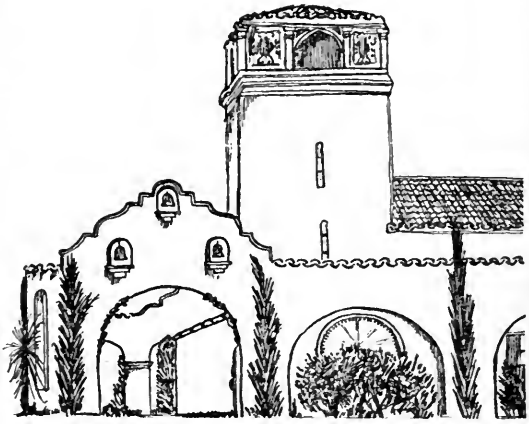

COLLEGE OF OSTEOPATHIC PHYSICIANS
AND SURGEONS · LOS ANGELES, CALIFORNIA

Practical Electro-Therapeutics

By

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REVISED 1908 EDITION
WITH SPECIAL SECTION ON
VIBRATORY STIMULATION

PUBLISHED BY
FRANK S. BETZ CO.
HAMMOND, IND.
1908

PREFACE.

This book contains a concise presentation of the most important modes of treating patients by means of electricity, a knowledge of which the busy practitioner may acquire more permanently through good illustrations than through the most elaborate descriptions. It has been written with the idea of bringing forth facts, and facts only, for a clear comprehension of the topic under discussion.

The author is a thorough believer in drugs, hygiene and diet, but believes that, by the application of the principles here laid down, results may be obtained which appear marvelous to one not familiar with their application. The combined effect of drugs, electricity, the electric light baths and vibratory stimulation seems at times almost magical in the instant relief brought to the patient.

INTRODUCTION.

While our conception of the nature of electricity is largely theoretical, we by no means lack positive knowledge concerning its actions and the laws that govern them. Great progress has been made in utilizing this agent in the arts, and by means of electro-therapeutics maladies are now cured that were formerly not amenable to treatment.

There is only one kind of electricity, no matter how generated, but its actions vary widely according to the current and instrument used in employing it.

Investigators have demonstrated that both animal and vegetable life are due to and dependent upon electric conditions, and it is more than likely that the organs of active nutrition give rise to electric currents. It is also true that animal organs and tissues are modified and influenced by electricity.

There are many reasons why the work of the nervous system should be compared with the complex workings of an electrical battery. In health the nerves are all in a state of vibration, due in all probability to the electrical currents which traverse the body in every direction. When it loses its vibratory function, death and degeneration ensue. The various nerves respond to different vibrations. The optic nerve responds to very rapid vibrations, while large waves stimulate the nerves of the ear, etc.

Electricity has become the mainstay of the neurologist both in diagnosis and treatment. It is one of his most important tools. The more familiar we are with its manifestations, the more we recognize its adaptation to the requirements of a disordered physiological condition. By means of electricity we frequently get a knowledge of the probable duration and curability of certain diseases, which we never could obtain in any other way. The value of this is evident, when we reflect that the correct determination of the polar responses of a muscle of a limb may mean a verdict of cerebral disease on the one hand, or a trifling pressure paralysis on the other. Again it is of great medico-legal value in determining the presence or absence of lesions due to accidents.

For the intelligent use of electricity it is absolutely necessary to know the elementary principles and have a clear knowledge of the physiological action of the different currents on the human system. If the nature of electricity is only imperfectly understood it is ridiculous to attempt to use it, for being a potent agent it may do much harm if not properly employed. It is better not to employ it at all than to use it without a clear knowledge of its physiological action, for, like strychnine, it may be valuable if given when indicated and in proper dosage, and vice versa.

By its careful study and application many ailments may be relieved and heroic operation will frequently become unnecessary.

If we wish mechanical effects we select the currents of alternation with a to-and-fro motion. For a chemical effect a current of considerable amperage is necessary, while physiological effects may be excited by every possible manifestation of electricity.

Idiosyncrasies, here as elsewhere, play their part. Some patients react better to one form of electricity than to another; while other patients, suffering from the same apparent pathological condition, and for no apparent reason, react better to other forms.

The large majority of patients who apply for electric treatment are chronic cases and require chronic treatments. Relapses are apt to occur just the same as those following surgical or medical treatment.

The source of many disorders is oftentimes found outside of the boundaries of the structure affected, and the therapeutic measures to be successful must be directed so as to control and correct the beginnings of the morbid processes.

The nervous system is made up of individual elements termed neurons, together with neuroglia, connective tissue, blood-vessels and lymphatics; and diseases that pertain to it must affect one or more of these structures. These tissues are not many, nor are the pathological processes that arise in them numerous. According to the location or function of the tissue involved, we have a large variety of clinical pictures and it is only proper to approach these troubles from a physiological and anatomical rather than from a symptomatic standpoint.

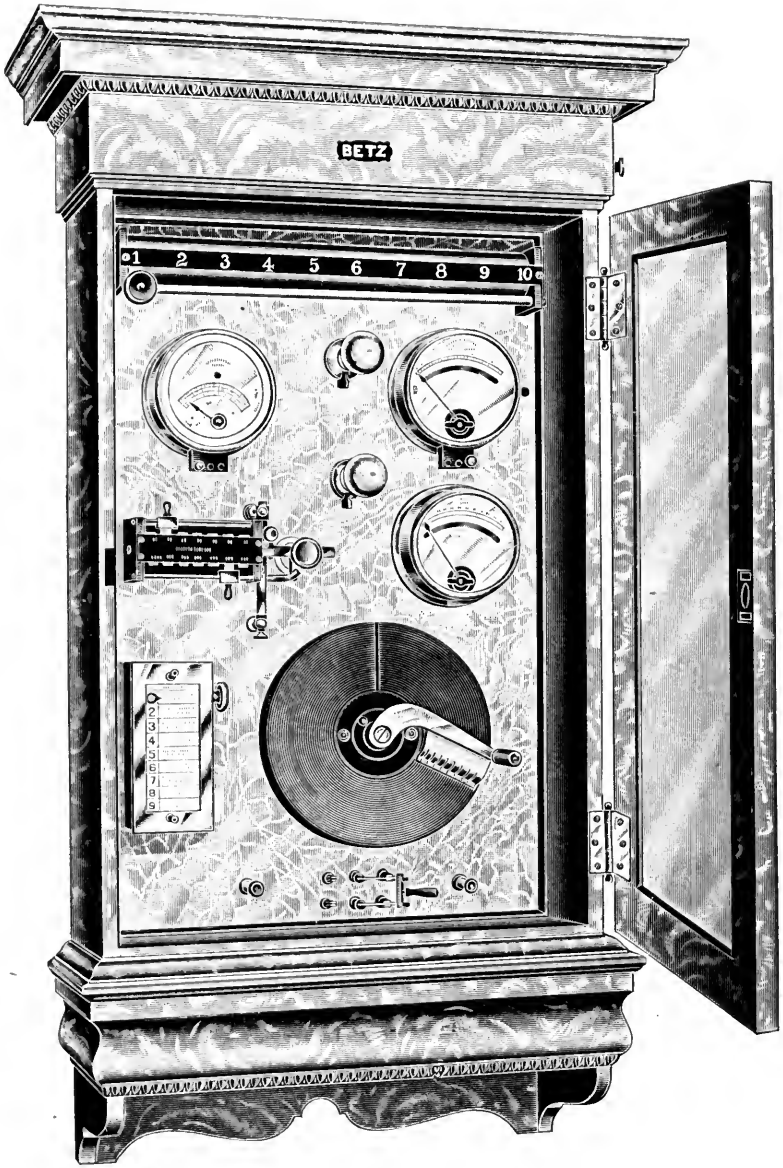
The author believes that if the elementary principles of

electro-therapeutics are thoroughly understood the physician will be able to make the applications that are necessary without more definite explanations than are found in this work.

Our physiology tells us that to keep an organ in perfect repair we must have a perfect circulation. Disease really means a stagnation of the circulation in that particular part. A congestion anywhere is a detriment to the organ concerned. Our bodies are run on strictly business principles. Money hoarded is of no value. It only increases in the channels of trade, and blood, like money, is of no value unless in circulation. We can only build up our vitality by using the means at our disposal just as does a business concern. We can only distribute; we can create nothing of the human principle, except out of the surplus. Surplus means growth.

There is enough energy going to waste in the healthy mortal to build up a helpless organ. Electricity affords us a means of directing this surplus energy to the diseased portion of the body.

Of all physical measures used in therapeutics, there is none that permits the use of suggestion along with it so well as does electricity. The patient is usually resting quietly while the current is passing, with the mind in a perfectly passive and receptive condition. Instructions in regard to habit, physical exercise and diet, being daily and frequently repeated, are adopted as fixed thoughts and not easily forgotten. These are of much value, as it brings about the earnest co-operation of the patient.



The Pope-Massey Galvanic and Faradic Wall Cabinet.

ELECTRICITY AND ITS GENERATION.

Recent research has proven that electricity pervades all space, possesses no inertia and moves without friction. It transmits energy and motion. Light, heat, electricity and magnetism are all transmitted through space by some active condition of ether, either longitudinal or horizontal vibrations.

We can not produce electricity any more than we can produce a current of water, but we can produce pressure somewhere in the circuit and thus cause it to be set in motion, and are able to regulate its flow.

Electricity may be compared with the flow of water in pipe which connects two reservoirs containing water at different levels. Water flows from higher to the lower level. The greater the difference in levels the greater the pressure and consequent flow of water. Water flows faster through a short than through a long small pipe.

Similarly, the greater the pressure or electro-motive force the stronger the current, and the greater the resistance of the circuit, the less the current.

The commercial current, due to its almost unvarying uniformity, is the most desirable to those who have access to it. It can be used for the purposes of galvanism, faradism, cautery and sinusoidal. When this current is not available the current may be produced by decomposition, or the conversion of chemical energy into electrical energy.

It has been proved that when two dissimilar substances are placed in contact, one of them always assumes the positive and the other the negative condition, though the amount of difference may be small and difficult to measure. Placing copper and zinc in contact develops a difference in potential easily detected. The same results hold true if the plates are slightly separated and immersed in a saline or acidulated solution (voltaic cell). The exposed ends of the plates are now charged to different degrees of electrical potential, one plate being higher than the other. When the exposed ends are connected by a conducting wire the difference tends to be equalized by a rush from one pole to the other, its passage

being through the liquid. In passing through the liquid, certain chemical changes take place. These in turn cause a new difference in potential, and follow one another with great rapidity, in fact too fast to be distinguished, appearing to be continuous. This equalizing flow, constantly taking place, is known as the direct current. It only becomes continuous when the difference in potential is maintained and no device is employed to interrupt it.

The chemical compound or solution which undergoes decomposition when traversed by an electrical fluid is known as an *electrolyte*.

