated in a previous chapter, will be found convenient and effective. But when we know the galvanic current is required in so many cases, especially at the commencement, and in making out a diagnosis, it is advisable, and even *profitable and practical* to have at hand two instruments, a faradic and a galvanic. Or, what is more convenient still, an instrument combining both currents like that of the McIntosh make, illustrated in the fore part of this work. These instruments are perfectly satisfactory in every regard. They are portable, easily managed, and in a few seconds' time we can change from the faradic to the galvanic current, or from the galvanic to the faradic current.

When a case of facial paralysis comes to us, our first business is to ascertain whether it is a case of central or peripheral paralysis. The manner of doing this has been described. The next thing is to apply the proper current. If the muscles contract

under the faradic current, this is the one to use. If they do not respond, then we resort to the galvanic current. In both cases we place the electrode of the positive pole immediately in front of the ear, while that of the negative pole is moved about over the cheek of the affected side. The current should be as strong as the patient can well bear, and the sitting should last from ten to fifteen minutes, and be repeated for the first week every twenty-four to forty-eight hours, according to the severity of the case. After this, especially if improvement be manifest, the application may be made twice a week till the cure is perfect.

All this applies to cases supposed to be curable. In cases of a central origin, like that of Mrs. A., previously described in this work, it will be found that electricity, no matter in what shape or form applied, will be of little avail. In fact, I think it may do harm in some cases. By referring to this case the reader will see that we commenced to treat Mrs. A. about the middle of September, 1881, and that we continued the treatment for about six weeks, when she got discouraged and applied to another physician. We heard no more from the case till December 19th, 1881, when the husband again called me. I found the patient in bed. I learned that after leaving me she went to an electrician, a man who gives special attention to the treatment of diseases with electricity. She told me that he had treated her eight or nine times, and that he had applied the galvanic current so strong to her face that she suffered severely from it; and that instead of any improvement, she had steadily grown worse from the time she went to him. She had quit him and was taking iodide of potassium and bromide of potassium under the instructions of one of the best physicians in the city. But with all of this she was growing worse. She suffered from a severe pain in the head, on the right side, immediately behind and a little below the ear. The left eye looked red and watery. The right arm and hand, and the right leg and foot, were motionless. She could not move them the least; they were paralyzed. I put her upon strychnia and bromide of potassium. Strychnia $\frac{1}{64}$ of a grain every three hours, and bromide of potassium ten grains every four hours. Under this treatment the pain in the head ceased, and the eye improved in appearance—looked nearly

natural in color; but up to this date, January 10th, 1882, there is no improvement in the paralysis.

I certainly think the strong electric currents used by the electric specialist aggravated the disease in this case, and would earnestly warn the novice against the reckless use of this potent measure in serious brain troubles. While it is *the* remedy in all cases of a peripheral origin, either in the form of faradization or galvanism, it will not cure, or even benefit many cases of a central origin. Happily, the great majority are of the curable kind. They result from extrinsic causes, cold, injuries, exposures, and not infrequently we meet with cases as complications of neuralgia. All these cases are readily benefited by the use of electricity. Where a paralysis results directly from a neuralgia, we should apply the electrode of the positive pole immediately over the nerve affected by the neuralgia, and that of the negative pole over the paralyzed part.

Neuralgias are sometimes speedily relieved, and occasionally cured by the application of electricity. Aside from its use in curing paralysis resulting from neuralgia, electricity may be used to relieve the pain. In cases of long standing, and even in acute cases, and where the pain is localized, the part sore and tender under pressure, the application of a mild galvanic current, applying the electrode of the positive pole to the affected part, while the negative is held in the hand of the patient, will sometimes do more toward restoring the parts to a physiological condition than any means to which we can resort. If the galvanic current fails to give the desired results, then, we try the faradic current. But we find that the galvanic current is most frequently useful; it only occasionally happens that the faradic current is the best.

“In morbid states involving *sensibility* the faradic current is of little service. A very high tension current, with excessively rapid interruptions applied along the trajectory of a nerve, is sometimes serviceable in a neuralgia. The power to relieve pain is the property of the galvanic current. A descending stable current is, theoretically, the best form of application to relieve the irritability of a sensory nerve; but in practice, it is found that the direction of the current is of little moment, the relief being the same in what direction soever the electricity may be flowing.

It follows, then, of course, that the galvanic and not the faradic current is to be used in the treatment of neuralgia. The use of the faradic current in such cases is one of the medical delusions against which we must protest.

The injunction, in systematic works, to add a little salt to the water with which the sponge electrodes are moistened, is proper only in the case of galvanic applications to the face and head. In neuralgias of the extremities, especially of long standing, I am convinced that we should use powerful currents, and therefore make the applications with large electrodes, moistened, but not with salt water. Not sufficient attention is paid to the duration and number of the *seances*. In galvanic applications about the head the sittings should not exceed five minutes, but they may be repeated several—say three—times a day. In neuralgias the applications should be more prolonged, and should be repeated at short intervals. Much better results would be obtained in these affections, sciatica for example, if the applications for galvanism were fifteen minutes long, and repeated every three or four hours. These statements are based on some experience with these frequent applications, and are not merely speculative theories.”—[Bartholow.]

These observations agree with my own previous experience, except that I think the application of the electrode of the positive pole to the tender part is always more agreeable, and in no case less effective than the negative pole.

Referring to the use of the galvanic and faradic currents, we would make this observation: Heretofore medical practitioners desiring to test the virtues of electricity in medicine have almost invariably invested in faradic machines only. They probably get good instruments, and use them according to directions; but, like all other therapeutic measures, the faradic current will not meet all the indications, neither will it do all that can be done with electricity, and if we expect to succeed, we must use both currents. One current will be found best in a certain case, another in a second case, and in other cases both currents may be required. As we proceed we shall aim to point out the special indications for the different currents.

In a communication for the *Peoria Medical Monthly* for Nov 1881, Dr. R. J. Curtiss, of Joliet, Ill., very ably and instructively illustrates the value of the galvanic current in painful affections, and we gladly appropriate and reprint his observations, for they are in harmony with our own, and we know them to be faithful illustrations of galvano-therapeutics. He says:

“There is no fact in therapeutics better verified than the power of a low tension galvanic current to relieve pain. A high tension current has less power in this direction, and still less if it is interrupted, while the high tension faradic current, most useful in anæsthesia, has very little power to relieve pain, and in some conditions will increase it.

“Galvanism will relieve pain independently of its effect on the cause of pain. In fact most pain remedies operate independently of the cause. It must be, however, that when pain, like sciatica, depends upon disease of the nerve itself that the galvanic current acts more or less by catalysis, upon the cause of the pain in the relief of the disease.

“The method by which galvanism acts, or the changes of a physical, chemical, or so-called vital character which are produced in the tissues in the relief of pain are probably better understood than the same action of drugs. The first effect of the current is a physical one, and operates on the molecules of tissues. If the action is increased it becomes more complex and has a chemical effect. These effects of galvanism are termed catalytic, and it is by this action that electricity can relieve pain.

“*Case 1.*—Mr. —, a bricklayer. This patient was obliged to stand in water at his work during one day. On the third day after he was unable to work on account of sciatica. The pain was intense, and the limb could not be moved without great increase of the pain. The extent of pain was from the point of emergence of the nerve from the pelvis to the heel. The foot was placed in warm water, which contained the negative pool of the battery,—the positive was applied at different points over the nerve. The applications were made twice daily, for three days, the direct current from twenty cells being used. Each application was followed by lessened pain and increased mobility of the

extremity. No medicine was prescribed. After the sixth application the patient was free from pain, and complained only of stiffness of the limb when walking.

“*Case 2.*—Mr. —, a carpenter by trade, had had sciatica for ten years, more or less in relation to pain and time. Two years before I saw him he was subjected to the operation of nerve stretching. The wound became troublesome, and finally was attacked by erysipelas, and three months elapsed before he recovered from the effects of the surgery and the accident. In this case a differential diagnosis was necessary between sciatica and locomotor ataxia. The pains in the legs at times resembled those of ataxia. The tendon reflex, however, was increased. There was no fault of co-ordination, or any other signs or symptoms of ataxia. He had been treated by a minister, he said, with electricity derived from an electro-magnetic machine. The nerve stretching and ministerial therapeutics did not relieve him. He stated, however, that he was free from pain while in bed with his wound, following surgical operation, but pain returned when he had recovered and resumed work.

“The electrical treatment of this patient was continued for three months and was successful. The applications were made daily as a rule, and variously applied in quality and tension as the effects justified. The treatment began with the use of twenty cells, which was increased by degrees to sixty, and finally to eighty—with the intensity diminished by the rheostat. The patient improved rapidly after the second month. As a rule each dose of galvanism was followed by relief of pain. If the intensity of the current, however, was great enough for him to sensibly feel it, it always appeared to increase the pain. I found that the quantity of electricity was what his case demanded with low intensity, which was a very different method from that employed by the minister. This patient was discharged over a year since, and has remained well with exception of stiffness of the muscles, and occasional ‘storm pains.’

“*Case 3.*—Mrs. E——, a married lady, aged 40, is neurasthenic, and says she had had neuralgia in different nerves and at different times, all her life. Among other trouble she had been subject to nervous headache—the pain being extreme in charac-

ter. I noticed that the dark hair contained tufts of gray, probably half a dozen in number, sharply defined, and which she believed had been caused by excessive pain. Without doubt the loss of pigment had relations to her neurasthenic condition. I was called to visit this lady on account of an attack of sciatica. I learned that she had adopted the blue glass treatment for neuralgia, and while setting in the blue light her pains all settled into the sciatic nerve. The pain, of course, was intense, and patient helpless. I was obliged to use in this case a faradic current of rather high intensity, and used the same daily with good effect for about a week, when the patient was able to resume her avocations and daily routine of a confirmed neurasthenic life. I was anxious to try in her case the 'central galvanization' and 'general faradization' methods of Beard and Rockwell, but a diagnosis of tuberculosis was made by another physician, who took charge of the case, and I think must have cured his patient of tuberculosis, for after three years she is as well and as sick as ever.

