

Garratt (A. C.) ^{C. 1/5} Porter M.D.
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author

ATMOSPHERIC ELECTRICITY
AS A REMEDY.

A PAPER READ BEFORE THE SUFFOLK DISTRICT
MEDICAL SOCIETY, OCTOBER 28, 1882.

BY ✓

ALFRED C. GARRATT, M. D.,

MEMBER OF THE MASSACHUSETTS MEDICAL SOCIETY, ETC.

[Reprinted from the *Boston Medical and Surgical Journal* of
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CAMBRIDGE:

Printed at the Riverside Press.

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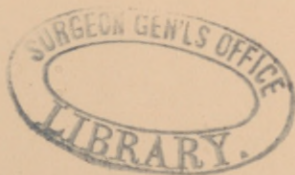
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FRANKLINISM ;

OR,

ATMOSPHERIC ELECTRICITY AS A REMEDY

BY A. C. GARRATT, M. D.

THE old-fashioned friction electrical machine, consisting of a glass globe or cylinder, or later of a single glass plate, has recently been so wonderfully improved and enlarged as to be in practice a comparatively new apparatus; more powerful and efficient, more certain and uniform in action at all times, and affording a wider use of static electricity in medicine. The friction machine, as is well known, would not work in stormy weather, nor when the atmosphere was damp, humid, or *nil*, unless the room and machine were kept warm and dry by fire, and sometimes not then. When it did work it gave sparks of only one or two inches in length, at best. To make up for this it was formerly the practice to accumulate the electricity in Leyden jars, and then apply it by shocks. But all this is in the past.

The new large sized *static-induction* machine — I refer to the improved Holtz, or Toepler-Holtz — is found to work at all times, in any weather, and with or without fire in the room. We can now at any moment get either a stream of fine little sparks that are numerous, rapid, and mild, or graduated stronger and longer sparks, from one to seven or even ten inches in length, repeated every few seconds or more often, for any length of time. Or they can be increased so as to resemble flashes of lightning attended with reports like those of a pistol. Yet this surprising power, made so manifest in this form from the machine, can be com-

pletely controlled and so as to be to the patient a comfortable, general electrization, formerly called *the electric air-bath*. Thus we can now apply long and heavy sparks, as in cramps, palsy, or anæsthesia; or sustain the patient enveloped from head to feet in an electrical potential, more or less high, for a longer or shorter time, as a general nerve tonic, and all the while as exhilarating and refreshing to the person as sunshine in winter, or a cool breeze in the heat of summer; and what is more important, the good effect of this is lasting. To imagine that this new machine, of seven glass plates twenty-five to thirty inches in diameter, is like the old friction machine, would be like comparing a powerful and beautiful steam engine to a tea-kettle.

With this immense advantage the medical use of atmospheric electricity is already revived with great success, in Germany, by Professor Clemens, and others; in Austria, by Professor Sewanda; and in France, by Professor Charcot, especially at his clinic in Paris, where he is aided by Dr. Vigouroux. This static-induction apparatus of *many plates and large size* must hereafter hold a prominent place for providing this most natural form of electricity in all more complete and thoroughly efficient electro-therapeutics. Not by any means supplanting the invaluable primary or secondary apparatus, but supplementing them at office or in hospital, with a greater efficiency of medical electricity when thus in ample quantity, and possessed of the peculiar statical quality, such as those cannot provide. But I insist, it is only the *large-sized* machines that are uniformly able to fulfill satisfactory results, and these are expensive. A machine of this kind having only two plates, if of large diameter, will produce quite long but *thin* sparks of relatively high tension, while the addition to the machine of several more plates, of like diameter, will increase its ability to produce greater quantity of electricity, hence thicker sparks when required, and ability to charge and sustain the insulating chairs and table with a high potential in all kinds of weather, which is a point of first importance.