The polarity of that end of the plate which is acted upon by the electrolyte is always of opposite sign to its terminal, as seen in the illustration. Whenever a connection between the exposed ends is broken the action

Voltaic Cell.

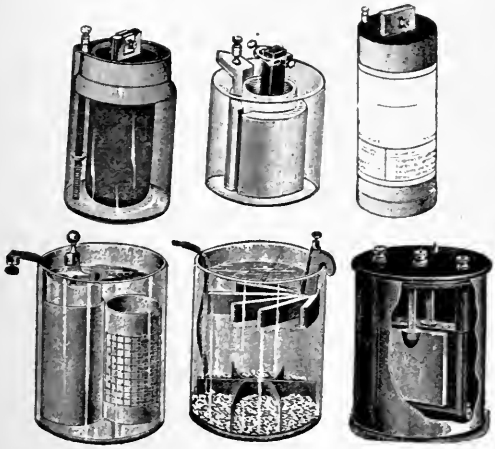
ceases until they are again connected. In any voltaic cell the element acted upon by the electrolyte is the generating plate and its electrode is always the negative.

The current flows from the higher to the lower level. The high point is always the anode or positive, and the low point is always the cathode or negative.

Within the cell the zinc is the positive element. The current flows from it to the carbon, but outside of the fluid this is reversed, the carbon terminal being the positive and the zinc the negative pole.

The larger the surface of carbon and zinc exposed to the action of the excitant the greater the energy developed. The decomposition taking place at the zinc makes it the generating plate. The positive electricity generated there, flowing through to the carbon, which is of lower potential, is carried out of the cell through the conducting wire.

It is not an easy matter to select the proper cells for medical purposes; portable dry battery cells are preferred by some, but they have a distinct disadvantage, because when exhausted they must be replaced by new cells. For office work those cells using a saturated solution of ammonia chloride are to be preferred, as the elements may remain in the fluid and do service for a long time and can be placed in closet or basement. In the cells using bichromate of soda and sulphuric acid, the elements must be removed from the fluid when the battery is not in use, as zinc is consumed as



Different Varieties of Galvanic Cells.

long as it is immersed. The sulpho-chromic battery is portable, but the fluid should be carried in a separate receptacle to prevent its splashing over.

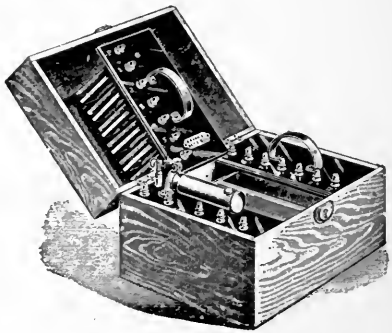
Battery Solution—

Bisulphate of mercury ..... ¼ pound.
Bichromate of soda..... 1 pound.

Add two quarts of water—stir and add one quart of commercial sulphuric acid, pouring the acid in slowly. Add enough water to make one gallon, and set aside to cool. Used hot it destroys the zincs very rapidly.

When communication is established between the elements in the fluid, large quantities of hydrogen bubbles collect around the carbon element, neutralizing the original flow of current. The larger the carbon surface the longer it takes to cover it with hydrogen. A cell in this condition is said to be *polarized.* It is of utmost importance to remove this hydrogen either by mechanical or chemical means. The chemical must be one with which the nascent hydrogen combines and is one usually rich in oxygen.

When acids enter into the composition of an electrolyte there is apt to be trouble on account of tendency to oxidize the metallic surface connected with the cell. All oxides are poor conductors and should be cleaned with a piece of emery



Portable Galvanic and Faradic Battery.

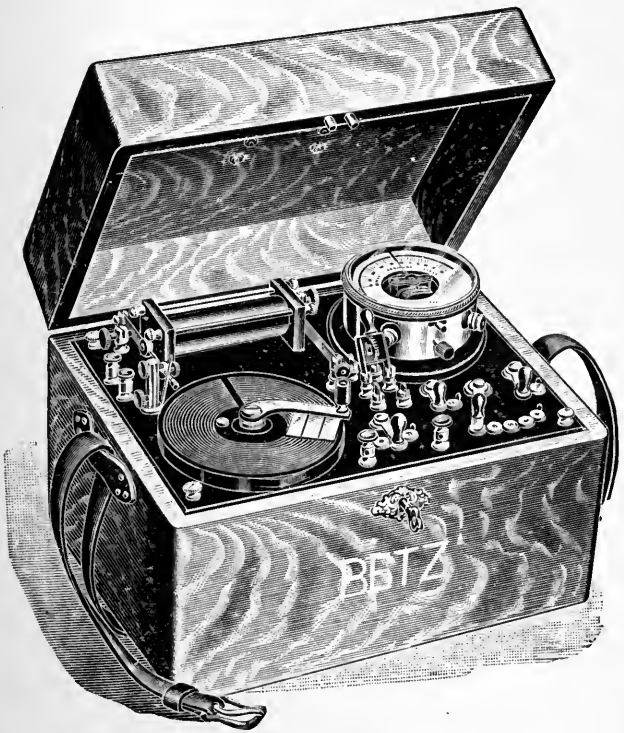
cloth. Contact surface must be free from dust and be bright.

The zinc must be amalgamated to prevent this local action. Iron must be separated from the zinc and made harmless. Before amalgamating, the zinc must be dipped in an acid bath, which removes impurities from the surface; then mercury is rubbed in with a cloth or a piece of galvanized iron, and when finished should be bright as silver. It is a peculiarity of this amalgam that it does not leave the zinc when the latter dissolves, but immediately attaches itself to fresh portions of the same. If a hissing noise is heard when the zinc is placed in the electrolyte it signifies that the zinc needs re-amalgamation.

A *storage battery* is one in which certain materials are so

arranged that when a current is passed through it, they store up energy (not electricity) in a chemical form. This energy can be reproduced as an electric current. They are usually so constructed as to maintain a current for a considerable length of time.

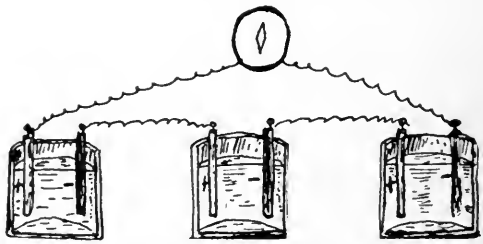
The manner of connecting the cells together depends on



Giant Portable Galvanic and Faradic Battery.

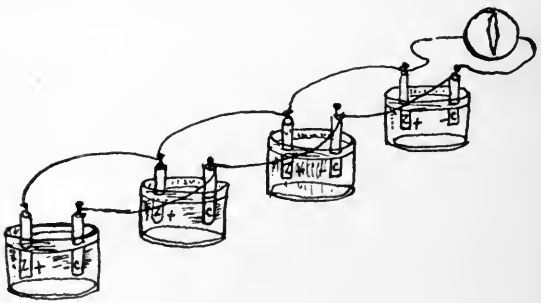
the kind of work required. In treating the human body, which offers considerable resistance, our desire is to increase the voltage—twenty volts for the slightest current and about one hundred volts for the more heavy current. This pressure may be obtained by connecting the cells in series, connecting the unlike elements of the cells, as per illustration.

For instance, from forty cells of one volt each we have a pressure or push power of forty volts, or as many cells as we have in the circuit. Sixty-six cells, of a volt and one-half each, give one hundred volts. All the cells, thus connected in series, will not give current enough to heat an ordinary cautery knife, because we can not obtain more



Cells Connected in Series.

current than from a single cell, its output being limited to its own internal resistance. If, however, this arrangement is reversed we have an increased quantity of current, or as many amperes as cells, and but one volt of pressure. This internal resistance is overcome by connecting the cells in



Cells Arranged in Parallel.

parallel, that is, all the carbons are connected together as the one positive pole and all the zincs as the negative, practically making them one enormous cell many times larger than the original, just the same as increasing the cell thirty, forty or fifty times, according to the number of

cells used. This gives us the desired amperage, but a very low voltage.

A battery works best when the internal and external resistances are the same. If the resistance is doubled the amperage is halved and half of its power is spent in the battery.

ESSENTIALS.

Though our knowledge of the nature of electricity is limited we can measure it and control it.

A *coulomb* is the measure of quantity, the same as a gallon is the measure for water. The use of this term is very limited in electro-therapeutics. A millicoulomb (one one-thousandth of a coulomb) is the unit of quantity consumed in a medical current.

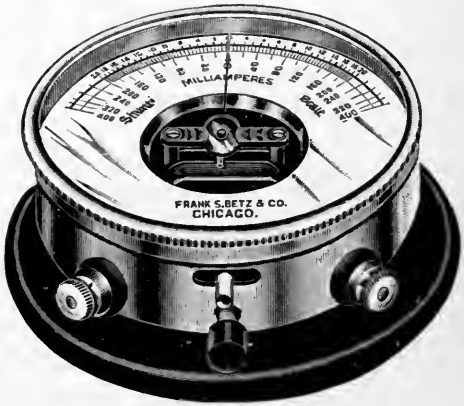
Amperage.—By amperage we mean the rate of flow. An ampere is the unit of current strength flowing through water, which will liberate 0.0000105 grams of hydrogen in one second.

By voltage we mean the difference in the electrical level, as, for instance, in placing two tanks filled with water, connected by a tube, on different levels. It is the force or push power. The human skin offers high resistance to electricity. With the ordinary sponge disk thirty volts are necessary to force a current into the tissues. The larger the quantity of electricity the less resistance is offered. As only a certain quantity of electricity can be forced through each square inch of surface with a given number of cells, the number of cells must either be increased or the area of the electrode. A large electrode should be used where a large current with little pain is desired. The resistance varies in different parts of the body according to the texture of the skin. Tissues underlying the fascia are fairly good conductors.

An *ohm* is the resistance offered to the flow of current by a copper wire one-twentieth of an inch thick and 250 feet long. A current can not flow through any conductor without losing some of its pressure. The current is always reduced by the resistance of the conductor through which it flows, determined by the substance of which this conductor is made. Length of wire increases the resistance, while thickness of wire decreases it, just as the small pipe will

carry less water than a larger one. To illustrate: In a fountain syringe full of water this pressure at the nozzle may be compared with the voltage, the pressure depending on the length of the tube and the height at which the bag hangs above the point of the nozzle. The longer and smaller the tube the greater the resistance; likewise, the longer and thinner the conducting wire the greater the resistance. Just as a pipe with a large lumen decreases friction, so a thicker wire decreases the resistance of the wire.

Ohm's Law.—The strength of the current passing through any part of a circuit varies directly as the difference of



Milliamperemeter.

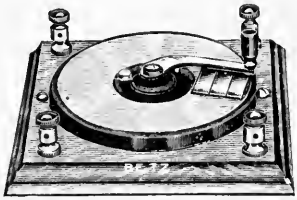
potential between the elements, and inversely as the resistance of the circuit itself.