"Case 4.—Was a robust, hearty person, who had sciatica for six weeks' duration, which he got by working in water which flowed from the savory Illinois and Michigan Canal. He said he came up to have me use my big battery on him, as he had tried a little one with no good effect. I applied the direct current from twenty cells, which was very unsatisfactory to the patient, who insisted that it was of no account because he couldn't feel it. By way of scientific experiment, therefore, I turned on sixty cells and interrupted the current. After the 'seance' was over, in about five minutes, the patient complained of an increase of pain. He returned three times, in as many days, and I applied the current in the same way with the same effect. He then staid away, and I met him on the street about ten days after, when he informed me that as soon as he stopped the electricity he began to get well, and recovered in a few days without treatment of any kind

"Case 5.—Mrs.—, married lady, aged 55, had schirrus of the liver. The pain from this disease was unusual, and prevented sleep, took away her appetite, and made her wish for the coming of the inevitable end. She had taken morphia and atropia, codeia, chloral, and even inhalations of chloroform. To

relieve her of pain I used the direct galvanic current from fifteen cells daily, about fifteen minutes, with the happiest effect. So long as she used this treatment she was comparatively free from pain, and availed herself of it until she could no longer, from progress of the disease, come to the office. The tumor filled the epigastric region and extended into the iliac fossa. Her last days were painless, and hopeful of cure, under the ministration of a 'cancer doctor' from Chicago.

"Case 6.—Mr.—, aged 60, had pulmonary consumption (fibrous phthisis), of which he died after two years duration of the disease. His cough was excessive, and he suffered greatly during the last six months from this source and from intercostal neuralgia, and pain referred to the left shoulder. Various anodynes and Sequard's neuralgic pills were prescribed. As an experiment, galvanism was used. Galvanization of the cervical region and epigastric region—one pole beneath the ear and the other over the stomach—with a current from five cells used for ten minutes, would insure a good night's rest—comparatively free from cough and pain. He also found relief from night sweats by use of faradism lightly applied over the surface. From choice the patient used galvanism for pain and faradism for sweating, instead of drugs. This patient after he began the use of electricity had a remarkable increase of appetite and digestion. He could take and digest three ounces daily of cod liver oil, and took daily a large quantity of raw beef and brandy, this remedy having been prescribed for him as the latest therapeutical novelty from Paris. His life by this means was surprisingly prolonged and his comfort greatly increased.

"Case 7.—Mrs.—, aged 53, had a cancer of the left breast, badly ulcerated. The pain in and about the tumor and through the chest, which at times amounted to angina, she was in the habit of relieving as much as possible by hypodermic injections of morphia. Hearing about the effects of galvanism in relieving pain in similar cases, she reported for that purpose. In this case the treatment by galvanism was remarkable in procuring relief from distress. The galvanism was used every other day by applying the positive pole over the dorsal and cervical spine, and the negative at various places over breast, side and arm. She

stopped the use of morphine while being treated by galvanism, and was relieved of immense suffering by its use. She had used plasters, probably arsenic and zinc, for the cure of the cancer, and declined further treatment than what was calculated to relieve her distress."

These are reports of seven cases where electricity was used to relieve pain. Galvanism was the principal resort, but in case "5" Dr. Curtiss says he "was obliged to use a faradic current of rather high intensity." But he does not say why he did this; and we are frequently at a loss to know which current to use, the faradic or the galvanic. In painful affections we are guided by these symptoms: where firm pressure over a painful part increases the pain, the faradic current will aggravate, while the galvanic current will relieve. On the other hand, where pressure does not increase the pain, then the faradic current, the positive pole over the painful part, will give relief.

A little experience in the treatment of neuralgia will enable the practitioner to classify his cases properly. On the one hand he will have patients who manifest a fair share of vitality, and yet they suffer from acute neuralgia, about which they complain bitterly. Touch these people and they are nervous; and handling the diseased or painful parts cannot be tolerated. Galvanization is soothing to these patients and will cure. On the other hand we find a class of rather feeble people, suffering from impairment of nutrition, more or less anemia, hyperaesthesia, exhaustion, &c. Holding the hands and rubbing the heads of these patients will give relief, and such measures are enjoyed as real luxuries by this class. They even fall asleep under such treatment. Here is the place for the faradic current; localized or general faradization. Mild currents should be used at first, then stronger, always being careful to avoid currents of high tension about the head and face. And large sponges should be used, that the current may be diffused as much as possible, for the concentration of current about the head and face cannot be well borne, and may aggravate the pain, while a diffusion over a large surface affords quick and permanent relief. Nothing so speedily improves nutrition, relieves pain and hyperaesthesia in such cases as faradization, local or general, as may be required.

Other diseases associated with or dependent upon impairment or perversion of nutrition, besides those of a neuralgic character, are frequently met with and quickly and permanently cured with electricity.

A case.—Lilly B., age fifteen, was brought to me about the middle of August, 1881, for advice regarding a curvature of the spine. Upon inquiry I found that she had been under treatment for nearly a year without benefit. She had menstruated once or twice, when about fourteen, but never since. She was wonderfully bent over in a forward direction. The difficulty did not seem to be in the spinal column, but in the muscles of the back. The girl seemed to lack the power to hold herself up, and she could not straighten herself without some help. She could get up and walk about in a half bent attitude, but would get very tired in a short time. Even sitting up in a chair was a burden to her; made her very tired. Her appetite was poor, face looked pale, pulse rather feeble, and all the functions of the body were performed in a sluggish manner, and some of them, especially menstruation, were suspended.

Our first advice was to have Mr. Schleifarth make and fit a suitable brace on the patient, which was done at once. This held her up temporarily, and with this on she could sit up and walk about without getting so tired. This brace was so constructed that it could be removed in a second or two, and replaced as readily. In addition to this we had her come to the office three times a week for electrical treatment. Faradization was used thus: The back was bared the entire length of the spine, and we had the patient hold the sponge electrode of the positive pole of the faradic machine in the hand, first in one hand, then in the other, changing every minute, while we applied the sponge attached to the negative pole to the back, commencing at the neck, and moving down the spine to the lower extremity, then up one side, down the other, then up, then down the centre, using as strong a current as could be borne without discomfort, and continuing the seance for fifteen minutes. She always felt refreshed and invigorated after these treatments. Small doses of strychnia and macrotys, occasionally alternated with arsenic, were given from the start. We continued this treatment about one

month, when we observed a marked improvement in the appearance of the patient. The appetite was better, sleep more refreshing, and she really felt stronger. Faradization was continued twice a week after this, for another month, when she had a slight show of the menses. She was still improving. Another month under the same treatment, and the menses appeared in a natural manner. She now looked red and fresh, had gained greatly in flesh, could sit up, and could walk and work with pleasure. We continued the faradization once a week till December 15, 1881, when we stopped, and she is now taking nothing but macrotys and strychnia, and is growing and gaining in strength daily. She still wears the brace, but says she can do without it, and she can really straighten herself up nicely and get around like other girls. We shall soon take off the brace.

Now, here is a case where faradization worked a wonderful cure. True, it may be said that strychnia, arsenic and macrotys had something to do in the cure. So they had; but they could not infuse new life and vigor into the muscles, and invigorate the nervous system so rapidly as actually resulted in this case. The very first seance was followed by immediate improvement, and the patient could even feel and realize that the electrical treatment was restoring her. And there is no doubt but that the indirect and constitutional influence of the faradization had more to do in re-establishing the menses in this case than anything else. Of course the faradization was comparatively local, and while we are sure the poorly nourished and feeble muscles of the back increased in size and gained in strength under the electrical influence, we are quite certain that the uterine and ovarian functions were stimulated also. As evidence tending to establish the fact that such things may result under similar circumstances, allow us to quote a paragraph or two from Prof. Rockwell:

“Localized electrization of poorly nourished and atrophied muscles develops size and increases strength. Localized electricity of any organ, such as the uterus, the nutrition of which has become impaired, and its size diminished, tends to develop it and to increase its functional activity. In localized electrization, these results are, of course, of a local nature; yet, owing to the fact that absolute localization is impossible, we not unfrequently ob-

serve effects extending far beyond the parts actually enclosed in the circuit.

“By reflex action, also, we obtain remote effects, which are either desirable or undesirable, according to the demands of the case in hand. Galvanization of the spine, and even of the extremities, may, in certain irritable conditions, excite the characteristic metallic taste. Galvanization, and even faradization of remote and limited areas, sometimes relieves pain, induces sleep, and increases the menstrual and other discharges through reflex influence alone.”

This was undoubtedly the case with our patient; and we have seen similar results in other cases, where the appetite increased, digestion and general nutrition improved under the influence of faradization, administered over very limited areas, through the electrical chair of Dr. Hathaway, of Chicago, when the hands and feet only of the patient are in contact with the electrodes. While localized faradization is certainly more potent in some cases, where it is practicable, we do know that special results actually follow general influences in many cases.

One thing should always be observed in the application of electricity, no matter whether we are using the electro-magnetic machine or a galvanic battery: the positive pole should always be applied to sensitive, painful or inflamed parts or organs, when such conditions are present. And while the positive pole is applied directly to or over these tender parts for the purpose of relieving pain and effecting cures, the negative pole should be placed upon some comparatively unimportant part of the body, and where the least excitement is produced. On the other hand, where it is the object to stimulate or invigorate any part or organ, the negative pole should be applied to the weak part, while the positive pole is placed upon some part of the body not likely to suffer serious injury from the sedative influence of the positive pole.