This "improved" Holtz machine is now not only being used in Paris and Berlin, in Vienna and London, but is already in use here in Boston, by myself; in New York, by W. J. Morton, Professor Hammond, and others; in Philadelphia, by Professors Blackwood and Bartholow, and is destined to be found hereafter, at least, in all large cities, medical centres, and in hospitals, in this country. The ordinary medium or smaller sizes and few plates of the Holtz, or Toepler-Holtz machines, have for some time been placed among the philosophical apparatus in many of our colleges. But are medical teachers and practitioners generally aware of the positively nerve correcting power of "static electricity," when provided, as now, in ample quantity, at all times, and yet under delicate and complete control for efficiency and absolute safety?

The name electricity, as it relates to therapeutics, has now become merely a generic or general term. We cannot but see the increasing necessity of more definitely designating its particular form or classification, and the precise mode of application in every case, whenever it is referred to in regard to treatment, as in reporting cases. It is not enough to state simply that electricity was applied. But who applied it, from what instrument or source, and how. These must appear, or the report is of no value. However, this paper is written not with the intention of covering this field, nor even any division of it, but to recall attention to its methodic use, and as an example of what has been and can be effected, often most promptly in some difficult cases, by means of this improved franklinism.

Although perfectly well known to many, we need to restate and familiarize the fact, that more than heretofore we are to recognize three distinct kinds of electricity for remedial uses, provided from three principal sources, by three distinct classes of apparatus, each producing electricity with very different and important characteristics peculiar to itself, which can be again modified so as to produce certain effects that can-

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not be replaced by any other. For it is fundamental that though in its nature electricity is always the same, yet its effects and ultimate results are decidedly varied, according to its source, form, and method of application. Hereafter it may be convenient for us to recognize the following classes:—

First Class: "Static Electricity," the oldest form known, is derived from the atmosphere only, and when employed as a remedy is termed franklinism.

Second Class: "Galvanic Electricity," and the voltaic (for these two may here be reckoned together as the same, each being produced by chemical action, as from moist metal plates in the voltaic pile, or wet metal plates in the cell of the galvanic battery, it being of the same nature and producing the same effects under like conditions) is known as the "primary" current, whether it is employed as a constant, or continuous, or interrupted current, and as a remedy it is or should be invariably termed galvanism.

Third Class: "Induced Electricity," which embraces all those phases of the familiar "secondary," interrupted, and usually *to and fro currents*; induced and greatly increased in certain physiological effects by means of a helix or coils of wire, either from the primary current alone, or from the primary with magnetism, or from magnetism alone, and of late from the static, each of which should be exactly and invariably expressed, as either the static-induced, or as electro-magnetism, or as magneto-electricity, when produced by a revolving armature in the presence of a magnet; all or either of these as the *induced* or "secondary," and when employed as a remedy the general term is faradism.

It is in regard to the greatly improved apparatus of the first class only, and the excellent effects of the electricity it provides, that our particular attention is attracted at this time. Having had considerable and diversified experience of late with static electricity from the improved Holtz machine, the writer is impressed

more than ever with the great (and in many cases of a certain class of diseases the superior) merits of the *static* quality and quantity of electricity, because of the decidedly good and quick work it can do in many difficult cases; so that he wishes all physicians to realize its availability, efficiency, and usefulness.

Considering the present almost general indifference of the profession as a whole to the remedial value of the old form of "static electricity," it recalls the quite general apathy and actual disbelief in some quarters in regard to the safety and power of the primary current or galvanism as a remedy, at the time when the writer first called the attention of this Society to it in 1857, now some twenty-five years ago. We can here appreciate the feelings of my friend Dr. W. J. Morton, when he, fresh from Europe and clinical experience with the static form, first presented this subject before the Academy of Medicine in New York some time ago, and showing the greater facilities of the Holtz machine for providing medical electricity said, "It may at first sight appear an act of temerity to ask attention to a method of treatment now so antiquated. But if, from this point of view, any apology is needed, it is simply that the writer, after careful trials in his own practice, of the medical merits of static electricity, feels a natural desire to have others realize its value. Believing, as I do, that in again giving it a trial we shall take a real advanced step in the cure of diseases, I have ventured to bring this subject before you at this time. The invention of Holtz began in 1865, and marked out for modern static electricity in medicine the possibilities of a new career. In the Holtz machine we have the means capable of furnishing electricity of high tension and in great quantity. By means of the two condensers and the ability of increasing the number of glass wheels, both the tension and the quantity are within the control of the operator. It gives with ease an eight-inch spark and a great *quantity*. Its constructor is Andeiveau, of Paris, while to

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Dr. Vigouroux, of Professor Charcot's clinic, is due its present adaptation to medical use."