A *watt* is the unit of power and is obtained by multiplying the volts by the amperes in a given circuit. Whether the cells are connected in parallel or in series, the amount of work done in each case will be equal, only differing in kind.

The *milliamperemeter* is used to gauge the amount of the current passing through the patient. The sensation of the patient is, as a rule, not a guide to deep therapeutic action in the majority of cases. A current comfortable to the skin may become very uncomfortable over an eruption or abrasion

underneath the electrode. The current passing into these spots at an uncomfortable rate causes pain and frequently electrolysis. Therefore, when a current of electricity is being applied, these eruptions or abrasions should either be avoided or covered by means of collodion, adhesive plaster, rubber tissues or vaseline.

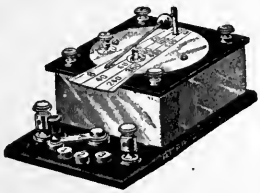
A *rheostat* is an instrument used to interpose resistance to the passage of current, and gives us a means whereby



Rheostat.

the current may be increased or decreased gradually, without the uncomfortable shock to the nerves unavoidable without its use.

In therapeutic work it should permit the gradual and gentle admission of a current after the electrodes are in place, up to the strength and voltage required, maintaining it without fluctuation, and, when work is done, permitting a gentle



Rheotome.

and gradual withdrawal of the current. The graphite rheostat is largely used for electro-therapeutic work; there is, however, one principal objection to it. It is really not a current selector in its true sense, but more or less of a volt selector. Energy resisted is converted into heat, and heat effects the graphite and carbon of which this rheostat is composed by decreasing its resisting power. This compels the operator to be on the lookout, as his

resistance needs readjustment while in use. Using a high resistance wire coil with an established known resistance in the main circuit, will give us a definite and known amount of voltage.

For cautery work the rheostat must have a small resistance and a large current-carrying capacity. It is usually composed of windings of German silver wire.

A *rheotome* consists of a wheel, which rotates at a given speed, closing and opening the circuit at regular intervals, which may be varied as to length of time.

As a rule, portable batteries have no meters; it is best to insert one in the circuit; a graphite rheostat may also be attached to control the current.

The materials used as *electrodes* must be good conductors

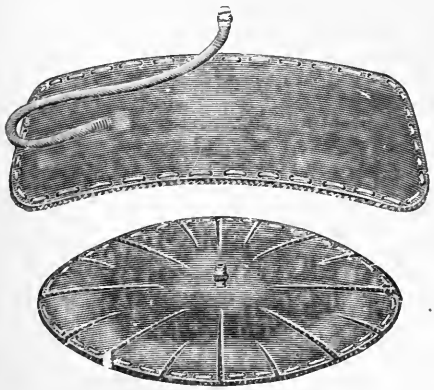
Portable Milliamperemeter and Rheostat.

of electricity, the heat conductivity and electrical conductivity of substances being equal.

Water passes with difficulty through a pipe filled with sand, stones, etc., but very easily through large, clear pipe. Thus a wire of poor conducting material offers great resistance to passage of current, but a good conductor of large cross section offers little resistance.

With low pressure currents, such as the galvanic and faradic, it is essential that good contact be made between any two parts of the circuit, for electricity has very slight power to jump through the air. Though the human body is composed of moist tissue, it is surrounded by an insulating envelope of dry skin, which, together with the slight layer of air, offers a great deal of resistance to the current of electricity. Hence it is necessary that the electrode covering should be moist and thus render both itself and the cuticle better con-

ductors. Deep penetration is the prime need for a well-moistened electrode covering. Moist absorbent cotton is easily applied and renewed. Well-moistened sculptors' clay may be used when a large abdominal pad is desired to transmit a large current with a small sensation and local



Abdominal Electrodes.

resistance at this spot. If thoroughly adhesive and accurately in contact it possesses advantages over other materials.

A flexible cord composed of fine strands of wire is used as a conductor for the electricity, and as the strands making up this cord are frequently broken, they move apart, causing the current to reach the body in fits and jerks; hence they

Carbon Electrode.

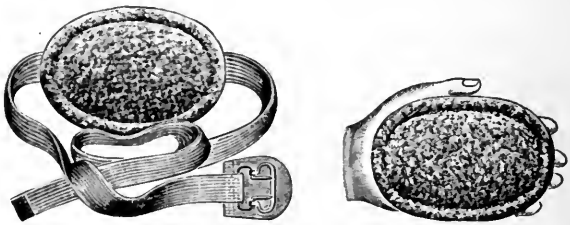
should be frequently examined as to their conductivity. Imperfect contact at the binding posts, due to corrosion, also interferes with the conduction of the current.

Electrodes must be made of substances not easily corroded by the current. Oxygen and chlorine set free in the vicinity of the positive pole attack the baser metals and form com-

pounds with them. When it is desired to avoid this secondary action of the current, a carbon electrode may be used.

The carbon electrode is made to fit snugly against the insulated shaft, which is penetrated by a brass or copper rod. It is intended for use with the positive pole. Though it may be used with the negative pole, it softens the carbon and loosens the connection with the metallic rod. It is covered with a thick layer of cotton wrapped neatly and compactly about it. The carbon is first dipped in water and then by rotary motion of the handle the cotton held in hand is twisted about the ball. It must be well moistened and soaped before use.

Gold, platinum and irido-platinum do not readily enter into composition with oxygen and chlorine. Therefore, steel instruments heavily plated will, for a time, serve the same pur-



Sponge Electrodes.

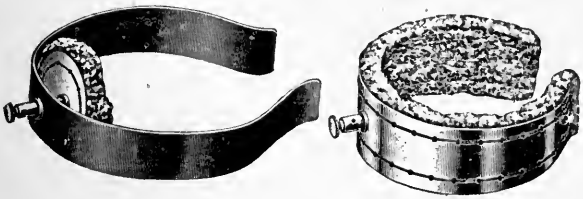
pose as those made entirely of the more expensive metal. Copper, electrodes of copper, zinc, etc., should be of as pure metal as possible and the surface brightly polished before each treatment. When we wish to use mercury, a copper or zinc electrode is dipped into an amalgamating fluid and is ready for use after a little rubbing with a clean cloth to remove the excessive acid.

Thin sheets of tin or plates of malleable metal will be found serviceable in applying electricity to irregular contours, as joints, etc. When metals used for active electrodes corrode underneath the covering, the substance thus formed accumulates on the surface of the electrode and may irritate the skin, or may even be conveyed into the tissues and there produce undesired local medication.

The sponge electrode should be well moistened with a bicarbonate of soda solution, as it greatly increases the

conducting power of all electrodes. Other salts used for this purpose are apt to irritate the skin. The sponge electrode should be cleaned after each use. If a large area is to be treated soap the sponge well with a good shaving soap to permit its being moved about easily. The electrode should be moved about slowly to avoid sudden starts of muscle action.

Varying degrees of pressure applied to an electrode will cause a variation in dosage. Build up the dosage as tolerance increases. Over reddened skin a current of small amperage will frequently bite, while on a pale skin it may not be felt at all. For electrolytic purposes the active electrode should be well insulated, except where action is wanted. A coating of shellac, or melted hard rubber, may be molded about the electrode.



Self-Retaining Electrodes.

A large electrode is usually used as the dispersing electrode and is most conveniently placed on the sternum, the back of the neck or even the palm of the hand. The resistance at the surface contact must be reduced as much as possible. The density of current must not be so strong as to cause electrolytic action on the tissues in contact.

The current is always greater in the polar than in the peripolar zone. The density of current varies directly as its strength and inversely as the area of its cross section. Thus, beneath an electrode of two square inches the current density would be twice as great as beneath one having four square inches, the current strength remaining the same.

The *polarity* of the direct current may be determined by means of moistened litmus paper, touched by the two cord tips a small distance apart. A blue discoloration takes place at the negative pole and a red at the positive pole. If the

current is strong enough to decompose water, bubbles of hydrogen gas will gather at the negative pole, and, being in excess of the oxygen gathered at the positive pole, will thus reveal the polarity. The positive pole is spoken of as the *anode*, while the negative is referred to as the *cathode*.

If a leash of needles is used and some of the needles are not doing their share of work let them remain in place for a time after the others are withdrawn, when their current will be concentrated along their paths and the desired action obtained. If it is found in electrolysis that the electrode can not be readily disengaged, owing to the coagulation and drawing of the tissue about it, turn off the current and reverse the polarity and turn the current on again for a few seconds. The moistening effect of the negative pole will release the electrode so that it can be removed without difficulty.

At the conclusion of the treatment the negative needle is easily withdrawn, and it is found to be bright and untarnished.

Needle Strand.

The positive needle, on the other hand, is withdrawn with difficulty, as it is adherent and it is more or less darkened and corroded according to the amount of current and time consumed in the treatment.

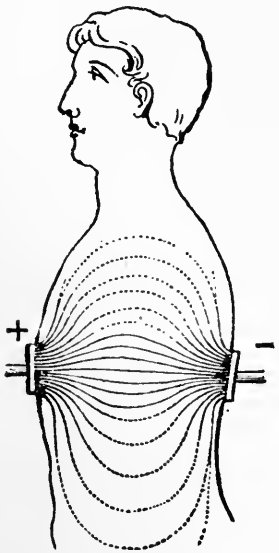
Current Diffusion.—The current does not travel through the body straight like a beam of light, but seems to curve somewhat about the poles. Especially is this the case in a large conductor like the human body, the circle rapidly increasing in size as we proceed from the pole. Hence it is difficult or almost impossible to bring a concentrated current to bear on organs or growths that are beneath the surface. The nearest approach to concentration at a distance requires a heavy current at the pole contact. The effects are determined by three elements, strength, duration and concentration. The *cauterant* effects depend on the polar concentration. An electrode of a certain size with a determined number of milliamperes may not cauterize in three minutes, but may in five. A half a milliampere applied at

the point of a fine needle, as in the epilation of hair, will cauterize in a few seconds.

It is in the immediate vicinity of the poles that the best therapeutic results are obtained, and the readiness with which electrodes may be brought in contact with diseased conditions is what the therapeutic effect depends upon.

PHYSIOLOGY OF DIRECT CURRENTS.

The direct current possesses chemical and physical-chemical properties of therapeutic value in the treatment



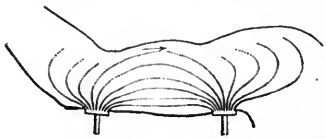
Current Diffusion.

of a great variety of morbid conditions. The action of the two poles is directly opposite and it is absolutely necessary to know which is which.

The *positive* pole attracts oxygen, acts as an acid caustic, is sedative in action, is a vasomotor constrictor, hardens the tissues and makes hard, unyielding cicatrices.