It will be observed that in case I., reported by Dr. Curtis, a severe case of sciatica was speedily relieved and permanently cured by the use of electricity; and that the positive pole was applied to the painful part, while the foot of the patient was held in warm water containing the negative pole of the battery. And in the case of Lilly B., reported by me, the negative pole was

applied to the back, all along the spine and over the muscles of the back, while the positive pole was held in the hand. A wonderful cure of spinal curvature and suppressed menses was the reward of this treatment. And we might cite the reader to numerous cases illustrating the truth of this law.

Dr. A. W. Tipton, in his new work on Electrical Medication, p. 56, illustrates the distinctive use of each pole very clearly. While the terms electro-vital fluid and electric fluid may be objectionable, Dr. Tipton makes the reader know what he means, and his instructions are eminently practical. He says: "The reader will bear in mind that all acutely inflammatory or hypersthenic affections are electrically *positive* in excess—having too much vital action—being *overcharged* with the electro-vital fluid; and that all paralytic diseases, or those of sluggish, azoödynamic character, are electrically negative, having too little electro-vital fluid, too little vital action. It is a universal law of electricity that positives repel each other, and that negatives repel each other; but that positives and negatives attract each other. This is a principle of electric action everywhere known where any thing is known on the subject. *We appropriate it practically to therapeutic purposes.* Therefore, when I wish to repress or repel inflammation, which is electrically positive in excess, I put the positive pole to it; or, at least, I bring it under that half of the circuit with which the positive pole is connected, and as near to the pole or electrode as possible. And because two positives repel each other, and also because the direction of the current is always from the positive to the negative pole, carrying the electro-vital fluid with it, either I must withdraw my positive electrode, or that excess of electro-vitality in the diseased part which makes it morbidly positive, and thus produces inflammation, must give way. I *will not* withdraw my positive pole, and therefore the positive inflammation *must* retreat and be dispersed. In treating this case, I will place my *negative* electrode either on some healthy part, or, if there be perceptible anywhere in the system a morbidly negative part, as is often the case, I will place my negative pole there. For example: if I am treating for *nephritis*—inflammation of the kidneys—when I do not perceive any part to be abnormally negative, I manipulate with my positive electrode over

the inflamed kidney, having the negative electrode placed at the coccyx, the lowest part of the spine. My positive pole repels the positive inflammation from the kidney; or, rather, repels from it that excess of electro-vital fluid which makes it morbidly positive and induces the inflammation, while the negative pole attracts the same towards the coccyx. On its way it becomes more or less diverted to adjacent nerves; or, if gathered in the healthy part, under the negative pole, it is immediately dispersed by the normal circulation as soon as the electrode is removed. But if I find a *spinal irritation*, say in one or more of the cervical or dorsal vertebrae, and, at the same time, a stomach affected with *chronic dyspepsia*, accompanied with *constipation of the bowels*, I will work over the inflamed or irritated spine with my positive pole, because I know from the irritation that there is an excess of electro-vital fluid in the part, making it improperly positive; and, with my negative electrode, I will, at the same time, treat over the stomach, bowels and liver; because I know, from the *inaction* of these organs, that there is a lack of vital force, a deficiency of the electro-vital fluid, there, and that, consequently, they are too negative."

Dr. Tipton is earnest and enthusiastic regarding these principles, and whether we agree with him in all his theories and details or not, the one idea advanced, and so fully illustrated in the above quotation, is one that cannot be treated with indifference if we expect to succeed with electricity. The distinctive use of the poles should be carefully observed under all circumstances. Where doubts arise as to the actual conditions of a part, then we may alternate, and finally use the pole that seems to give the best results.

We have now defined electricity, explained the different methods of generating it, described the leading and most practical electro-magnetic machines and galvanic batteries in the market, illustrated the difference between the electro-magnetic and galvanic currents, and have shown the marked difference in results from the application of the different poles, referring to specific conditions where each pole has a specific action in relieving pain or restoring vitality. The knowledge thus far gained from these pages should be sufficient to enable any intelligent physician, who

has a practical knowledge of disease, to commence the use of electricity understandingly.

CENTRAL GALVANIZATION.

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Central galvanization is a method of applying electricity that demands special attention. It consists essentially in bringing the brain, sympathetic, spinal cord, and pneumogastric, under the influence of the galvanic current. One pole of the battery is placed over the region of the stomach, while the other is applied to some part of the head or spine. In all cases of cerebral excitement, pain in the head, mental disturbances from sympathy, apply the negative pole of a galvanic battery over the stomach, and the positive pole to the top of the head. Great caution should be observed in applying the galvanic current to these parts. In all cases the head and face are more impressible than other parts of the body, and this is especially so with the galvanic current, for it passes directly through the scalp and skull, enters the brain and goes through every nerve and tissue it meets. In using this current in any case in the manner denominated central galvanization, the electrodes should be large, so as to diffuse the current as much as possible. And we should commence with a very mild current, one or two cells, increasing gradually as the patient can bear it. And we should not depend upon the suggestions of the patient too much regarding the strength of the current, for bad results may be suffered before we are aware of any danger. Suppose the patient is suffering from pain in the head, or there is cerebral excitement, and we desire to relieve it with electricity. Let the patient be seated, bare the stomach and make the top of the head quite wet with warm water. Now attach two large sponge electrodes, well moistened with warm water, to the cords of the battery, turn on two or three cells only, then apply the sponge of the negative electrode over the stomach, and carefully test the patient and the strength of the current in this manner: while the negative electrode is still over the stomach, we take up the positive sponge electrode, and with a tapping motion about the temple, or over the brow, we rapidly apply and remove the sponge. If the patient is quite sensitive,

we may expect to hear remarks like this: "O, I see sparks! I see flashes of light when you hit my head with the sponge." If no such results as these follow this test, then connect two or three more cells, and repeat the experiment. If the battery is in any thing like good order, from four to six cells will certainly give the results above named—sensations expressed by the words sparks, flashes of light, etc. But some people are not very sensitive, and ten to twelve cells may be required to excite any unusual manifestation. On the other hand, we frequently find people who are so sensitive that but two or three cells can be tolerated.

Having carefully tested the strength of the current and the impressibility of the patient, while the negative electrode is still over the stomach, we carefully place the sponge of the positive pole on the top of the head and steadily hold it there for a time—from one to fifteen minutes, as may be determined by the immediate effect. The moment we place the sponge on the head the patient complains or speaks about a peculiar metallic taste in the mouth. If this is not mentioned voluntarily, it is called out in answer to questions. Occasionally it is complained of greatly, and seems to be quite disagreeable to some people. In other cases it is barely perceptible. Central galvanization with the negative pole to the stomach, and the positive pole to the head, is a potent measure, and if it does no good, it is likely to do harm. It lessens the quantity of arterial blood in the brain, and if used too strong, or continued too long, dizziness is experienced, and if still further continued the patient becomes unconscious and falls from the chair in a condition of syncope, and vigorous efforts, with the application of stimulants, may be required to bring about a reaction. From this it will be seen that great caution should be observed in the application of this measure. If the patient complains of dizziness, then the current should be lessened in tension; and if the dizziness is still suffered, a rheostat may be used. The rheostat is very convenient in applying electricity to the head, eyes and ears. It is fully described and its use illustrated on previous pages. But with the greatest care and the use of the rheostat some patients cannot bear central galvanization long at a time. We observe the face growing pale,

and the patient sighs a time or two, or expresses feelings of weakness or depression, and we are forced to desist. One or two minutes is as long as we can use it in such cases; in others it will be well borne for ten or fifteen minutes.

We use central galvanization in obscure nervous affections, such as hysteria, hysterical insanity, chorea, nervous headache, etc. Some of the most persistent cases of hysterical insanity are speedily relieved and permanently cured by this measure. Just how the cure is wrought we cannot always tell. But we do know that the galvanic current is capable of working wonderful changes. With it we can disturb nervous influences, divert the circulation, separate the constituents of the fluids of the body, and even dissolve the tissues. An agent capable of doing all this may be expected to do either good or harm whenever employed. We may apply the faradic current to the extent of toleration, and rarely do injury with it; for it has no power to disorganize the fluids or dissolve the tissues. In changing from the galvanic to the induced current the electrolic power is lost. Faradization influences nerves and muscles principally; the galvanic current produces a change in everything coming under its influence; and the changes are not always simple excitements, contractions and relaxations, but are organic in character.

The application of electricity to the head is opposed by some electricians, because they cannot explain just *how* central galvanization cures. And because bad results may come from reckless manipulators, they oppose and denounce it. We are not of this class, for we have cured some troublesome cases with central galvanization that had resisted various measures. Of course we should be cautious at the commencement, and if we find that the current is not well borne, and that the patient grows worse under the treatment, it need not be continued. Two or three sittings will be sufficient to test any case, for if the results are to be good a few seances will decide it.

Central galvanization is sometimes applied by placing the positive pole to the stomach and the negative to the head, or over different points along the spine. But the most satisfactory method is to apply the negative electrode over the stomach, and the positive pole to the top of the head, nape of the neck, or over

the upper portion of the spine. Spinal irritation is sometimes instantly relieved by this measure. It is even astonishing how quickly harrassing pains and feelings of distress vanish under the influence of galvanism. And some cases of persistent nausea, no doubt from spinal irritation, are immediately relieved by this measure.