The first medical use of atmospheric electricity, after a time termed "static," dates back one hundred and fifty years. For a long time thereafter the term electricity or electrization covered the whole subject, for that in fact was the whole of it. During a whole generation men obtained electricity from one source only, by one kind of apparatus, and only employed it for remedial purposes, and that by one principal method of application, namely, the shock; sometimes, however, by sparks. The limited power of the friction apparatus no doubt led to that mode of use. For seventy years or more static electricity as a remedy flourished and grew into much favor and use, notwithstanding its capricious action in variable weather, and the crude and cruel method by shocks, as was then generally practiced in England, here, and throughout Europe, even from 1730 to 1800, when the galvanic current was discovered, and the voltaic pile was constructed. Within that first epoch, from 1742 to 1760, Dr. Benjamin Franklin not only experimented successfully to learn something of the nature of this newly developed force, but he also devoted much time to the treatment of many cases of rheumatism, neuralgia, cramps, pains, and palsy, at Philadelphia, and some of them with marked success, using, of course, static electricity, the only form then known. No doubt Dr. Franklin was the first medical electrician in America.

Early in this century, however, the frictional electric machine became gradually neglected or supplanted, for it certainly was much less in use by medical men, possibly from its inconvenience, and partly from the peculiar effects, physiological and remedial, of the galvanic current, obtained from the voltaic pile, or from the new compound battery cells. To my mind it was still more from the disgust physicians must have had for the increasing fashion of hawking about small electrical machines with ample chains and battery of Leyden

jars to exhibit at public fairs, shows, or museums, and "shocking" men and women there in platoons and by wholesale to prevent or cure them of consumption, decrepitude, palsy, or rheumatism.

Some years after, in 1832, Faraday appeared with his new-found *induced*, interrupted current, obtained from the galvanic or primary current by induction. Then, soon after, came Dr. Charles Page, of this Commonwealth, with his very ingenious and portable arrangement of helix and cell and automatic vibrator, for providing physicians with this new form of electricity so admirably adapted to certain medical uses. Faraday at once named this the "secondary" current, in contra-distinction to the galvanic or "primary," which was its source. Still, in many countries the old static form continued somewhat in professional use even up to twenty-five years ago, if not later. While abroad in 1857 the writer found frictional electricity now and then resorted to in some certain cases by very eminent men in Edinburgh, Paris, and Berlin, in Marseilles and London, but nowhere in this country at that time could we learn that it was employed by any in the regular profession. Todd and Bowman were using it from a large machine in some cases at King's College Hospital, while Golding Bird, Sir William Gull, and Wilks quite frequently referred certain nervous cases to "the electrical room" of Guy's Hospital (which room was kept by a fire constantly warm and dry) for sparks to be given or drawn, or for general insulation and electrifying. At the same time Duchenne, of Boulogne, was demonstrating the superior usefulness of electro-magnetism, while Prof. Robert Remak was advocating at Berlin the surprising and superior remedial power of the primary current by direct applications, and by central galvanization, especially for profound nervous diseases of the head, or central ganglia.

Suffice it to say I was strongly impressed with the peculiar utility of all the three forms, especially the

primary current from a compound battery, and the static from a friction machine; they as remedies were then to me new and unique. From what I there saw in the few selected cases of the marked good effects by the static form, I provided myself also with a first-class static machine, which has been more or less in use in my electrical rooms in this city almost to the present time, it being, no doubt, the most worked, exclusively for remedial uses, by a regular physician, of any apparatus of that sort in this country. After all, the friction machine, working only at times, was found to be quite limited in its range of usefulness, because it produced too little for the electric air bath, and we could not increase or accumulate it by Leyden jars for any practical purposes, as I had determined never to use it as a shock. For these and other reasons its occasional good effects could not be reported, nor could the method be recommended to the medical profession.