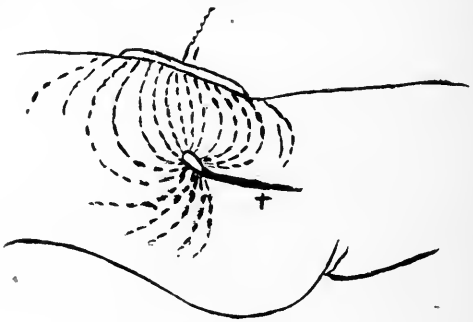
The *negative* pole attracts hydrogen, acts as an alkaline caustic, is irritating and stimulating, is a vasomotor dilator, and liquifies and disintegrates tissues. Its cicatrices are soft and pliable.

The human body may be regarded as made up of tissue bathed in acids or alkaline solutions. By means of the direct current these fluids may be moved from one part of the body to another. If, for instance, the current be passed through a piece of muscle or beef the negative end will become swollen from accumulation of fluids and solids, and the positive end will become dry and mummified, due to the



Current Diffusion

accumulation of acids and the absence of liquids. Knowing the action of each pole, we place the electrode according to the action desired. For instance, we place the positive electrode over a painful and inflamed area to relieve the congestion by its vasomotor constrictor effect. The oxygen set free at this pole assists in oxidizing the tissue waste and toxines which clog the lymphatics, while the sedative action



Current Diffusion in Pelvic Applications.

of this pole relieves the pain. Absorption is stimulated, causing exudations, effusions and morbid fluids to be removed from the tissues.

On the other hand the negative electrode may be applied for its vasomotor dilator effects, thus causing a greater abundance of nutritive fluids to be brought to the tissues needing them, thereby quickening metabolism.

Negative Electrolysis for Bed Sore.

The current causes contraction of muscular tissue, both striped and unstriped, and invigorates the processes that depend upon muscular activity. Thus it restores the equilibrium of the circulation in the intestines and assists the excretory organs, promoting elimination and overcoming passive congestion, and assists in relieving chronic cases of constipation.

By it we obtain definite knowledge concerning the action, nutrition and capacity of muscles and nerves, as by no other agent, and if the indications are chiefly those of degeneration, the negative electrode, by dilating the blood-vessels with a current of ten to twenty milliamperes, improves their defective nutrition as no other agent at our command.

There is no feeling beyond that of heat under the negative electrode and a numb feeling under the positive. *As the sensibilities of persons vary, it is necessary to have an ampere meter to determine how much work is being done.* It is

simply an impossibility to do good work without a milliampere meter, as it means nothing to say you are using five, ten or twenty cells. When using a meter we can turn on the current until the meter marks the required dosage, irrespective of patient's sensibilities.

The interruptions in the galvanic current disperse the products of electrolytic decomposition and permit more vigorous interchange between the blood and the muscles, followed by increased nutrition.

Experiments have demonstrated that rhythmic galvanic currents produce improvement in nutrition where the continuous galvanic current has little or no effect. Experiments further show that a slowly interrupted galvanic current of about two milliamperes, each contraction being followed by a period of repose, produces the best effect. A rapid rate of change in the constant galvanic current is unpleasant, while a slow rate is a great comfort.

Thus all the effects of a powerful, intermittent faradic current are obtained. The dose must be modified to suit the ascertained reaction of each patient. There is an entirely different sensation imparted to the tissues, and there is no cramping of muscles as in the faradic, sinusoidal or Leyden jar current. It makes contractions and then lets go. Thus we often get response in paralysis from the interrupted galvanic when there is no response from the faradic. Don't exercise a muscle too fast or too long. You may be able to run at a certain speed for a certain distance, but you can't keep it up indefinitely. The continuous current of moderate strength applied gradually does not contract a muscle. If, however, there is a rapid change from maximum to zero and vice versa, it determines muscular contraction.

A given quantity of electricity passed in the form of a series of swift shocks, by a unidirectional current, may throw an animal into violent tetanus, exhaust the muscles and nerves, and lead to gradual or sudden death, while the same quantity passed as a continuous current may leave scarcely any visible physiological effect.

By *electrolysis* we mean the decomposition of a compound body by means of electricity, as, for instance, the decomposition of water into oxygen and hydrogen. (It must not be confounded with galvano-cautery, which destroys tissues regardless of chemical composition.) In electrolysis there is

no more heat than can be accounted for by the activity of the chemical processes.

The body to be decomposed must be a conductor of electricity and possess certain elements to be an electrolyte. So far as the human body is concerned it may be regarded as a six-tenths of one per cent. solution of common salt (normal physiological saline solution).

When a current passes through a tissue it is conducted almost entirely by the inorganic constituents contained therein. Investigation has demonstrated that no current can pass through the human body without effecting electrolytic decomposition, or, in other words, the only medium of conduction is chemical decomposition or electrolysis. It does not matter whether it is a continuous or alternating current. Electrolytic effects are produced not only in the medium immediately surrounding the poles or electrodes, but also in the intervening tract. (With the various forms of alternating currents, little, if any, accumulation of electrolytic materials takes place at the poles.) There has been decomposition, recomposition and redistribution. Conduction has been made possible by the conveyance of the charge from atom to atom in the intra-polar circuit. There is a movement of salts and fluids from the anode (positive pole), toward the cathode (negative pole), the free ions appearing at the poles. This action is easily observed in the decomposition of water, which in its pure state is practically a non-conductor. Animal fat is a bad conductor. In living tissue the current is conducted by means of the blood-vessels, the connective tissue and fluids. In dead tissue the resistance is enormously increased and practically acts as an insulator.

Under the microscope the tissues about the positive pole appear as though acted upon by acetic acid, the muscles and fibers are sharply defined and uninjured, no matter how great the change of the contents might be. When electrolysis alone is desired the electrodes must be composed of some material not acted on by the galvanic current, as platinum, gold or carbon.

The action of the current is best studied on a piece of beef. The glazed, dried appearance of the tissues about the positive pole is partly due to the cataphoric action of the current in driving liquids away from the vicinity of the positive pole,

and partly to the action of the acids, muriatic, nitric, sulphuric and phosphoric, collected at the positive pole.

Around the negative pole the appearance is just the opposite. The moist and swollen tissue is surrounded by a frothy alkaline liquid. The alkalies here collected are soda, potash, lime and ammonium.

The positive pole affects the tissues as an acid caustic. It coagulates albumen and shrinks tissues, causing a superficial, dry, hard cicatrix. It stimulates absorption by contracting the blood-vessels, and thus producing decreased nutrition. The contact of the positive pole with the mucous lining by a metal electrode is very painful and not easily borne. Oxidation of metal electrodes takes place at this pole, and deposits of metallic salt are made in the tissues.

The negative pole affects the tissue as an alkaline caustic, causing a deep red, moist, soft condition. Scars left are soft and retractile. Therefore, when we have a dense, fibrous tissue to resolve or remove we use the negative pole. It is also used to avoid the white scar, usually following the application of the positive pole.

If the current is applied mildly it acts as a chemical absorbent and changes the histological structure of dense fibrous tissue, whether the result of inflammation or other pathological process. The details of the process by which this is brought about are still a matter of speculation. Probably the hydrogen gas forming in the tissues tends to expand the interstices of the connective tissues, which are abnormally dense and impenetrable, and that access of nutritive fluids is more freely established as well as conditions more favorable for absorption.

The desiccating action of the positive pole renders it of value in lessening congestion and checking hemorrhage, while the congesting effect of the negative pole renders assistance in impaired nutrition in dilating orifices or canals and in promoting flow of drainage.

Galvanic burns heal slowly. There is hot, burning pain at the needle. Dry resistance and friction mean heat. The parts should be saturated with an alkaline hot water, which will dilate the capillaries, and friction will be less and comfort more.

In certain joint diseases, ulcers, bed sores, etc., manifest-

ing feeble reparative activity, the cause may have been primarily an injury, a bacterial infection or an inflammation of other origin, leaving obstruction from organized or unorganized exudates. The electric energy may be transformed into physiological energy and the reparative process is strengthened.

If inflammatory exudates or excess of connective tissue growth is the retarding cause aside from the devitalized state of the living cells, the action of the negative pole quickens the protoplasmic combination necessary for nutrition, aids in bringing more nutritive material and assists in the disintegration of the overgrowth of connective tissue elements (cathodal electrolysis). Thus bed sores, chronic ulcers, with horny-like margins, are soon changed into healthy surfaces, and granulating surfaces are aroused to quick repair by daily application of the negative current about their margins with a strength of about one milliampere per square centimeter of electrode surface. As bacteria are usually in some defenseless or weakened area, thus tubercular joints may improve when treated daily for fifteen to twenty minutes.

The strength of current must fall short of an amount that would result in electrolysis of the mucous membrane or cuticle (less than fifteen to twenty milliamperes). Eight to fifteen minutes. Keep electrode gently moving over limited area during the application so that too great a density is not employed at one point.

Cathodal electrolysis is also used in the removal of non-vascular, dense, horny or warty moles and superfluous hair. A retrograde action, the reverse of tissue building, can usually be started in these abnormal or redundant deposits.

Anodal Electrolysis.—Local derangement of blood-vessels, such as nævi, cirsoid aneurism, aneurism hemorrhoids, abnormal vascular growths of any kind, can have their blood supply cut off neatly and easily without resulting scar tissue. An abnormal growth may be arrested by robbing it of its blood supply by the destruction of blood and lymph vessels. Such growths, when treated, gradually shrink and are absorbed, leaving the normal tissues in possession of the field, with an opportunity to repair damage with a minimum amount of cicatrical tissue. Moles and nævi must be

treated with noncorrodible metals, such as gold or platinum, as the ordinary metal needle leaves a disfiguring metallic deposit in the skin. A great advantage lies in the fact that the electrolytic effect can be limited to destroy only the vitality of abnormal cells.

In the removal of fibroids needle or trocar-shaped electrodes are used, insulated, except at the part thrust into the growth, in order to protect the skin. Twenty to thirty milliamperes are used for from three to five minutes.

A double needle electrode may be used, confining the current to the tissues between them. The needles may be coated with an insulating coat of white varnish or vulcanite and thoroughly dried, the tip of the needle being protected from varnish by thrusting it into a cork.

The destruction of fibroid tissue at the end of the electrode results in a rapid absorption of the tumor. Care must be taken not to pierce normal tissue or to destroy more of the tumor at one sitting than can be absorbed. Fifty milliam-

Hemorrhoidal Needle Electrode.

peres may be used without too great density at any one point if a leash of needles is used for five minutes. This current is employed extensively in the treatment of goiters of fibroid nature, hypertrophy of the prostate, fibroid growths of mammæ, lymphatic glands, and fibromata of the uterus. It frequently causes a rapid diminution in the size of tumor or tissue. Infection is possible and must be guarded against. Treatments may be given at intervals of from three to four days.