We meet with many patients where the symptoms are delusive. We find it impossible to make out what we call a positive diagnosis. We may be able to find a positive wrong here, and another there, and we may apply the appropriate remedy in every such case, but still there lingers a nervous distress, melancholy, or wakefulness, and the patient may suffer from fits of sobbing—don't feel right at any time. With other appropriate measures we now resort to central galvanization. Of course we cannot always know, to a certainty, that they will relieve the patient, but we frequently find that improvement commences at once. Just how the favorable change is wrought we do not pretend to explain, but we do know that with central galvanization we can frequently relieve, and many times speedily and permanently cure people who had lingered for months under different plans of treatment, medical and hygienic.

ELECTROLYSIS.

Electrolysis is a term applied to the process of decomposing compound substances by electricity. For this purpose the galvanic current, not the faradic, must be used; and that this direct current is capable of separating the elements that enter into the composition of fluids and solids is readily illustrated, as follows: Let us dissolve about thirty grains of iodide of potassium in two ounces of water. We put this solution in an open dish, on a suitable table, and observe that it is colorless. We now attach conducting cords to a galvanic battery, and on the distal ends of these cords we attach metallic electrodes, iron, copper or platinum. We now dip both of these electrodes into the iodide solution, at some distance from each other, and hold them there for a few minutes. Very soon we observe that the solution about the electrode attached to the positive pole of the battery changes color. It looks yellow at first, but rapidly grows darker, and

finally the whole solution presents the full color of iodine. In this case the iodine and oxygen go to the positive pole, while the hydrogen and alkali go to the negative pole. In all cases of electrolysis, or wherever the poles of a galvanic battery are applied, the acids and oxygen present go to the positive pole, and the alkalies and hydrogen go to the negative pole.

Now it is well known that the human body is largely made of water, holding salts of potash, soda, &c., in solution. It is also a fact that the composition of the fluids and tissues of the body thus made up are readily decomposed in the living subject, by the application of the poles of a galvanic battery, the acids and oxygen rushing to the positive pole, while the alkalies and hydrogen as rapidly concentrate about the negative pole. In a given case, where metallic electrodes are applied directly to a part, the electrode attached to the positive pole is corroded; and if a strong current from many cells is used, the accumulation of alkalies at the negative pole may be so great as to produce a severe caustic effect. Such a result is rarely desirable, and unless we want it we are careful to avoid such violent action, by using a smaller number of cells. In either case, whether few or many cells are used, but especially where the current is strong, morbid growths, swellings, tumors, and enlarged glands are frequently dissolved and carried away in a very short time by subjecting them to the process of electrolysis. Just how this disturbance of the elements in the tissues results in the removal of the diseased conditions referred to, we are not at present able to tell. Of course, in certain cases, where we use electrolysis to the extent of destroying the tissues, the effect is similar to the operation of an ordinary caustic, only the pain and subsequent inflammation are not so great, while the cure is more certain.

A few cases in practice will serve to illustrate electrolysis, and the appropriate instruments in making the applications. A young lady, aged 22, otherwise healthy, came to me last fall, September, 1881, asking advice about an enlargement of the parotid gland. She said the lump had been coming for several months, and that, notwithstanding she had consulted two doctors, and had used their medicines, the gland continued to enlarge. When she came to me it was large enough to make her appearance quite

unsightly, and she was very anxious to have it reduced, or removed—anything to get rid of it. She suffered from no pain, neither was the gland tender under pressure; no increased redness, but the tumor was very hard.

Treatment.—I attached conducting cords to a twenty-four cell zinc-carbon galvanic battery, McIntosh's, and on the distal end of the positive pole I attached a large sponge electrode. On the distal end of the negative pole I attached a small sponge electrode. I moistened both electrodes with warm water, and placed the one attached to the positive pole in the patient's hand. The small electrode, attached to the negative pole, I placed firmly on the tumor, and held it there for fifteen minutes. After fixing the electrodes as above described, I connected six cells of the battery. This produced a sensation of warmth in the tumor, or in the skin covering it. I carefully connected more cells, one by one, till a distinct burning sensation was complained of, but I did not remove the sponge from the tumor till the fifteen minutes were up. I did, however, move the sponge about over the tumor during the whole time of the operation. I did this to prevent a caustic effect. When I removed the sponge at the end of the fifteen minutes, the skin covering the tumor was very red. I had this patient return twice a week for a month, and I could see a decided improvement. The decomposition of the fluids in this tumor, effected by the application of the negative pole externally, was resulting in a gradual dissipation of the enlargement. But the process seemed slow, and we determined to resort to a more direct method of application. Instead of using a small sponge electrode on the negative pole, I attached an electrolysis needle. This is a harpoon shaped needle made expressly for the purpose. About a half an inch of the pointed end is left exposed; the remainder of the needle is carefully insulated with gutta serena. These needles are kept in stock by surgical instrument makers, and can be had of different sizes, styles and shapes, already insulated and ready for use. One of these needles attached to the negative pole, as above stated, and the sponge attached to the positive electrode placed in the patient's hand, I thrust this electrolysis needle into the center of the tumor. This was readily done by picking up the tumor between the thumb and fingers, and

giving the needle a quick motion, as in introducing a hypodermic syringe. I now turned on six cells. The patient complained a little of a burning sensation, but she could bear it stronger, and we carefully connected other cells, one by one, till twelve were included in the circuit. This was all done in a minute or two. By this time the needle seemed quite loose in the tissues, and I could turn it about in any direction. I took advantage of this and did turn the point in different ways, and by the time the fifteen minutes were up, the time usually occupied in electrolysis seances, the needle seemed to be in a free space. I now turned off the battery, withdrew the needle and dismissed the patient for a few days. But little inflammation resulted from this operation, and scarcely any soreness was left after three days. The tumor had rapidly shrunk, and by the use of sponge electrodes applied externally after this twice a week, it speedily diminished in size, and finally disappeared entirely.

It should be observed that in the introduction of electrolysis needles into deep tissues, they should always be introduced so that a part of the insulated portion of the needle goes beneath the skin. This protects the skin from the electrolic effect of the current, and saves the patient from great pain.

While tumors, swellings and enlargements of various kinds may be reduced in size, and finally removed by external electrolysis, where it is practicable, the introduction of needles into the tissues will result in a more rapid dissipation of morbid growth. And, in some cases, it is required to introduce these needles quite a number of times; in others, one application is enough. Take a wart on the hand or face for instance. Let the patient take the sponge of the positive electrode in the hand, while we apply an electrolysis needle, attached to the negative pole, to the little tumor. The needle should be well fixed in the wart before the current is turned on, and then one or two cells at a time should be connected till the current is the required strength. The needle should not be taken away during the operation, for every time we take it off and reapply it we break the current, and this produces a shock which unnecessarily annoys the patient. We may move the needle about a little, so as to completely disorganize the whole tumor during the one operation; but we should

be careful in moving the needle that we do not, at any time, lift it from the tumor. When done, before removing the needle, and this should be observed in all cases, disconnect the cells, or turn them off. www.libtool.com.cn

In all such cases as these the operator will be governed by the results in the number of cells used. First turn on two or three, and if but little effect is produced, connect others, and continue to increase till a burning sensation is complained of, and the tissues at the needle turn white, and the needle loosens. Fifteen minutes is long enough for any operation in electrolysis.

Some operators apply the sponge electrodes of both poles to the diseased parts, only at different points; and they attach electrolysis needles to both poles of the battery, where needles are used, and they thrust both needles into the tissues, only at extreme points. This may be better than the plan we have practiced and suggested, but we doubt it very much. We have tried it, and could never discover any advantage. And the needle of the positive pole, unless well covered with gold, is so corroded and the tissues so hardened about it that at the end of fifteen minutes it is removed with difficulty. A sponge on the positive pole, held in the hand, and a needle on the negative pole is all sufficient—*the best*.

Electrolysis, applied in different ways, is a potent measure in such diseases as goitre, benign and malignant tumors, mother's marks, chronic rheumatic swellings, &c. In fact this is one of the most valuable therapeutic uses of electricity, if not really the most important of all. The current should be as strong as can be borne, and if necessary anæsthetics, local or general, should be used.

THE REMOVAL OF HAIRS BY ELECTROLYSIS.

Electrolysis is successfully resorted to for the removal of hairs from the face, when it is desirable to have them permanently removed. Frequently the opinion and advice of the physician is sought by women respecting this abnormal and obnoxious growth. This growth of hair on the face of a lady is not always a trifling matter. It may not kill the patient, but it is almost certain to occasion great annoyance. It is very apt to affect her disposition,

and to injure her prospects in life, especially if she be young and unmarried; and it may eventually ruin both her health and her happiness by producing a mental disquietude which in many instances urges on melancholy.

These observations, from a paper written by George Henry Fox, A. M., M. D., read before the Medical society of New York, with the following detailed procedure for the removal of this offensive growth, taken from the same paper, may interest a few, and it would leave our work incomplete to omit this use of electrolysis:

“The operation for the permanent removal of hairs by electrolysis, has been described by several who have written on the subject, and the descriptions differ merely in a few non-essential points. The operation is a simple one, which any physician with a steady hand and keen eye can readily perform, although, as in many other simple operations, a peculiar dexterity is required, and far more satisfactory results are obtained after a certain amount of experience. An ordinary galvanic battery is required and a fine needle, which is to be attached to the negative cord. The number of cells required for the operation depends upon the activity of the battery, the delicacy of the patient's skin, and the strength of the hairs to be removed, and should be determined in each case by the effect which is produced. I commonly use from ten to sixteen cells of a zinc-carbon battery, or a corresponding number of a chloride of silver battery.