Notwithstanding, in my own experience during the many years, when other treatments were baffled, and only slight applications were required, positive sparks, an inch or two long, could be elicited from the prime conductor, or negative sparks from the rubber end, so making very efficient localized effects. The former succeeded admirably sometimes in cervical, occipital, and facial neuralgias, also for recurring pains along the back or about the thorax and heart. Recent experience with the Holtz machine while the patient is well insulated on the platform chair, and fully charged generally with positive electricity, the negative sparks being thoroughly *drawn*, proved it a rapid remedy often for chronic muscular, periosteal, or arthritic rheumatism, for cramps in the muscles of the limbs, or of the diaphragm or stomach, or cramps anywhere, especially if it is also directed to the cervical and dorsal spine, also for some of those obstinate "shoulder cases," lumbago, and sciatica, for soreness and stiffness in overworked or strained muscles. Fine positive sparks or electric spray can be directed to the closed eyelids in

cases of pains in the eyeballs occurring in delicate persons when caused by fatigue of the ciliary muscles. Longer and stronger sparks are required in local palsy, writer's palsy or cramp, lead palsy, etc.

Does this appear difficult or unsafe? From much experience I am sure it is neither. For example, with the new apparatus and appliances we can give the spray or positive sparks to the temples or about the head for neuralgic headaches. As aid in the treatment of some cases of dim sight and partial amaurosis, as from chronic alcoholism or use of tobacco, or from over-use, the application needs to be reversed and increased, so as to *draw* less frequent and larger sparks from the closed eyes and about them, endeavoring all the while to hold or maintain the eyes, one at a time, in a high positive electrical saturation. This is important. It is accomplished by first placing the patient on the chair, and, while fully charged positively, bringing the gold-pointed electrode connected with the negative main conductor or grounding approximately near the eye, say within three or four inches at first, then as the patient gets used to it bring it nearer. Then replace it, if well borne, by a large ball electrode, with slower turning of the glass wheels, so near only as to allow few sparks, within the bounds of pain and flashes of light, at first, always beginning gently, never working here very painfully nor long, while carefully watching the effects. Repeat these sittings daily or once or twice a week, according to the after-effects brought about. Bearing in mind that though the whole person is enveloped in electricity, yet while the electrode, pointed or ball-shaped, is held near the eye, ear, throat, or any other point of the body, there is accumulated at that point a still higher potential of electricity in the tissues beneath the skin, but of the opposite quality; also that at each disruptive discharge, if of considerable strength, as for palsy of the limbs, the long sparks are believed to either penetrate to the periosteum of the bones, or by induction to disturb the elec-

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tricity of the tissues to that depth, so producing a radical nutritive change. But to clearly understand this versatile power we are working with, and which is to be so important to physicians, we must further analyze and understand this wonderful apparatus known as the Holtz machine.

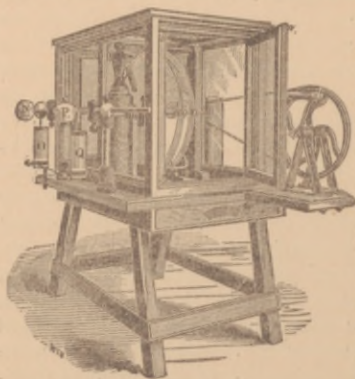


A DESCRIPTION OF THE HOLTZ ELECTRICAL MACHINE.

THIS beautiful apparatus, which produces static electricity, by induction, in great quantities, is far superior to the old-fashioned friction machine, especially for remedial purposes. More than heretofore we shall recognize *three principal classes* of electrical apparatus: the first for franklinism, the second for galvanism, the third for faradism. The Holtz or the Toepler-Holtz, if of large size, is the best of the first class.

The improved large-sized Holtz electrical machine the writer is using of late, and would recommend in "medical electricity," for treating certain classes of cases, consists of seven circular glass plates, all adjusted parallel across the main shaft, and near to each other, so as to leave only thin spaces between them.