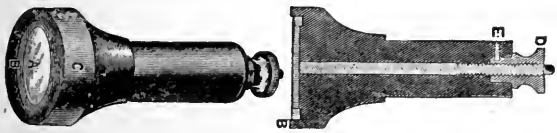
Electric belts or body batteries are capable under the direction of an intelligent physician of accomplishing a great deal of good in stimulating nutrition. Though the current is very small and of but a few milliamperes and few volts' pressure, it is capable of doing great harm unless employed with a correct knowledge of the physics of electricity and a clear conception of the disease to be combated. Polarity must be taken into account, also the current strength and the time it would be safe to allow them to be

used. Their use is very limited, but have been known to do a great deal of good in joint diseases and chronic ulcers.

By *cataphoresis* is meant the introduction of a medicament into the body by means of a galvanic current, the medicament traveling through the tissues beneath the skin with the current..

The pole selected for drug application will vary with its electrical affinity to the metal contained in the salt acted upon. Acids travel from negative to positive poles and vice versa. The large majority of drugs travel from the positive to the negative pole. Iodine bromin, chlorin and oxygen are exceptions to this rule. Potassium iodide, being very soluble, carries iodine into the tissues in a less caustic form than iodine alone, and goes in faster and in greater quantity.

Drugs containing alcohol, ether or chloroform permeate the skin and mucous membrane readily by aid of the galvanic



Electrode for Drug Cataphoresis.

current. Cocaine, aconite, atropine and other drugs are thus employed.

Cocaine on the positive pole has a decided local anesthetic effect, and will frequently relieve neuralgia when the current alone is without avail.

A fifteen to twenty per cent. solution of cocaine in water may be used with a current of from five to ten milliamperes for ten minutes. The negative pole may be held in the hand of patient. The skin must be thoroughly freed from its fats by means of soap, water and alcohol. It does not, however, produce anesthesia enough for the performance of minor surgical operations. In minor operations, cocaine diffused throughout the tissues by using the hypodermic needle as the positive electrode has been found very effective.

Galvano-cocaine anesthesia produced with eight per cent. solution of cocaine in guaiacol is profound and facilitates minor surgical operations. One to three milliamperes will

produce anesthesia in four to five minutes, which may last thirty minutes. It may also be used in dentistry to deaden sensitive dentine. Guaiacol seems to localize the action of cocaine, preventing its dispersion through the body.

Salts diffused into the tissues do not produce tissue electrolysis, but remain in the tissues as a partly insoluble albumino-metallic salt, exercising by selective affinity, a denutritive absorbent action on diseased structures. The electrodes employed in electric diffusion of metallic salts are in the form of needles or bulbs.

The bulbs are used in treating diseased tissue, and the needles when it is necessary to penetrate diseased growths.

As the positive electrode is the one always employed in metallic diffusion, the electrode must always be kept moving to prevent adhesion and consequent damage to the mucous surface. If adhesion should accidentally occur reverse the polarity; this will release the electrode. Bulbs and needles should always be polished before using. Solutions of various metallic salts may be employed on the deeper tissues of nasal cavities, bladder and vagina, by means of special electrodes.

Electric diffusion of metallic salts from soluble electrodes may be instructively studied in experiments on hard-boiled eggs or butchers' beef.

Mercury may be administered by amalgamating gold electrodes with this metal, i. e., causing the mercury to adhere to the electrode surface by first dipping the latter into weak acids and then into mercury. Employed as a positive pole the mercury disappears together with probably a minute quantity of gold and is diffused in the immediate vicinity of the electrode along the line of current flow, enabling us to saturate neoplasms and even cancerous tissue.

Intrauterine applications of metallic electrolysis may be made with any oxidizable electrodes, such as *copper or zinc*, which are the most popular at present, but electrodes made of silver, iron, lead or tin may also be used.

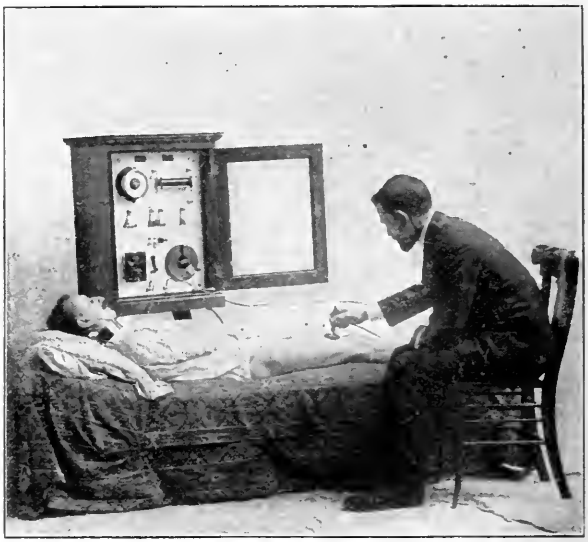
When a soluble metallic electrode is used there is no caustic action, as is the case when non-attackable electrodes are employed, the current energy being expended on the electrode and in diffusing the newly formed salts into the tissues. When slight action only is required the electrode should be kept in motion and a low current strength employed (fifteen

Diagnostic Outfit.

to twenty milliamperes). A caustic action is produced if the current is beyond thirty milliamperes, but this degree is rarely exceeded. The duration of the application varies from five to fifteen minutes. If the electrode becomes adherent it can usually be successfully detached by rotating it on its axis before attempting to withdraw it. If necessary reduce current strength to zero and use negative polarity for four to five minutes, which will detach the adherent electrode.

Malignant tumors may at times be destroyed when placed under the cataphoric diffusion of the electrolytic salts of mercury or zinc. The radiating chemicals unite with the protoplasm of the cells and other elements of the growth, producing a rapidly enlarging area of necrosis, which is found to be more readily effective in the degenerating tissues. A current of from five hundred to eight hundred milliameters

applied from thirty to sixty minutes is usually necessary. At the termination of the application the growth has been changed into a lead-colored soft area, with a distinct edge, constituting the area of necrosis, surrounding which will be found a reddened, slightly swollen ring, constituting the zone of sterilization. Necrose portions remain sterile and odorless until separation takes place, which usually occurs from seven to twenty-one days later, the wound healing by granulation.



Galvanic Stimulation.

Cancer germs are killed *in situ*, preventing the auto-infection of the cut edges that usually follows extirpation by means of the knife. The operation is bloodless.

Cataphoresis also permits the destruction of small growth or infected glands, etc. It permits localized destruction of growths within inaccessible cavities, such as the mouth, the rectum, etc. Being perfectly under control, it is capable of being directed at any point at will. When the disease is not too extensive it may possibly be eradicated. Failing in this it may be a great palliative.

In addition to electrolysis and cataphoresis, which are effects obtained only for the galvanic current of considerable amperage, we have the distinct functional stimulation and sedation.

By virtue of the fact that stimulation and sedation occur only on the instant of variation of slight currents of high voltage it is confined principally to the galvanic and faradic currents. The functional stimulation produced is proportionate to the amount of variation and to the suddenness

Galvanization of Pneumogastric Nerve.

or the increased speed of variation. For speed of variation we might substitute pressure, for the greater the pressure the less milliamperage we require to produce stimulation. Nerve stimulation is thus limited to the opening and closing of the circuit when a weak current is used. With a strong current the stimulation or sedation continues throughout the application, producing a contraction or sensation. All current variations are stimulant, though the continuous galvanic current is sedative at the positive pole, and very rapidly successive faradic currents of high voltage and minute

amperage will act as an analgesic. The action is always greatest when the concentrating electrode is over the nerve.

Tissues exposed to the negative pole of the galvanic current are distinctly increased in their excitability to stimulize. A positive pole has a contrary effect. The irritability of the parts is markedly decreased. The stimulating and sedative effects of the galvanic current are equally active on nerve and muscular tissue, and it is probable that the glands and secretory organs respond to this current independently of their enervating and trophic nerves. The general tissue stimulating action of this current is demonstrated by the activity produced in tissue metabolism, nutritive repair and emphatic activity of the pelvic organs.

When applying general galvanic stimulation the patient must be disrobed and lying on a couch. A large dispersing electrode should be placed over the back and connected with the positive pole. To the negative cord is attached a round, active pad, well moistened and soaped. The pad is held in contact with the patient and the current is turned on, after which the pad is passed over the nerve points of each group of muscles, taking care to act only on the groups associated in action at one time. The current strength depends on the part of the body and the amount of adipose tissue covering the points. Fleshy persons require more current. Fifteen to twenty milliamperes will do for the arms, thirty to thirty-five on the legs and thigh and fifty and over for the abdomen and back. In weak and nervous people treatments are apt to be followed by a short period of vascular depression and cold extremities. But as strength is gained the warm reaction is more immediately realized.

The galvanic current will be found preferable to faradic stimulation in the cases usually placed on the rest cure, the strong current transmitted through the abdominal viscera being particularly valuable in arousing dormant abdominal nervous forces so commonly deranged in these cases.

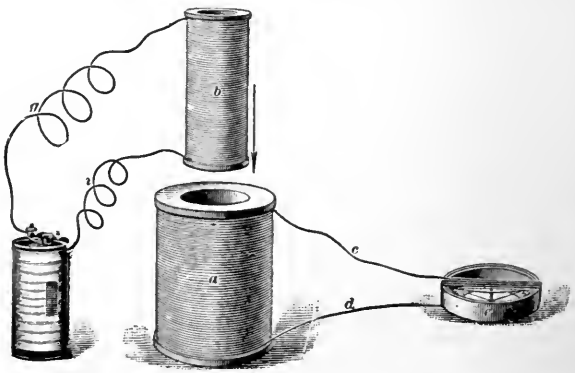
Delicate patients who have been treated for grave conditions of debility had better sit or lie down and rest for a while after the treatment. A nervous chill sometimes follows over-electrization. The system can become habituated to electricity the same as it becomes accustomed to opium or any other potent remedy. Extremely sensitive patients nearly always bear a longer and much stronger

application after a course of treatments. Patients need not necessarily be discouraged if short treatments with gentle currents only can be borne at the beginning.

When a headache persists for some time after a treatment, a mistake has been made somewhere in the application. Sudden shocks and interruptions may cause momentary headaches, which pass away after a short time.

THE FARADIC CURRENT.

The faradic current is produced in a closed wire circuit placed over or close to another in which a galvanic current is varied. The strength of the current so produced is proportionate to the strength of the producing current plus the length of the wire subjected to the influence of the inducing current circuit. Convenience necessitates the coiling of one insulated wire about the other, producing a solenoid or induction coil in which many feet of wire occupy but a small



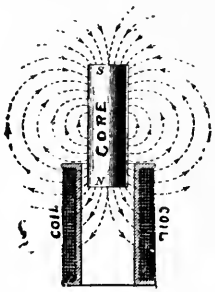
space. It is necessary that the two wires carrying the inducing and the induced current should be close to each other and properly insulated.