“Upon the style of needle employed depends, in a large measure, the success of the operation. A fine cambric needle, which has been recommended, may be successfully used, but on account of its stiffness it is more difficult to introduce it into the follicle without piercing the follicular wall than the hair-like flexible steel broach which I have recommended and invariably use. The cambric needle being larger is also productive of more inflammatory reaction, and more likely to leave permanent traces of the operation. Formerly I used a very fine platinum wire, pointed by means of a jeweler's file, but the delicate flexible broach, much finer than those commonly employed by dentists in extracting nerves, is far superior to any other needle which I have ever seen, and is almost a necessity in removing the hairs from the upper

lip without the production of a scar. The needle can be readily attached to the end of the battery cord by a few turns of copper-wire protected by an inch or more of rubber tubing, or a special handle may be made for the purpose.

“ Provided with battery and needle, the next thing is to get the patient in a proper chair and in a proper light. A high reclining chair and a southerly bay-window are desirable, but the main point is to secure sufficient light and to have the operator's eyes upon a level with the patient's chin. The needle is now introduced into the follicle by the side of the hair. If this is skillfully done, no pain whatever is felt by the patient. The sponge-cup or sponge-tipped positive electrode should now be used to complete the circuit. This may be applied to the skin in the immediate vicinity of the hair, if but a few cells are used, but it is usually more convenient to allow the patient to hold the positive electrode in one hand, and when the needle has entered the follicle, to ask her to complete the circuit by applying the moistened sponge to the palm of either hand. The electrolytic action now manifests itself subjectively in the form of a sharp stinging sensation, and objectively in the form of slight hyperæmia around the needle. In a few seconds the hyperæmia will give place to a blanching of the skin, and a little froth will appear at the mouth of the follicle. If the hair be now seized with a pair of forceps and the gentlest traction exerted, it will be found to be loose in the follicle in the course of from ten to twenty seconds, provided the needle has been skillfully introduced. Before withdrawing the needle the patient should remove her hand from the sponge, in order to avoid the slight shock which would otherwise be felt.

“ In a paper on this subject which I read before the New York State Medical Society, three years ago, I recommended the extraction of the hair before introduction of the needle where the follicles were of large size. Under no circumstances, at the present time, do I ever remove the hair until it is loosened by means of the electrolysis.

“ At that time I was in the habit of using a much coarser needle than I do at present. With the finest flexible needle it is extremely rare to produce wheals or pustulation. In many cases the effect of the operation is simply to leave red points, which soon disappear.

“The operation is by no means a pleasant one, but rarely does a patient make any complaint of pain. The majority say it is not as unpleasant as having teeth filled in a dentist’s chair, and with the fine needle the painful sensation is greatly reduced. At the first sitting the patient is often nervous, and suffers really more than in a dozen subsequent operations. When the sitting is prolonged, and especially in a poor light, the removal of the hair is very trying to the eyes of the operator. At certain times I know that I have suffered quite as much or even more than the patient. The use of a lens held in the hand or fixed before the eye has been suggested, but for my part I find one of no value. A delicacy of touch and steadiness of hand is more essential in this operation than an unusual keenness of vision.

“As to the number of hairs which can be removed at one sitting, I would say that from thirty to fifty is the number which I usually expect to destroy in an operation lasting three-quarters of an hour. Upon the neck it takes much longer to destroy hairs than upon the chin or cheeks. I have removed over two hundred hairs at one sitting, when patients from a distance were anxious to leave the city; but I deem it far better to spare one’s eyes and to be more thorough, even if it involves a greater number of sittings.

“If the operation is very skillfully performed, it ought not to leave scars, as a rule. In some cases it is impossible to prevent the production of minute punctate cicatrices, which, however, can only be seen on close inspection. I made a mistake in some of my earlier cases in operating upon two or more coarse hairs very close together, instead of taking one here and there at short distances apart. A little attention to this hint may serve to prevent the production of slight scarring by those who may attempt the operation. Here again I must refer to the fine needle, for its use greatly lessens the liability to the production of scars.

“As regards the immediate success of the operation, it must be stated that, as a rule, a certain percentage of hairs will return and demand removal a second time. I used to expect a return of from thirty to fifty per cent of the hairs, while now I am surprised if from five to ten per cent reappear. In one case in which I removed over fifty hairs with unusual care, not a single one has

returned after an interval of three months. In some patients the growth of hair appears to have ceased, for some unknown cause, and when the hairs are destroyed the cure is effected. In other patients the fine hairs are constantly growing larger and darker, and after the most conspicuous have been removed a new growth will in time succeed, and appear, perhaps, like a return of those previously removed.

“In this operation for the permanent removal of hair the question arises as to how the electricity destroys the papilla from which the hair springs. Is it by thermic or by electro-chemical action? A recent writer on the subject objects to the use of the term electrolysis as being a misnomer, claims that the heat generated in the needle by the passage of the electricity is the active agent in the destruction of the tissue, and suggests for the operation the name of *akido-galvano-cautery*. It cannot be denied that in this operation the temperature of the needle is slightly raised by its resistance to the galvanic current, but surely not to such a degree as to produce a caustic effect. On the other hand, it is evident, from the frothing seen at the mouth of the follicle and other effects, that a decomposition of the water and salts contained in the cutaneous tissues is taking place around the needle and causing the escape of bubbles of hydrogen. This is certainly nothing more nor less than electrolysis.

“In conclusion, I would like to refer to the cause of facial hirsuties in females, and I shall speak briefly on this point, for I know very little about it. I have wondered and pondered by the half-hour while operating on cases, and endeavored to find some characteristic common to all of my patients, but in vain. Some are in fine physical condition, while others are debilitated. Some are extremely nervous; some are not so in the slightest degree. Some are stout and others thin. Some are of dark and others of light complexion. Some are maidens from twenty to fifty years of age; while of others who are married, some have children and some have none. The somewhat common idea that the growth of a beard in the female is necessarily associated with masculine traits of character is certainly not founded upon fact, for most of my patients have presented the very highest type of feminine refinement. That facial hirsuties is dependent upon a malforma-

tion or imperfect development of the reproductive organs, as some have claimed, is, in my opinion, doubtful. Certainly, an intimate relation between these two conditions has not been satisfactorily proven, save in a few exceptional cases.

“The relation of facial hairiness in females to derangement of the nervous system is a subject which has already commanded attention, but has not as yet been sufficiently studied. I have already spoken of the depressed mental condition existing in many of my patients, and which I believe to be not merely a result of the disfiguring growth of hair, but a symptom of general nervous disease, upon which the hirsuties in all probability depends. Excessive growth of hair, whether in the male or female, is an aberration of nutrition, and not a sign of excessive vitality. The Samsons of the present day are clean-limbed, and usually short-haired specimens of the human race, and in our highest type of feminine health and beauty there is but a moderate growth of hair. The lady in the museum, whose luxuriant tresses trail upon the floor, is rarely, if ever, well-developed, and, like her bearded sister, furnishes unmistakable evidence of perverted nutrition.

“An abnormal growth of hair, whether it be in respect to length or location, indicates an abnormal condition of the nervous system. Precisely what this condition may be, and how it may be remedied, I must leave for others to determine.

“In the following report of cases, I have selected twelve of those in which the growth of hair was more or less abundant, and which will serve to illustrate some of the difficulties in the way of treatment, as well as its success.

“CASE I.—Mrs. —, aged thirty-one, married at eighteen, and has one child. Is quite stout and in fair health. Is greatly worried by a growth of hair upon chin and neck. Seldom goes out for exercise, but prefers “to sit and mope.” Her sleep is often disturbed by the thought of her “misfortune.” The patient is almost a monomaniac on the subject of her beard, and most of the time is greatly depressed in mind. The growth of hair upon extremities is abnormal. The facial hirsuties appeared about two years ago, and pulling the hair out seemed to increase the growth. As a proof that pulling makes the hairs grow

stronger, she cites the fact that the hairs on the right extremity of upper lip, which she could pull more readily than on the left side, are now much more developed in size. There is no tendency to hirsuties among her female relations.

“Applied for treatment in March, 1880. During the summer I removed over a thousand dark hairs, leaving an abundant growth of fine pigmentless hairs, which were scarcely noticeable at the distance of a few feet. At her earnest request, I continued to operate upon these and removed a second thousand or more, most of which were so fine as to constitute no disfigurement whatever, but their removal produced a marked indirect effect upon her health and happiness. In this case about twenty-five hundred hairs were removed by count. How many of these reappeared and were removed a second time it is difficult to say. There was, evidently, a constant tendency for the fine downy hairs to develop in size and thickness, and at times I despaired of being able to effect their removal, but after eighteen months of intermittent treatment, success crowned my efforts, and her chin and neck appeared quite smooth and natural. In January, 1882, I saw the patient, at which time there were no conspicuous hairs, and she stated that she considered the operations to have been perfectly successful and that the results had far exceeded her anticipations.

“CASE II.—Miss —, aged twenty-four; a tall blonde, in good health. Applied for treatment in October, 1879, on account of a growth of light hairs on both sides of chin, about an inch in length. She had consulted the eminent dermatologist of London, Prof. Erasmus Wilson, and stated that she had been advised by him not to touch the hairs, and informed that absolutely nothing could be done in her case. Her extremities were quite hairy, and the hair of the head was thick and long. The hair on her chin had mostly grown during the previous year, and after a severe fever. In this case I removed three hundred hairs, operating upon the left side of chin by electrolysis, and upon the right side by the method suggested for the mechanical destruction of the follicle, consisting in the introduction and sudden twisting of a barbed needle. In April, 1880, the patient returned to the city, and I found that nearly all of the hairs upon the right side

had returned, while there was a perceptible diminution of the number upon the left side of chin, where the electrolysis had been employed. In April I removed one hundred and fifty, and in June one hundred hairs of a finer growth than those first operated upon, which left the face quite free.