Four of these glass plates are covered with shellac, and are fastened to the shaft, being twenty-five inches in diameter, and can be revolved slowly or more rapidly by hand or motor power, and by aid of the mul-



tipling wheel. The other three glass wheels are twenty-eight inches each in diameter, fixed alternately between their revolving fellows, and are continually stationary, being held by insulating bearings and screw clamps at their outer edges. Each of these latter wheels have three large holes cut in them, one circular and large enough at the centre to allow the axis of the revolving plates to pass through without touching them, while the other two oval openings, called windows or cells, are at opposite sides of the horizontal diameter. Fixed on these glass wheels at opposite sides near the edges of the windows are pieces of stiff paper, covered with gold foil, notched on their edges where they appear just within the side of the windows, so as to lean a little over towards the nearest revolving plate, as accumulators.

Near the outer or other sides of each of the *revolving* plates, in rather wider spaces, and opposite the gold points in the edge of the windows in the alternate stationary plates, are horizontal brass arms with metallic combs and gold fringes, reaching in between the glass plates, for taking up the electricity and leading it on to the two main conductors. The other brass arms with gold fringes, that brush the glass wheels, and are seen to be fixed at an angle of forty-five degrees, are for maintaining the reliable position of the positive and the negative pole; at the same time, together with the small piece of cat skin next the rear glass wheel, they also act to insure the "initial charge" in starting the machine; all of which is inclosed in a large plate-glass case, with a strong mahogany frame and doors, made as nearly air-tight as possible. The two main conductors, P. and N., project out forward by piercing the front glass plate of the case, some two feet apart. The *positive* pole is on the right hand, and the *negative* is on the left, as we face the front of the machine. To these are attached two small glass condensers, with a connecting rod between them.

Outside the glass case, and near the outer ends of

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the two poles, or main conductors, are two brass sliding rods, one of which passes through each pole or arm, and at right angles to it, while in line with each other, so as to graduate any degree of distance between these main poles of the apparatus. These sliding rods can be drawn back entirely out of the way, or approximated more or less, or even made to touch each other, as in preparing to make some kinds of applications, in regulating the length and strength of spray, sparks, and electric currents. Within the glass case a dish of some kind of dryers, as quicklime or chloride of calcium, may be placed to insure a dry air within and certain action in all kinds of weather. The versatility of use and surprising efficiency will appear on further examination of this wonderful electric; but its cost and size may for a time limit its use to hospitals, dispensaries, and office use, for it is not portable.

To work this machine it must be put in motion by hand or motor power, always in such direction that the plates revolve *towards* the gold-paper *points*, which are in the cells of the stationary plates. The first revolutions self-charge this machine, because a small piece of cat skin thus becomes slightly rubbed between the two rear dielectric plates, one of which receives on one of its sides the very minute quantity of the negative, and the other plate, in like manner, an equal amount of positive electricity, which serves only as an *initial* inducing charge, for by the law of electro-static induction, long known, namely, that when one kind of electricity is found on one side of a glass plane or jar, its opposite kind will appear on the other side. Its presence here and in the cell quickly starts a general reaction that passes from plate to plate until all are generating the electric force in very great quantity and tension, which at once accumulates in all the cells of the stationary plates. From thence, as fast as made, the metal combs and brass transfer arms lead it on to the main conductors, the positive from the top of the glass wheels to the right hand, the negative from the

lower part of the wheels to the left conductor in precisely equal quantities, so that in practice we always find the right-hand pole yielding positive or + electricity, and the other negative or - electricity. This is, then, in no proper sense a friction machine, nor is it depending on grounding, but works by a process of induction and transfer peculiar to itself.¹

A very significant fact here is that we have in this Holtz machine *two* main conductors (instead of one prime conductor, as in the friction machine) and *two* small condensers, O and Q, each about the size of a six or ten-ounce vial. Larger ones come with the apparatus, to be used when we want very large accumulation, or very large and long sparks. One condenser can be attached to each of the main conductors. They always fill or charge inside with the same kind of electricity as the conductor, but outside they are charged the reverse of their inside and the conductor to which they are attached, but most likely yield a current by a double induction, so that this secondary positive pole is still on the right hand.