The action of the inducing current from the cell in the first coil is increased if a soft iron core be inserted within it, making what is called an electro-magnet. The value of an electro-magnet depends upon the fact of its being able to rapidly acquire and as readily to lose its magnetism.

Electro-magnetism is supposed to be electricity in rotation, and is supposed to know no barrier and to travel from the north pole to the south pole. Certain metals under certain conditions exert an attractive or repulsive influence

on each other. Science has not been able to tell us what these forces are, but it has formulated laws under which these forces act and react.

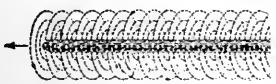
The theory is, that the ions in the space surrounding the conductor through which the direct current is flowing are influenced by the current, causing them to move about it in a certain direction. These ions are very close together near the conductor, and farther apart as their distance from



the conductor increases. A general idea may be had from this illustration.

Increasing the strength of the current increases the diameter of existing circles of whirling ions.

The cell current traverses the primary coil and returns to the cell through the interrupter. While traversing this coil the current makes the core magnetic, which in turn attracts the small armature on the interrupter, breaking the



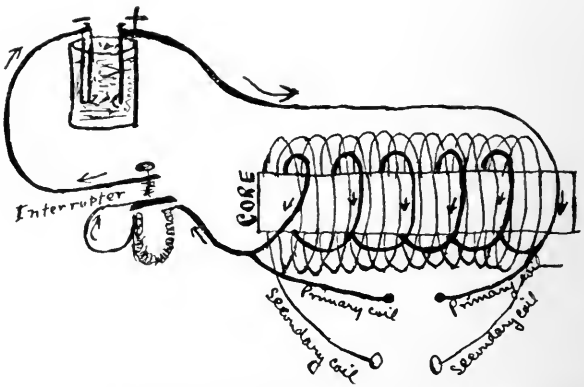
Magnetic Whirls.

cell current. The magnetism of the core having now disappeared, the spring returns to contact, when the whole process is repeated.

Induced currents are only caused by the changing strength of the magnetic field surrounding the secondary circuit. If a constant current is passing in the primary circuit there will be no induced currents, the strength of current depending on the abruptness of change in the primary circuit, and

their direction will depend upon whether the primary current increases or decreases.

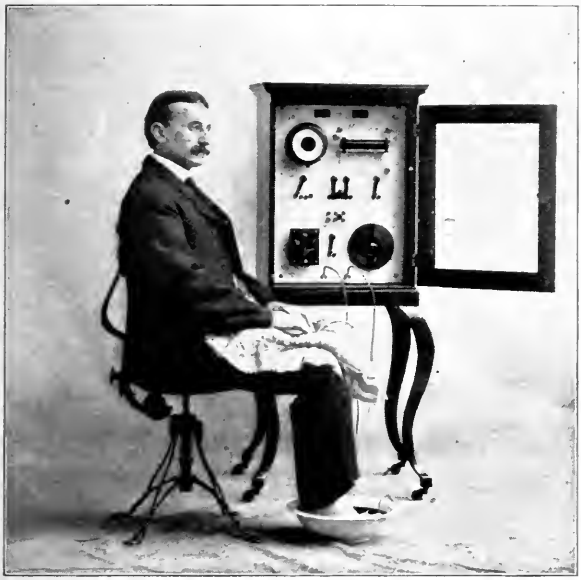
The Vibrator.—There should be at least two adjustable vibrators, one for slow vibrations of fifty to one hundred and fifty periods per minute, giving muscles time to rest between each alternate contraction, but permitting adjustment of from two hundred to two thousand periods per minute for producing muscular massage; and one for sedation, with a rapid vibration adjustable for seven to nine thousand periods per minute.



Faradic Apparatus, Showing Primary and Secondary Coil.

The vibrator must be kept well polished and thoroughly free from oxidation, for starts and jerks in the vibratory movement are often unpleasant and sometimes harmful.

In the primary coil the patient is placed in what is called a shunt circuit, permitting only an infinitesimal amount of current to traverse the tissues when the spring is in contact, the resistance of the coil being many ohms less than that of the body of the patient. It will be seen that all the circuit takes the short road through the cell instead of through the patient. The current gets much of its force from the demagnetization of the coil. At the moment of closure of the cell current, a reverse does arise in the primary coil by self-induction, but never reaches the patient. When the cell current is open at the interrupter, however, the primary direct induction arising in the primary coil has no



General Faradization.

recourse but to traverse the patient. This induced current gets much of its force from the demagnetization of the core, and since it is produced in a coil nearer the core than the secondary wire, the volume of the current is greater, other factors remaining the same. The direct inductions only can reach the patient, the inverse inductions being neutralized by the cell current.

In a simple coil of but few turns a current arises, flowing in one direction in the second wire on closing the cell circuit in the first, and another current arises on opening the cell circuit. The current that appears in the secondary coil on opening the cell circuit is in the same direction as the cell current, while the current that appears in the secondary at the closing of the cell circuit is inversed, the current in the secondary coil being thus a to-and-fro current.

No amount of electrolysis can be caused on account of this continuously neutralizing character of an alternating cur-

rent. It is this same condition that makes it impossible for us to measure the current strength. No current arises in the secondary coil unless its ends are closed by a patient or other conductor.

The large amperage of one or more galvanic cells is transformed into a current with a large electromotive force and with a current strength of but a few milliamperes. What is lost in amperage is gained in voltage.

The voltage or penetrating power of the secondary coil depends upon the length and diameter of the wire used and on the number of windings. A coil with twenty windings possesses twenty times the electromotive force of one winding. A coarse wire with an equal number of turns as a fine wire has the same voltage. The fineness of wire merely reduces the volume of current. A coil of an equal number of windings of fine wire will have less amperage, and a heavy wire coil, other things being equal, will have a larger amperage. A coil wound with heavy wire acts on the muscles and not on the sensory nerves, hence is less painful. The fine wire acts on the sensory nerves and not on the muscles. When the secondary coil is only partly over the primary coil the resistance of the secondary coil remains the same, while its voltage is reduced.

Any unevenness in its action may be readily detected by connecting the various cells with a telephone receiver. The quality of the interruptions with slow and rapid vibrations may be studied.

The quantity of current is due to:

1. The galvanic current inducing the flow.
2. The primary coil.
3. The number of windings on the secondary coil.
4. Thickness of wire.
5. Character of interruptions.
6. Position of coil over the primary.
7. Surface resistance.
8. Kind and size of electrodes used.

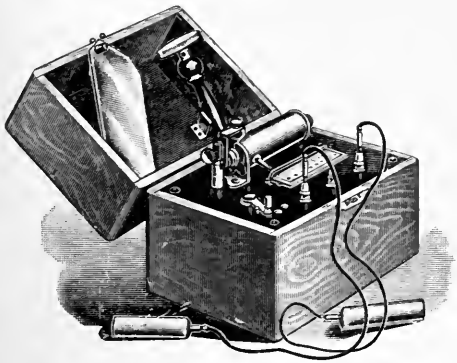
One or two galvanic cells are sufficient to operate a faradic coil, and although it would be impossible by means of sensation to detect a current from these cells, yet there is a marked sensation when the terminals of the primary coil are taken hold of. It is not the current from the batteries which we

feel, but the current induced, in the windings of the coil, by the influx and withdrawal of the magnetic lines.

An apparatus now on the market consists of a set of three coils. Two switches on the end permit of tapping and using different lengths of wire from the same coil.

PHYSIOLOGY OF COIL CURRENTS.

The uses of the induction-coil currents are limited in their range of influence as compared with those of the direct current, their range being the physiological responsiveness of the tissues. Nevertheless, a large amount of valuable work can be done with a coil the frequency of whose interruptions



Faradic Battery.

can be varied at the will of the operator, and in which the electromotive force in both the primary and secondary circuit may be conveniently modified.

The effects of coil currents are tonic and stimulating or sedative and paralyzing, depending on the technique employed.

Slowly interrupted coil currents have little action on non-striated muscles, but when rapidly interrupted these muscles respond vigorously, each fiber contracting successively. The normal movements of the arteries and arterioles are stimulated, thus accelerating the flow of blood and lymph through the tissues and relieving venous stasis, absorption is promoted and elimination of waste material

increased. The action of this current is more mechanical than medicinal.

A coarse wire coil is to be preferred where there is a loss of tone and venous engorgement, and it is contraindicated where the tissues are sensitive and inflamed. On account of the low voltage a large electrode should be used and the skin should be saturated thoroughly. Slowly interrupted currents of from thirty to fifty periods per minute produce a series of muscular contractions, with an intervening period

General Faradization.

and relaxation and rest. This physiological activity has a marked effect on the improvement of nutrition. Rapid interruptions produce tetanic contractions, which in turn bring about a muscular anemia, and if prolonged will produce degeneration. Thus we see why a tetanizing current decreases neuromuscular nutrition. The coarse-coil current lacks penetrating power on account of its low voltage, and, being limited to a smaller area, it has greater stimulating qualities.

Relief brought about by the positive pole of the galvanic

current is less harmful and more permanent than that obtained by tetanic contractions.

The action of the alternating current on non-striated muscle fibers decreases rapidly in diseased conditions, such as paresis, atony, etc. It is a current of higher voltage, penetrates more deeply and is more diffused. Its action is spent on a larger tissue area.

The primary effect of the stimulating treatment may be a feeling of depression and lassitude, and soreness and fatigue

Applying General Faradization by Means of Hand.

may follow the first treatment. This can only be avoided by making the first treatment tentative and by using the hand as an electrode. In timid women and in the treatment of children it is best for the physician to use the moistened hand as an electrode until all fear is allayed, the hand being more agreeable to the patient, more flexible and adaptable, and has a lightness and softness of touch, particularly for applications to the head and sides of the neck. It also keeps the operator informed of the current strength. He can

increase or diminish the current by tightening or loosening his grasp upon the wet sponge.

The polarity of the faradic current is as distinct as that of the galvanic. The secondary also has a distinct polarity, though not so marked as the primary, the direct inductions being stronger and more abruptly produced than the inverse productions, the electrode on the negative pole being the most stimulating and the positive the most sedative.

It increases tissue metabolism, increases the absorption of

Applying Faradic Current by Means of Hand.

oxygen and elimination of a corresponding amount of carbon dioxide. It therefore accelerates functional activity. This can be readily demonstrated by grasping a bi-polar electrode in the hand, and using a fine wire current as strong as can be borne for a few minutes. The hand becomes bathed in perspiration; it also becomes pale and bloodless, due to the tetanic contraction. Its power to promote rapid absorption of inflammatory exudates may be attributed directly to its stimulation of the capillary and lymphatic circulation.