“CASE III.—Miss —, a young lady, aged twenty-six; tall and of fair complexion; in good health, though delicate in appearance and inheriting a tendency to pulmonary disease. Applied for treatment in December, 1879, on account of hairs growing on either side of chin, which had appeared within three months. There was a very light moustache on upper lip, though scarcely more than is commonly seen. In two operations I removed sixty hairs from right side, and thirty-five from left side of chin.

“In May, 1880, about ten of the dark long hairs, previously operated on, appeared to have returned. Removed twenty-five from either side of chin, most of them being fine and light-colored.

“In October, the patient reported that she had been free from the capillary growth during the early part of the summer, but during the past two months a few fine hairs on either side of chin had rapidly increased in size. These were removed, and as I have recently been informed by a member of her family, there has been no subsequent appearance of the hairs.

“CASE IV.—Miss —, aged thirty-two, tall, of blonde complexion, and lymphatic temperament; health good. Applied for treatment in June, 1880, on account of long curling hairs on sides of chin and a mole on neck. She had been in the habit of pulling them every three weeks. There was no hirsuties on other portions of her body, nor were any female relatives affected similarly. Her hair, a lock of which turned gray at sixteen, appeared quite gray in front, while the back hair was of a natural brown hue. Upon her legs a singular condition had existed for two or three years. The hair upon the tibial region, instead of being normal or in excess, had almost entirely disappeared, and the existence of many follicles, either inflamed or distended by an accumulation of epidermic cells, showed plainly that the loss of hair was the result of the affection which is known as lichen

pilaris. The hair upon her chin had been growing for five years or more.

"In June and July, 1880, I removed one hundred and sixty hairs.

"In November I removed eighty, much finer than those first operated upon.

"In June, 1881, there were but seven to be removed.

"In January, 1882, I removed twenty-five, which were evidently of recent development, and not a return of those previously operated upon.

"CASE V.—Miss —, a maiden lady, aged forty-six; tall, thin, and of dark complexion; health poor. Applied for treatment in July, 1880, on account of numerous fine dark hairs upon either side of chin. She had been in the habit of cutting them close or pulling them out, and at the time of her first visit they were about half an inch in length. There was no excessive growth of hair on other portions of the body. The hairs on chin had begun to grow at eighteen years of age, and she stated that a sister and two paternal aunts suffered in very much the same way. During the week in which she remained in the city I removed five hundred of the largest hairs in six operations.

"In September she returned to the city with apparently as luxuriant a growth as before, and no indication, at first glance, of any having been removed. Close inspection, however, showed a few red points, especially on upper lip, where hairs had evidently been destroyed. I now removed six hundred in four operations, including many finer hairs, and used a stronger current and far more care in operating than I did at first.

"In November the number of hairs was evidently decreased, and I removed less than a hundred.

"In June, 1881, there were but a few conspicuous hairs. I removed one hundred more, however, most of them being very fine.

"In October there were but seven dark hairs, which I removed with twenty-five downy ones, which appeared as though they might develop and become conspicuous. A few minute cicatrices were visible upon close inspection. The patient has since written to me as follows:

"The result of the operation is very satisfactory. There are

no hairs perceptible on lip or chin, and the few scars are not noticeable.'

"CASE VI.—Mrs. —, a married lady, aged twenty-five; quite stout, of dark complexion and in fair health. Applied for treatment, in August, 1880, on account of long, dark, curling hairs upon either side of chin, for which she had been recently applying a depilatory. She had a luxuriant growth of hair upon the head, and said that no female relative was affected with hirsuties. The growth of hair upon her face was first noticed at eighteen years of age. She began to pull out the hairs three years ago at long intervals, but more frequently of late. She thinks that the epilation increased the growth, but not so much as did the depilatory powder which she used.

"In twelve sittings, extending through a year, I removed four hundred and fifty hairs, one-half of them being quite fine and evincing a marked tendency to develop in size. After a six months' interval, the patient writes that the operations have proved satisfactory, although the growth has not been entirely removed, and a little more must be done to make a complete cure.

"CASE VII.—Miss —, a maiden lady of forty-six; small, thin and dark; in fair health, although of delicate appearance. Applied for treatment in October, 1880, on account of dark, curling hairs on sides of chin, and dark hairs at either end of upper lip. The growth first appeared on lip fifteen years ago. This had been treated by applications of sulphuric acid, which had lessened the growth of hair in the centre of the lip, and given it a wider appearance than the rest of the face. The hair first appeared on chin three years ago. Her mother had four or five hairy moles on her chin.

"In October, I removed one hundred and twenty-five hairs.

"In the following June, 1881, the patient returned to the city, and I removed seventy-five hairs. It must not be inferred that over one-half of the hairs upon which I first operated had returned, as in this second operation I removed many fine hairs which had been left.

"In November there were but one or two hairs at all conspicuous. These I removed, with a few more fine ones, and the pa-

tient returned to her home well pleased with the results of treatment.

“CASE VIII.—Miss —, aged about thirty; tall, dark, and of extremely nervous temperament; health good. Applied for treatment, in January, 1881, for a slight growth of hair mostly on right side of chin, which had appeared during the preceding year. She had always noticed a tendency to a slight excess of hair upon extremities, although upon the scalp her hair was rather thin.

“At two operations, in January and February, I removed thirty-two hairs from chin and left cheek.

“In June there were but five hairs to remove.

“In February, 1882, I removed twenty-seven fine hairs, which were evidently a recent development and not a return of those previously operated upon.

“CASE IX.—Mrs. —, a married lady, of about forty-five, with no children; tall, thin, and of dark complexion; health poor; applied for treatment in March, 1881, on account of a few fine and long hairs on chin, and a fibrous mole on right cheek, from which a few hairs sprung. She had first noticed the growth of hair about three years before and had resorted to depilatories and epilation. In March I removed forty-five hairs from the chin and inserted the needle at several points around the base of the mole, which was of the size of a split pea. In June, there was scarcely a trace of the mole and no hair on chin, save a very few fine ones which I removed. I have heard through friends of the patient since that the growth of hair was permanently removed.

“CASE X.—Mrs. —, a young married lady of twenty-eight; of rather weak constitution, but in fair health. Applied for treatment in April, 1880, with an abundant growth of fine, soft hair on cheeks, chin, and neck, which, if allowed to grow, would undoubtedly have produced a fine, thick, soft beard. The upper lip was free from an excess of hair, and there was no tendency to hirsuties on other parts of the body. The growth of hair began at the age of fourteen, and there had been no perceptible increase during the past three or four years. For nine years she had been in the habit of pulling out the hairs at intervals of three days, and necessarily devoting a liberal amount of her

time to this procedure. Attempts had been made to destroy the hairs by hypodermic injections of carbolic acid, but with no result save the production of a few disfiguring scars. The patient stated that her mother had a remarkably fair complexion, and that no female relative suffered from hirsuties.

“During the months of May and June I operated daily, and sometimes twice a day upon the patient’s face, and removed upward of five thousand hairs. I operated rapidly—too rapidly, as the sequel proved—and removed from one to two hundred hairs at a sitting.

“In October, 1881, the patient came again to New York, and at first glance I could not see that very much had been accomplished. She expressed her opinion, nevertheless, that the operations of the previous year had proven quite satisfactory, inasmuch as they had lessened the growth of hair decidedly. I accordingly resumed the treatment, and with the assistance of Dr. W. S. Conover removed about one thousand hairs. This left the face much smoother and more free from hair than after the first series of operations.

“CASE XI.—Miss —, aged thirty-five; of dark complexion, and in fair health; a teacher by occupation. Applied for treatment in December, 1879, with a thick and strong growth of black hairs on cheeks, lip, chin, and neck. Indeed, she would have had as perfect a beard as almost any of the women on exhibition if she had allowed the hair to grow, but for over fifteen years she had been using both a depilatory and the tweezers. Four hours at a time she was in the habit of devoting to the painful operation of removing the hair. Neither her mother nor any one of four sisters manifested any tendency to hirsuties, and the patient herself did not, except on face.

“During the first six months of treatment I removed, with the assistance of Dr. Conover, over twenty-seven hundred hairs. During the following year about twenty-three hundred were removed by Dr. Conover and myself, making five thousand hairs in all.

The patient is still under occasional treatment for the growth of hair upon the upper lip, from which would grow a strong moustache. The removal of this is very tedious, since with a

view to the prevention of even minute scars, she only allows a dozen or more isolated hairs to grow at one time upon the lip. The left side of her face, exclusive of the upper lip, is, and has been for the past eight months, perfectly free from the objectionable growth. Upon the right side the hairs were removed with less care at first, and some fine ones have been lately removed. There have been many minute cicatrices left by the needle, but they are of little account, and the result of the prolonged treatment has been most satisfactory both to myself and to the patient.

“CASE XII.—Mrs. —, a large, handsome lady, aged twenty-five, and apparently in perfect health; married four years and no children. Her skin was unusually fine and delicate, and with the exception of fifty-seven hairs growing upon her neck and a single mole upon right side of chin, there was no tendency to an abnormal growth of hair upon face or other portion of body.

“This patient’s skin seemed unusually sensitive, and as an exception to the rule she complained of the pain produced by the operation. Small wheals, like mosquito-bites, were produced at the points where the needle was inserted.

“These fifty-seven hairs were removed in November, 1881. Two months later she wrote me in accordance with my request, and stated that the red marks caused by the needle still lingered, ‘but so surely did the instrument do its work that the objectionable hairs seem to be permanently eradicated, *not one* having reappeared. The mole on the chin has entirely gone.’ ”

MISCELLANEOUS DISEASES TREATED BY ELECTRICITY.