From this description it may be seen that we can get from this apparatus *two* different electric circuits. The first, of course, is direct from the main poles. This is the source for charging the insulated chair and patient in most of the various methods of electrizing; as for giving or drawing sparks, or spray, or both, or for using it as a *primary interrupted current* by means of the spring and sponge electrode. A long and large brass tube can connect to either pole, or to grounding. Flexible insulated chain or wire conductors can connect the electrodes to either pole, or both, or to grounding. This machine works best for some applications with grounding; in other applications, as when using the secondary current, without grounding.

The second source or route of an electric circuit, and that of a different quality, is from the lower *outside* of

¹ These machines and appliances can be had of J. & H. Berge, New York.

the two glass condensers that are attached respectively to the two main poles. This is a truly induced *secondary current* of very great remedial use and value. It is peculiar for retaining the static characteristic, and the writer believes it to be in effect a one-way flowing interrupted current. This description of this current is believed to be new, as it has never been mentioned before, to our knowledge, in any medical or other scientific work.

Holtz, the inventor of the apparatus, must have been aware of this secondary current, from the differently charged condensers, because he provided a small rod to connect them, and so close or complete this circuit when required. My friend, Dr. J. W. Morton, of New York, who first made use of this current as a remedy, we see accepts it as an induced to-and-fro current, like the electro-magnetic. Indeed, he so defines it. The presence of an induced electricity about the outside of Leyden jars was known long ago, but not as a current. The fact of this static induction led Faraday to persevere for years to find the induced or secondary from the galvanic. His first discovery of it was not an accident, but the result of experiments based on philosophy. But no form of the old friction machine could produce and maintain such a current as this. It was impossible. This static secondary *current* was not in existence until the Holtz machine appeared. Dr. Morton was the first to arrange and use it for medical purposes, and called attention to it, for which the medical profession are under very great obligations to him.

To clearly differentiate this from the proper induced static electricity of the Holtz, or Toepler-Holtz machine, this lower current, taken from the outside of the two condensers, may be designated as the *static secondary current*. From its action and effects I believe it to resemble that scarce and choice interrupted one-way current, called by Faraday "the extra current," because it is re-induced in the coarse inner wire coil

within a large helix, when it is worked by several galvanic cells. The extra current was the one so much employed by Dr. Duchenne in accomplishing his wonderful works in Boulogne and Paris. Now this static secondary current is even more desirable than the extra, because it consists of great quantity with far less intensity; hence less painful and more efficient.

In using this static secondary current in practice, we must employ two moist, sponge-faced insulated electrodes. Remove the connecting rod from the condensers, also the others from chair or grounding, and bring the sliding rods above close together. Start the revolving plates quite gradually at first, until fine sparks appear above between the ball ends of the two sliding rods, which now must be very slightly separated to a quarter inch more or less, when will be realized the most decided and delicate electro-muscular action. This can be modified so as to meet a wide field of need, because efficient with so little that is disagreeable. In the young, and for the more delicate of any age, it is practical, as for local palsy, or cold rheumatism, and many cases of neuralgia. This in fact is localized static electricity. It is then very important to know and realize the peculiar character of this new electric current in therapeutics. As already stated it retains the static characteristic of quantity, with small intensity, which is significant. It is not made up of to-and-fro or alternate waves of a current, like the galvano-magneto-electric current. This is open to proof or disproof, but, believing it can be demonstrated and established, the following is offered from among other tests as evidence:—

First, arrange the machine, by removing the grounding conductor, also the small rod from between the condensers, and see that the ends of the sliding rods are brought close together, within a quarter inch or less before beginning. Then take the two sponge-faced electrodes, moisten them, and hold them face to face while their flexible conductors connect them

to the two condensers near their base. When all is ready start the machine and speed up; then begin slowly to separate the electrodes and watch the effect. There will appear a multitude of fine sparks or *streams of electricity* mingled in a glow of purplish light between the sponges. If the speed is good and one of the sliding rods is gradually drawn outward, these streams become less in number but longer, while emitting very strong fumes of ozone, that presently fills the room. Even when the sponges are applied to the arm or hand, with the sliding rods close together, there will appear the streams of electric fire on the skin. Evidently here is the static quality made manifest in this very peculiar secondary current.