The increased contraction and the subsequent relaxation empty and fill the capillary vessels and, together, with increased blood pressure, favor the removal of any obstruction in them. By stimulating the contraction of adjacent muscles the veins are emptied, inviting the blood from the overloaded capillaries. The lymphatic circulation is stimulated by the same process.

Muscular exhaustion is almost instantaneously relieved, and the lightness and buoyancy experienced in the muscles

Anodal Electrolysis in Intercostal Neuralgia.

exercised are due to the increased supply of blood and oxygen to the muscle. Rapidly interrupted induced currents produce a vibratory movement in the protoplasm of the body. We can appreciate the influence of this current when we realize that nine tenths of the body is composed of protoplasm.

Faradization usually gives a refreshed and exhilarated feeling, usually following immediately upon treatment, and may last for hours. In others a fatigued and exhausted feeling may follow, with an intense desire for sleep. Patients

suffering from nervous pains in the head, back, side, stomach and limbs frequently find relief during or shortly after treatment.

The disagreeable symptoms which sometimes follow general faradization, headache, malaise, vertigo, chilliness, faintness and cold perspiration, are not permanent, but are like similar effects from the injudicious use following other tonics. Extreme nervousness may cause unnecessary alarm.

The graphite rheostat used with the direct current is also used with the induction-coil current, as the most sensitive patient will permit stronger current when applied gradually. By varying the pressure of the electrode held in the hand the current may also be increased or decreased. Great care must be exercised in applying the current over bony surfaces, as they are always painful. The treatment with the faradic current is less likely to aggravate the disease than the galvanic, as there are no chemical effects. It is mechanical

Current-Interrupting Electrode Handle.

and physiological in its nature, having no cataphoric or electrolytic action like the poles of the galvanic current.

A moist conductor conveys the faradic current through the skin to the nerves and muscles beneath, while the dry metallic is used in moist cavities only. The difference between the electromotive force between the galvanic and faradic current may be demonstrated by touching the bare terminals of each.

In paralysis the paretic neurons and impaired muscles may be improved in nutrition. Stimulation of the vaso-motor nerves of the bowels increases peristalsis and accelerates the blood to the intestines, promotes secretion and relieves constipation. Glandular secretions are also stimulated.

When the intensity of the current has been arranged, the frequency of the interruptions must be considered. If the treatment is given with a view of stimulating the nutrition of weakened and impoverished muscles, they must not be

made to contract with such frequency as to further exhaust them. Slow interruptions with complete and uniform contractions meet the need in such conditions. A rheotome, or a break-circuit handle, can be used to bring about these interruptions.

Short treatments are the rule. When there are a hundred or more interruptions per second there is a benumbing or anesthetic effect produced on the nerve supplying the part. A rapidly and smoothly interrupted faradic current benumbs the nerves and abolishes pain. The rapidity of interruptions varies the quality of the physiological effect. From five to three hundred interruptions determine the muscular actions, while the sedative effects are produced by very rapid interruptions of twenty thousand to fifty thousand per minute. Muscle contractions cease with this rapidity. Slow interruptions favor muscle contractions; rapid interruptions affect the nerve. The anesthetic effect increases with the number of windings, thinness of the wire

Faradic Brush Electrode.

and rapidity of the interruptions. A fine coil with thirty-five volts and thirty-five hundred interruptions a minute is frequently not felt after five minutes until moved up to fifty volts.

In bi-polar applications the effects from a short, heavy coil are stronger and of greater physiological effect than from a fine wire. As the resistance of the tissue increases fine coil indications improve. A current in a short wire gives a shorter spark with greater heat. A fine wire gives a long spark with less heat.

A powerful secondary induction coil made of two hundred and eighty miles of wire, with three hundred and forty thousand turns, yields a spark forty-two and one-half inches long when operated by thirty Grove cells.

Low surface resistance renders the current less painful and more penetrating without affecting the superficial sensory nerves, yet acting with energy upon the deep-seated muscles. Where we desire to stimulate the nerve terminals

General Faradization.

in the skin a dry electrode serves this purpose best, since the resistance due to lack of moisture intensifies the current at this point. The wire brush electrode is well adapted when counter-irritant effects are desired.

It is well known that any impression, mechanical, chemical, terminal or electrical, made on the terminal sensory nerves is carried to the central ganglion, where it is capable of modifying function or of even producing organic change. The difference between the sensation caused by the cathode, or negative, and the anode, or positive pole, depends on the size of the electrode. If the anode is small and cathode large, the current will be stronger under the anode, due to difference in current density. The current density varies directly with the current strength and inversely as the surface area of the electrode.

It is absolutely necessary for the physician to have the

therapeutic properties of the various currents firmly fixed in his mind. He must know how to regulate the electromotive force and how to determine the number of interruptions necessary in a given case. The susceptibility of the patient and the varying tolerance of the different portions of the body will also require special study.

On account of the anatomical formation of the chest strong currents are not tolerated, yet currents of sufficient strength to increase physiological development are borne with comfort. There is no action produced on the heart and lungs, the application being merely a muscular stimulant. In some patients the splenic and hepatic regions are unaccountably tender and justify the suspicion that these organs may be more or less diseased. The current applied directly to the abdomen acts directly on all organs contained, regardless of nerve supply. Adipose tissue is a poor conductor and must be considered when treating corpulent persons.

On account of the physiological importance of the cilio-spinal centers, they should be given special attention in every general faradic treatment. The current is also used in treating spasmodic and hysteric contraction. Treatment must continue until the muscle is thoroughly relaxed, but repeated application may be necessary.

Nervous and active people respond to this current more readily than do the cold and phlegmatic. The nutrition of the entire nervous system is directly influenced by this current. In an ordinary application the brain, the spinal cord and the sympathetic ganglion are all subjected to the action of the current. The tonic effect of faradization is largely due to the passive exercise which it produces. It is both deep and superficial. The molecules are agitated just as the particles of a bar of iron are moved by the influence of magnetization. Every atom is kept in incessant disturbance.

A current too weak to cause muscular contraction is not followed by a marked tonic effect. The idea is to bring about not only a contraction, but a relaxation. The relaxation will in itself bring about an increased flow of blood to the parts.

Assimilation depends upon equalization of the circulation. The tissues of the body are frequently developed in size and

firmness to a marked degree, and vigor is frequently imparted to those deficient in power by means of this current.

GALVANO-FARADIZATION.

Vigorous faradization alone produces fatigue. The use of the refreshing and invigorating galvanic current in conjunction with the faradic enables us to obtain the therapeutic qualities of the first without the exhausting effects on the patient.

Combined Galvanic and Faradic Currents.

The effect is obtained by uniting the secondary induction coil and the galvanic battery in one circuit by connecting with a wire the negative pole of one and the positive pole of the other, attaching the electrodes to the two extreme poles and sending the currents through the body.

This current is especially indicated in diseases of the abdominal viscera and of the bowels.

Interrupted induction-coil currents increase metabolism by action in the muscular system. Increased nutrition is produced in two ways, muscular contraction and stimulation of terminal sensory nerves, action on cell function and promoting gland activity.

Galvano-faradization is like adding two drugs to be administered in one prescription. Spasmodic conditions which have failed to respond to either of the other currents applied alone are relaxed almost immediately by galvano-faradic electricity.

ELECTRIC BATH

The tub should be of wood or porcelain, otherwise the current will travel through the metal instead of through patient and the water. It must not be in metallic connection with the earth, and the waste pipe and water faucets should not be connected directly with the bath, but a rubber tubing used.

An ordinary bath tub may be used if a piece of rubber sheeting large enough to cover the inside of a bath tub be used.

With a current of moderate amperage and low electromotive force, insulation is not necessary. If, however, we wish to make use of all the therapeutic properties of the electric bath, insulation becomes necessary, and is accomplished by placing the tub on insulating supports of glass or vulcanite.

There are two kinds of electric baths, namely: monopolar and dipolar.

Monopolar.—One electrode is placed to the nape of neck, arm or some other part of the body out of the water. The water bath constitutes the other electrode and very carefully adapts itself to all parts of the submerged body, the copper electrode in the water completing the circuit. If the positive current is used outside of the water, the current from this electrode will flow into the body, diffusing itself into the water from all parts of the patient, to be again concentrated at the negative electrode.

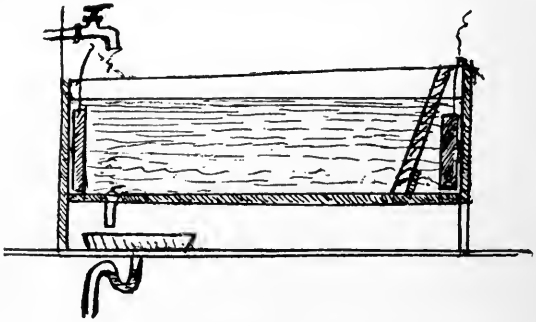
Only a moderate current can be employed outside of water, as a too concentrated one would cause pain and produce destruction by local electrolytic action.

The *dipolar* bath is the one most used. The electrodes are usually made of copper, the larger electrode, twelve by eighteen inches, being used at the head, while the smaller electrode, nine by twelve inches in size, is placed at the foot end. The shoulders must not come in contact with the electrodes, as this would cause a burning pain. The soles of the feet, on account of poor conductivity, may be placed against the foot electrode.

The current may be continuous or alternating. The steady current may be obtained from the medical galvanic battery, but must be under control, hence the necessity for a good rheostat and milliamperemeter.

The patient should not be left alone in the bath, and pulse and respiration should be carefully counted during the administration.

It has been estimated that about twenty per cent. of the entire current passes through the patient. Thus, if the milliampere registers one hundred and fifty, the patient is subjected to a current of about twenty-five milliamperes.



Electric Bath.

The current should be turned on gradually, observing the effect on the patient. The temperature used is usually about 98½° F., but it must be remembered that the higher the temperature the better its conducting capacity. When the physician can command any current strength desired, the temperature of the water makes little difference. The addition of salts to the water increases the conducting capacity of the water and lessons the current strength passing through the patient.

Various drugs dissolved in the water may be carried into the body by means of cataphoresis. Extracts of herbs and barks have been used with effect in a variety of troubles. According to an eminent European authority, tannic acid, which is much cheaper than the lithium salts, is very effective in the treatment of uric acid troubles.

Never give a bath to a patient immediately after he has had a full meal.

The effects of an electric bath are exhilarating, refreshing and invigorating to the patient. Circulation and nutrition are benefited and irritability relieved, and sleep is restored, and new vigor imparted to mental and physical faculties. The cutaneous glands are stimulated to increased elimination of effete material, and by increasing the amount of blood brought to the surface it relieves the congested internal organs.

For tonic effects the interrupted currents give the best results.

Gout, rheumatism, lumbago and sciatica have been successfully treated by the various currents. If the alternating current causes pain the direct current should be used.