As examples of the great utility of electricity in the treatment of many stubborn diseases, we reprint the following observations from the experience of Romaine J. Curtis, M. D., of Joliet, Ill., and published in the *Peoria Medical Monthly*, for June, 1882:

SKIN DISEASES—CHROMOPHYTOSIS.—Mr. —, aged about 23, on his travels got inoculated with the materies morbi of chromophytosis. He had carried the picture about a year when

I saw him. The disease completely covered the anterior half of the trunk, and there were patches of it on his back. He was directed to use a solution of chloral, an ointment of zinc, and to bathe twice a day with use of green soap, thoroughly washing away the loosened cuticle. This treatment was of no avail, and afterwards chrysophanic acid and mercurial preparations were used. Various other medicines were prescribed, and he continued medication for about four months locally, and I gave him cod's oil and Fowler's solution. The disease would clear up in places at times, or its products with cuticle be washed off by aid of green soap, and the surface of patches look clear for a time, but would soon be covered by a fresh plant. During part of this time he wore a special covering for the diseased surface, using a new one every day, my opinion being that the clothing preserved the germs of the disease with obvious results.

I began to use galvanism in this case as a sort of dernier resort, and because I did not know what else to do. The applications were made daily, a large sponge being applied to the diseased surface and the positive pole at different places on the healthy skin. The disease began to disappear immediately. The skin along the median line became healthy first and extended outwards until the disease disappeared.

HERPES—SHINGLES.—Mr. —, aged 48 years, had complained of heart disease (intercostal neuralgia) for several years. Latterly he had an eruption of herpes zoster, covering the greater portion of left chest. He had taken iron, arsenic, cod's oil and quinine with some benefit, and was using a lotion of cologne, glycerine and lead.

The continuous galvanic current was used every other day in this case for some time without benefit. I then interrupted the current, using varieties of tension and number of cells, but the disease refused to yield until the faradic current was used, which made short work of his shingles, greatly to patient's relief, for he was impressed that should the disease extend to the right side of his spine his life would soon terminate.

ECZEMA.—Miss —, aged 18 years, had eczema, covering left side of nose and portion of cheek, of four years' duration. She had been through the regular course of zinc, arsenic, iron,

quinine, cod's oil, etc., etc., and had "tried Homœopathy," which was found wanting. No medicine was used in the treatment of this case, but the galvanic current effected a cure in four months. The poles were applied indifferently, one being over the eruption, and the other sometimes behind the ear and sometimes on the cervical spine. After each *seance* there would be for a few hours some swelling and increased redness of the eczematous skin.

ACNE.—Mr. —, aged 20 years, had been disfigured by acne of the face since his fifteenth year. He had a long history of mortification of spirit, sulphur baths, zinc ointment and Fowler's solution. The treatment of galvanism was continued at irregular intervals for six months. Each application had the effect of so reddening the surface where the sponge was applied to the face, that the patient would take his dose only late in the evening—a sample of pride under great difficulties. He was cured, however, without lotion, ointment or medicine.

AMAUROSIS.—R. M., aged 23 years, worked in the rail mills, and was subject to extreme degrees of temperature during the "heats." He gradually became blind—could see the largest test type with indistinctness only at a few inches. He had naso-pharyngeal catarrh and sequent vomiting, steel scales, and carbonaceous matter was always present in the nasal and pharyngeal cavities, where they could be seen by the laryngoscope.

The patient was obliged to stop work, and was treated for his catarrh by sprays, and his amaurosis by galvanism for six months, when he was discharged cured. The current from five or six cells was generally used, and the positive pole applied over the eye and the other over the mastoid. The current was tempered by the rheostat, so that during its passage faint flashes could be seen. In this case the retina of the eye was anæmic.

AMENORRHŒA.—Miss —, aged 26 years, had been a teacher in public schools for eight years. During past two years she had suspension of the menstrual function and occasional attacks of asthma. She was plethoric; of good appearance physi-

cally, and complained of no local pain or other sensory disturbance. I suppose, in the light of modern pathology, her disease would be called neurasthenia, of some set of motor or gland nerves. She declined a pelvic examination, and I recommended galvanism for the amenorrhœa. The current was passed from the lumbar region through to ovaries. The *seances* were held twice a week, and during the sixth week of treatment the menses were restored, which had the effect of stopping the asthma.

LEAD POISONING.—Mrs. —, aged 23, married four years, no children; was a fashionable person of most intense personal vanity. She was a perfect specimen of neurasthenia; the antecedents and sequences of this disease were all there. She was even subject to hay fever. She had uterine disease, and had been subject to the silver treatment for a year or two by an eminent gynecologist of Buffalo. She had “wrist drop,” which was very noticeable when I made my first visit, and I suspected the cause of her abdominal pains; which suspicion was confirmed by an inquiry in this direction and the exhibition by her husband of her large collection of hair washes and cosmetics, all of which contained lead. The patient had been bed-ridden for several months. Her cosmetics were disposed of; iodide of potash was given, and general faradism employed daily for a month, when she recovered from her neurasthenia, and resumed her social standing without the aid of lead.

LUMBAGO.—Mr. —, a carpenter, strained his back by working on a cornice, and was placed *hors de combat* by pain in his back when he attempted to move. His appearance and movements were such as are always exhibited by the lame back. He came to the office three times, and a current of sixty cells was passed through the painful part, about fifteen minutes each time. The relief was marked at each dose of the remedy and the cure prompt.

Mr. —, aged about 40 years, a rheumatic subject, was brought to my office and carried in groaning from pain, which was referred to the lumbar region. This case illustrated the exception which proves all rules. I applied the galvanic current,

with very large quantity, with greatly lessened intensity, fully expecting to stop his pain and groaning in a few minutes. To my surprise he complained of an increase of the pain, and in a few minutes fainted. When he recovered he refused to allow further galvanization and would not take medicine. He was taken home and a physician sent for, who gave him morphia, and sympathized with him by remarking that "electricity was a humbug anyhow" —an opinion to which the patient gave his free assent, and I suppose they are both of the same opinion still, and that each of them knows as much about it as both, and both of them as much as either.

RHEUMATISM.—Mr. —, aged about 30 years, a laborer, native of England, had muscular rheumatism of the right leg. The muscles were tender, swollen and paretic, and he went and came on crutches. There was no evidence of venereal disease. The patient had a gouty ancestry, and the exciting cause of his own disease was working in a wet ditch. He had suffered from this disorder for several months, had taken several medicines, and received some benefit from iodide and colchicum. He was sent to me by a physician who was somewhat undecided about the humbug of electricity, and was disposed to investigate. The patient's foot and leg and the negative pole were put into a vessel of warm water, the positive pole being applied to the leg higher up. This treatment was continued daily for two weeks, when patient was discharged cured.

INDURATIONS.—Mr. —, aged about 60 years, had acute rheumatism, which lasted two months. He was treated by salicylate of soda, which failed, as he could not take it without insanity, and he was brought through by the alkaline treatment. On subsidence of the acute symptoms the tendons of various muscles in upper and lower extremities were subject to indurations, which showed no disposition to absorb. He was given iodide and colchicum without much benefit, the enlargement of the hamstring tendons and tendons of ankle joints and wrists being thick and painful. He remained without much improvement for two months, when he was brought daily to the office for galvanic treatment. The different indurations were treated separately by passing the galvanic current through them. The treatment was continued

daily and every third day for three months, when the indurations of the tendons were absorbed and the normal functions restored.

Mr. —, aged 37 years, a merchant, sprained his ankle severely, which injury was followed by an induration of the tendo Achilles. The tendon in lower half of its length was more than double its natural thickness. This deformity was treated every other day for a month with the negative pole attached to a roller electrode, thus combining the electrolytic effects with massage, a very convenient and efficient method. The tendon was restored to its morphological and physiological integrity.

NÆVI MATERNI.—Miss —, aged 12, had a port wine mark on her left cheek about the size of a dime. The natural beauty of the anatomical deformity was somewhat deteriorated by several applications of some sort of caustic, which had, however, not removed it. Three fine needles were inserted through the nævus, carrying the negative pole, and the positive was placed near by on the sound skin. The current from the cells was used about five minutes. In a week the operation was repeated, and the nævus disappeared.

Miss —, aged 16, had a prominent, raised, purple nævus on the left cheek; a physician had attempted its removal with a faradic machine, and afterwards applied caustic, and then suggested cutting it out. In this case four electrolytic applications of galvanism were used, which removed the mark.

Mrs. —, by some slip of the embryonic tissues, had a spot on her left upper lip about half an inch in diameter, from which sprang a vigorous growth of hair. I undertook to destroy the hair follicles in this case, and succeeded after the following method: A small needle (negative pole) was pushed into the follicle beside the hair and held in position about five minutes, the lady holding the other electrode in her hand. Five or six hairs were thus abused at each *seance* until the whole crop was removed. This is an operation which is tedious and very useless, unless there is considerable beauty behind the unnatural growth. It is, however, a very satisfactory operation for the patient.

LOCAL ATROPHY.—Mr. — received an injury to the shoul-

der in a railroad accident. There was nothing of dislocation or fracture, but the injury was followed by atrophy of the deltoid muscle. There was no antecedent paralysis; but the muscle, what was left of it, would contract by volitional stimulus, though there was not force enough to raise the arm from the body to a level with the shoulder. The faradic current was used in this case with the roller electrode for three months, the applications being made two or three times a week, when the muscle was restored in form and function.

Mr. —, about a year before I saw him, was thrown from his horse, striking on the back of his right shoulder. The arm was useless for several months from pain and paresis. On examination the spine of the scapula was his most prominent morphological feature, by reason of the atrophy of the muscles above and below. Electricity, faradic and interrupted galvanic, with massage, were used for this deformity for a year with the result of making restoration, which, though not complete, was serviceable.