Again, if we take the same electrodes and apply them separately, one on the inside and the other on the back of the hand, while the sliding rods are an inch or more apart, and then start the wheels, at first moderately, until a spark appears between the sliding rods, there will be felt a distinct single sensation of electricity in the hand; and as these succeed each other we are enabled to count and compare them. They are found to synchronize precisely with each disruptive spark. Now, as the sliding rods are brought gradually closer together, and the sparks are shorter and more frequent, we still are able to count them and realize that they are simultaneous with the sparks of the same number, and no more, until they are too frequent to be counted, but right for treatment. Is not this satisfactory evidence of a simple interruption of an induced one-way current? This is capable of demonstration by any one familiar with electrical apparatus.

There is one more *method* of application of electricity from a Holtz machine that ought to be described in this connection. Though placed last on purpose, yet it is one of the very first in importance, because of so frequent and wide range of use. I refer now to the current proper, *the static primary interrupted current*, if it may be so called, that can be taken from the two

main conductors in this wise : First, arrange the machine for it by drawing the sliding rods close back, and see that the large-sized condensers and their connecting rod are all in place. Seat the person on the insulating chair and connect them by the long brass tube with the negative pole, and remove all grounding. Select now the *spring and sponge electrode*,¹ only one, and connect it by a flexible conductor to the positive pole, start the machine, and speed up. Then place the moist sponge face of the electrode on the skin, for instance, in the palm of the hand of the person over the palmar arch, and pull the spring very little and gently until sparks appear between the brass balls on the back of the electrode. As the sparks then can be graduated to need, most lively responsive nerve and muscle action is made visible, and are mildly felt. By turning the sponge of the electrode on its edge the interossei and lumbricales can be reached from the back of the hand, and seen to exercise, with only moderate sensation. All or any of the muscles of the leg or arm or fore-arm, flexors, or extensors can be made to exercise freely without pain. The effect of this method is not only local but also general. The loose hairs of the head are seen to float in waves, synchronizing with the interruptions marked off by the visible sparks. Patients take it well. It is adapted to a large class of delicate ladies, children, and men who are very sensitive, timid, or unable or unwilling to bear much sensation, yet who are neuralgic, rheumatic, weak, or paralyzed, and need effectual applications. The strength of any electric application can always be regulated by the revolutions of the wheels.

Though static electricity is the principal theme of this paper, it is not to be supposed that the writer advocates its use in every case, nor necessarily in every kind of affection, nor in all stages of any affection to the exclusion of one or both of the other forms

¹ This electrode was first made by Mr. Berge, of New York, for Dr. Morton, by whom it was designed.

where electricity is indicated. Skill is required in selecting the cases for electrical treatments, as well as in choosing the class of instrument, the electrodes, and the method of application, and, perhaps, alteration. It is not electricity alone, but its wise and correct application, that cures. For instance, the static is the most apt and speedy remedy for painful cramps and contractions in any part of the body or limbs; in facial palsy, if cold and stiff; in dropsical joints, and the subacute or chronic white synovitis; for lumbago, neuralgic sciatica, the painful and stiff shoulder cases, writers' cramp and palsy; in diminished power of muscles in hemiplegia, and diminished electro-muscular response in paraplegia, and in hysterical and hypochondriacal affections in very delicate persons, for weakness or neuralgia of the back or irritable spine. Galvanism is generally better adapted to neuralgia and affections of the skin or muscles where there is desired improved nutrition, as in most affections of the vaso-motor system and the trophic nerves, applied for central galvanization, as first pointed out by Remak, of Berlin, and for differential diagnosis. While faradism, — not given by tin handles, nor exclusively through the hands and feet, — if correctly applied locally, or generally, or both, or alternated with the galvanic, is very versatile and efficient in a great variety of nerve and muscle troubles — as for some kinds of neuralgia and rheumatism; for strains, sprains, sore muscles, and weak back; for diphtheritic palsy, some facial palsy, writers' palsy, local, posture, rheumatic, lead, and other palsy or weaknesses. As a specialist in treating nervous affections I could not do without any one of them, while physicians in general practice will surely secure the aid of the latter, and of the others as far as they can.

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