Mr. —, aged 23 years, had typhoid fever, the duration of which was six weeks. During convalescence he over-fed and was relapsed for nearly two months. He finally recovered from this illness, and rapidly gained his average weight of 170 pounds; but three months afterwards his gait was ataxic, for the reason that he had lost sensation of his legs and feet. There were no pains in legs, nor other evidence of tabes, except diminished sensation. The faradic current was used in this case, and fully restored the sensation of legs in a month's time. The applications were made daily by placing the feet in a bath containing one pole, while the other was applied on the extremities above—to the spine or held in the hands.

THE WRONG CURRENT.

From the proceedings of the New York Medical Society, and published in the *Medical Record*, we glean the following important items, which entirely agreed with our own observations.

Dr. Rockwell thought that the mistake could be best pointed out by reporting a few illustrative cases, from a score or more that might be narrated:

Mrs. —, an opera singer thirty years of age, was sent to him by Dr. J. B. Read. Several months before, while singing in public, she was suddenly attacked with left *facial* paralysis. The eye refused to close, she subsequently suffered from severe cephalalgia and marked vertigo. The physician to whom the patient first applied prescribed electricity, used it a few times, and then directed her to buy a small faradic apparatus, and apply the current along the course of the affected nerve. This was done faithfully for many weeks, but with negative results. On examination, no response, as might have been expected, could be obtained by the use of the faradic current. Galvanism, however, at once produced faint contractions, and three weeks after the proper treatment was begun, farado-muscular contractility returned, and recovery to a good extent had taken place.

CASE II.—A boy, four years of age, suffered from cerebrospinal meningitis, which was followed by *complete paralysis of the right leg*. The patient was sent to Dr. Rockwell by Dr. Chauveau. Before Dr. Chauveau saw him a physician had recommended the faradic current, and it had been used faithfully, but without benefit. On examination there was no response to faradism, and only slight reaction to galvanism. Under the systematic use of the galvanic current, however, improvement began, and farado-muscular contractility was finally restored. The improvement in the power of locomotion was coincident with that of the electro-muscular contractility. Dr. Rockwell thought there could be no doubt that in both these cases the failure to correctly differentiate in the selection of the method of treatment not only interfered with the rapidity of recovery, but in one instance, at least, might be the cause of some permanent disability.

ELECTRICAL CONDITIONS OF THE MUSCLES IN FACIAL PARALYSIS.—In facial paralysis the farado-muscular contractility is either normal or decreased, but the galvano-muscular contractility may in addition, in certain cases, be *increased*, while the reaction to the faradic current in the same cases is either wanting or very much diminished. In these cases the galvanic current must be used with increasing strength, at each sitting, in order to keep up the vigor of the muscular contractions when galvano-muscu-

lar contractility is reduced to normal, or sometimes before faradomuscular contractility becomes manifest, and a rapid recovery usually follows.

Dr. E. C. Seguin said, with regard to the use of *the actual cautery*, that his experience was very much in accord with that given by Dr. Rockwell. Occasionally remarkable results were obtained from one or two applications. He had found it very serviceable in exceedingly painful cases, as well as those of the character described.

With regard to the simplicity and painlessness of the application, he entirely agreed with Dr. R. Sometimes considerable argument was necessary to induce a patient to submit to the first application, but he had not had any trouble whatever concerning the second operation; indeed most patients returned of their own accord and asked for the use of the cautery. The question of the *utility of the two electric currents* he regarded as a very important one. But he thought it possible that in one of Dr. Rockwell's cases at least, if it had been left to nature, the patient might have recovered without electricity. It was probably a case of paralysis from lesion of the nerve, whether from superficial pressure or from reflex action upon the nucleus of the nerve was uncertain, but there were good reasons, from clinical history and from electrical reactions, to assimilate it with cases of ordinary nerve injury. In such cases he thought there was a fatality in the degeneration and regeneration of the nerve, and he doubted very much whether measures commonly used had greatly to do with recovery. The process of regeneration is much slower than that of degeneration, but it takes place with a great deal of certainty, and in a majority of cases of facial paralysis the recovery was through the process of repair of the nerve, and the consequent repair of the muscular tissue. He agreed entirely with Dr. Rockwell that the faradic current was next to useless for several weeks or months, and he also doubted whether galvanic applications had much to do with recovery. The changes in the electrical and nutritive state of the muscular fibres produced by the application might do something toward keeping up the nutrition of the muscle, and preserve it in a condition fit for action when the nerve had improved. He did not, however, believe that electrical currents could hasten cell growths.

The inutility of the faradic current in facial paralysis was a point worth directing attention to, and undoubtedly ignorance with reference to it had many times brought discredit upon the profession. www.libtool.com.cn

Dr. Janeway said he had long believed that the great value of the galvanic current in facial paralysis was two-fold.

In the first place, it gave a means of making a prognosis with regard to the probable time required for recovery. If the faradic reaction was destroyed and the galvanic preserved, the great probabilities were that it would require more than two months for recovery to occur, probably from three to six months.

In the second place, it was valuable in keeping up the nutrition of the muscles. The faradic current he regarded as totally useless in these cases, to say the least. Dr. Janeway then referred to a case of *facial paralysis* of the peripheral type, due to exposure to cold and occurring in a child eight months old.

With reference to the actual cautery, he had to admit the same doubt that Dr. Seguin had expressed concerning the utility of the galvanic current. He was sometimes in great doubt as to whether the good results were due to the mental effect or to the actual influence of the cautery. It was very frequently difficult to separate effects produced by an agent itself from those produced by the imagination.

In connection with the sequelæ of cerebro-spinal meningitis he had used, with benefit, the actual cautery along the side of the spine, in addition to blistering in the upper cervical and occipital region.

Dr. Rockwell said he was very nearly in accord with the views expressed by Dr. Janeway and Dr. Seguin concerning the use of the two electric currents in the peripheral form of facial paralysis. The aid afforded to nutrition by the use of the galvanic current was very important. His chief object in reporting the cases was to direct attention to the necessity of correctly differentiating between the two currents.

Dr. Putzel referred to a case in which the faradic current used in facial paralysis produced actual harm. The paralysis was due to exposure to cold, and the degenerative reaction was well marked. The result was twitchings, followed by contracture, which was persistent.

Dr. Seguin wished to put upon record his experience with reference to an undescribed sequel of facial paralysis due to cold, namely, a condition of marked twitchings corresponding precisely with post-hemiplegic chorea. Within the last eight years he had seen four or five recovered cases of facial paralysis in which, during the period of actual recovery, there occurred clonic twitchings, short, lightning-like jerks of muscles formerly paralyzed; and this phenomenon occurred without mislaid treatment or contracture.

Dr. Putzel thought there was a difference between this condition and post-hemiplegic chorea, because in the latter there was a slow movement of one muscular fiber after another, while in these cases the muscle twitches as a whole and then subsides.

Dr. Seguin remarked that the point brought out by Dr. Putzel was an interesting one. He had shown to his class a graded series of cases in which there were post-paralytic movements, and had been able to show two or three varieties in a single lecture. He had classified the cases into (1) those in which athetoid movements occurred, (2) those in which the movements were more marked, and (3) the ataxic cases. The shading off from one condition to the other is sometimes exceedingly delicate.

Dr. Roberts, as illustrating how widespread the opinion was that the differentiating of the two currents was not a matter of much practical importance, said that not long since he heard a college professor explain to his class the feasibility of treating all cases with an ordinary faradic battery.

Dr. Birdsall referred to two cases of facial paralysis of peripheral origin, in which there were contracture after a number of months and muscular movements of the quick variety. He had used the galvanic current in facial paralysis with the result of giving the patient relief from the feeling of tension.

A WORD TO BEGINNERS.

All physicians before commencing the use of electricity, should remember that this agent will not cure everything. In fact, there are many cases in which it is not available,

and instead of being useful it may do much harm. Again, in all cases where its proper application might prove beneficial, it should be used by a skilled hand, or administered by one who is quite well acquainted with the instruments employed, and the effects of the currents generated by them. The practice of putting electricity and electrical instruments into the hands of the people, to be used hap-hazard, as domestic remedies, should be discouraged, even prohibited. Just as well put any other potent remedy in their hands, and tell them to go ahead, for no measure employed by the medical profession requires more skill and experience in its successful employment than electricity. The common use of electricity by the people, all over this country, mostly by means of very cheap and inefficient instruments, can only result in disaster to nearly every patient who suffers such quackery to be imposed upon him. And, in many cases, where the good results looked for are not realized, electricity is held responsible, when, in fact, the measure itself is not to blame. The use of electricity should be confined to the medical profession, and its members should thoroughly understand it, and always use the very best instruments to be had. When this comes to be the condition of things, then electricity will be fully appreciated, appropriated when it may do great good, and avoided when it can only do harm. It is to be hoped that every intelligent physician in the country will discourage the foolish practice of advising *families* to buy batteries, and use them upon the different members of the household who may happen to complain of pains and aches here and there. Such a practice is exceedingly reprehensible.

To succeed in the use of electricity, it is not only imperatively necessary that the operator understands the instruments used, but that he has a good knowledge of the disease he undertakes to treat; and then he must give the matter his personal attention. And it should also be remembered that time is required in bringing about favorable changes with electricity. It is true that much good may result from a few applications of electricity, but we more frequently find that great changes and permanent good result from the long continued and patient use of this measure. Patience is positively required in the use of electricity; and un-

less operators have sufficient faith, and the patient confidence to continue treatment for any reasonable length of time, it is hardly worth while to commence. These are the essential requisites in the use of electricity, and if properly observed, there is enough in these papers to guide any intelligent physician in the successful application of this great therapeutic measure.

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