In disordered circulation, as found in Raynaud's disease, the electric bath is the best-known treatment. Weak currents are used to build up the nutrition of the parts diseased. The negative pole is applied over the diseased area, the object being to increase circulation in the diseased member.

Chronic rheumatism, rheumatoid arthritis, gout and diabetes are diseases in which a judicious selection of currents and proper attention to detail in a course of electric baths will accomplish more than massage, medicament, change of climate, or all of them combined.

Neurasthenia frequently yields to electric baths when central galvanism and static electricity have failed.

Diphtheria and other forms of toxic neuritis are effectively treated, as it increases the activity of the organs of elimination.

In giving an *electric douche*, the indifferent electrode is placed under the patient's feet, or under the gluteal region if the patient is seated. The water from the nozzle constitutes the other electrode. The water from the nozzle renders the skin a good conductor of electricity and at the same time increases the cutaneous irritability, rendering the action on the periphery stronger and more effective. Its conductivity is increased by raising the temperature of the water and also by the addition of salt or sodium bicarbonate. The nozzle must be held at some distance from the body and the flow of water must be delivered in an unbroken stream.

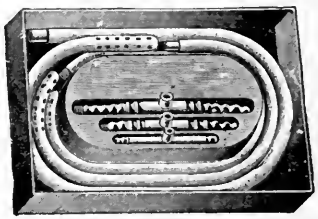
As the stream of water constitutes the active electrode, this form of treatment is adapted to a large number of pathological conditions, applied to mucous cavities and the

mucous canal. In treating cavities electrified water may be used. The whole surface of the cavities may thus become more completely electrified than otherwise. The fluid must come in contact with the metal electrode within the nozzle.

Five to twenty milliamperes may be used, the application lasting ten minutes. It may also be used in cases where the urethra is sensitive to the passage of a bougie or metal

Urethral Electrode for Giving Electric Douche.

electrode. Electricity thus applied allays irritability, heals sore or bleeding points and prepares cases for electrolytic treatment. It reduces the inflammation which is frequently present and which prevents the introduction of instruments on account of the pain produced. It cures some maladies of the prostate and allays irritation, and cases of impotence have been reported cured in this manner.



Hydro-Electric Rectal Tubes and Catheters.

Chronic urethritis is more safely treated by this method than by any other, because it dilates and puts the mucous lining on the stretch, thus cleansing all the parts. The current is equally divided and better tolerated. By hanging the bag higher there is no doubt but that the posterior urethra is reached.

The dangers and difficulties of applying strong galvanic currents to mucous canals and cavities are obviated by the

use of special electrodes, completely insulated and perforated to allow the passage through them of a current of water and electricity, the water in the canal constituting the true electrode.

A one per cent. solution of common salt water may be used, though medicated solutions of copper, zinc or silver may be employed, the various salts being driven into the tissues by cataphoric action of the constant current. The inflammatory infection of the uterine canal, ulcerations of the cervix, relaxed vaginal walls and weakened pelvic structures are thus conveniently treated by means of the vaginal electric douche. The temperature of the water must be regulated to suit the patient. In treating the bladder from twenty to thirty milliamperes may be used. Under this treatment, vesical atrophy or weakness is much benefited and good results have been obtained in inflammatory conditions.

By means of a special electrode a current of from twenty to thirty milliamperes can be employed within the rectum without danger of electrolytic action. The water is allowed to flow until the rectum becomes filled; the water in the bowel constitutes the active electrode, and diffuses the current to all parts of the rectum and powerfully stimulates peristalsis. The alternating current will cause non-striated muscle fibers to contract when not pathologically altered. Experiments have proved that non-striated muscle fibers when in paretic condition do not respond to coil currents,

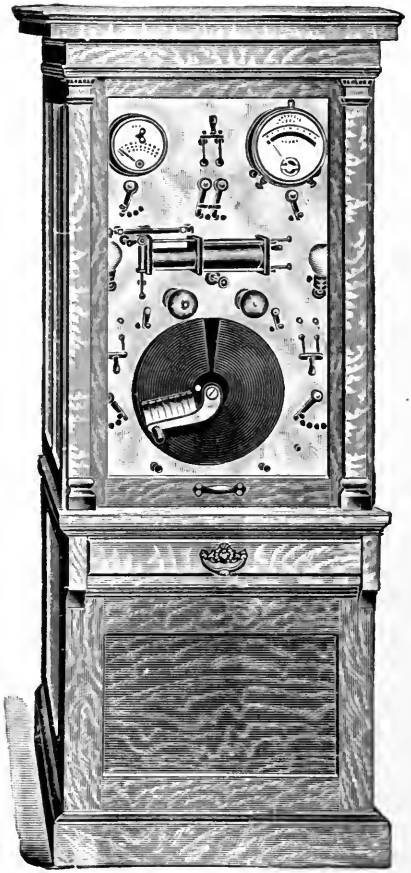
Rectal Hydro Electrode.

while vigorous contraction can be produced by the galvanic current. Inflammation and ulceration of rectal mucosa are frequently speedily cured by this means. Its use in chronic constipation should be familiar to all physicians.

Catarrh of the nose and naso-pharynx are much relieved and frequently entirely cured by the electric douche.

In atrophic nasal catarrh, the diseased glands may be modified in their function and the function of the mucous membrane improved. In catarrh of the nose it may be found

serviceable to add various medicaments to the water used. Among these cupric sulphate is perhaps the best. Atrophic cases of catarrh have been reported cured, with complete return of the sensation of smell. From three to ten milliamperes are used, the application lasting until three pints of water pass through.

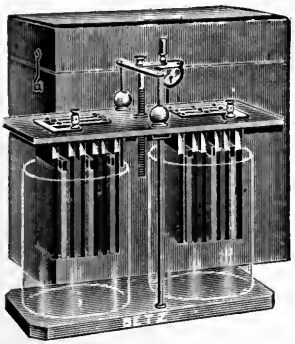


Massey Galvanic, Faradic and Cautery Battery.

GALVANO-CAUTERY.

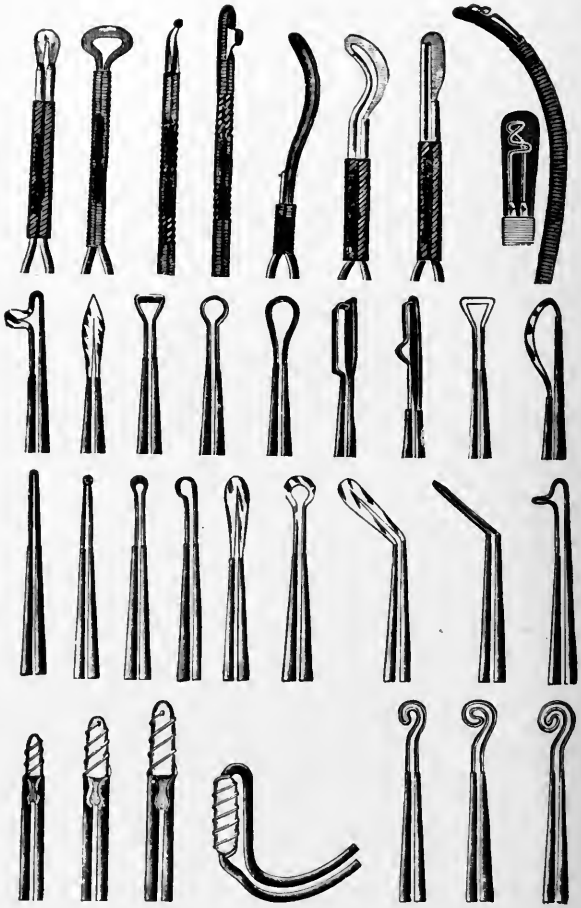
Energy can not be lost. In disappearing it reappears in some other form. Whenever resistance is placed in the path of an electric current it can overcome the resistance only by giving up part of its energy, which reappears in the form of heat. It is this property which is used in the heating of lamps and cauteries.

Either the commercial current, storage cells or a battery with large zinc and carbon elements may be used.



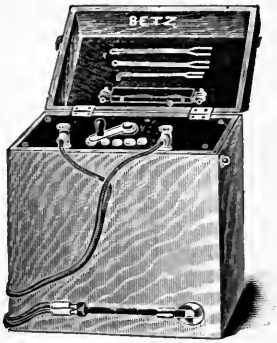
Giant Cautery Battery.

Metals, fluids, etc., all show a difference in ability to receive heat from some source or other. Thus, a platinum wire held over a Bunsen burner will show a temperature three times higher than a copper wire under same length of exposure. Also, if a silver and platinum wire were held over the Bunsen burner together, the platinum would be red hot while the silver would be still comparatively cold. It is estimated that each molecule requires the same amount of heat to raise its temperature a certain number of degrees Thus we see a clear relationship between thermal capacity and specific gravity. The greater the mass in weight of the conductor, the more time will it require to effect a rise in temperature. There is also some similarity between thermal and electrostatic capacity.



Cautery Electrodes.

Electric-cautery has been extensively used and its recognition is well deserved. It has supplanted almost entirely the chemical agents formerly used, being completely under the control of the operator. The instrument may be carried without harm through a narrow or complicated passage



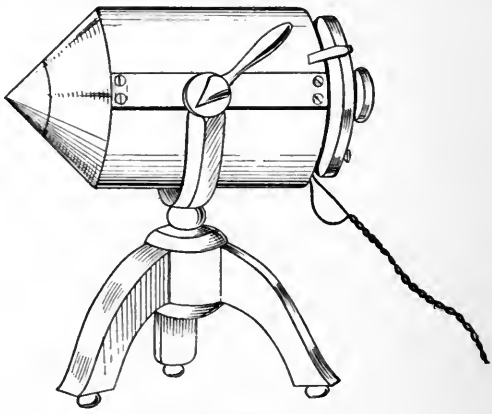
New Dry Cell Cautery Battery.

until it reaches the desired point of action, and when the effect is complete it may be withdrawn equally harmlessly.

As a remedial measure, galvano-cautery is perhaps most frequently resorted to by the nose and throat specialist for the reduction of hypertrophic tissue, the cauterization of the seat of the implanted mucous polypi, ignipuncture of the tonsils, etc.

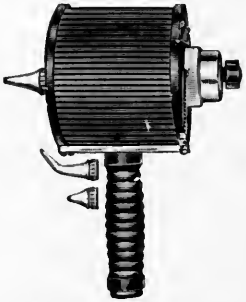
MAGNET.

The use of a magnet has become the principal means of extracting foreign metallic bodies from the eyeball. A small



Giant Eye Magnet.

magnet may be used where the foreign body is embedded in the superficial portions of the eye. When imbedded in the



New Portable Haab Magnet.

deeper portions of the eye, a giant magnet, regulated by a rheostat, will frequently avoid an otherwise delicate opera-

tion. In fact, may prevent enucleation in many cases. In opacities of the eyeball, it is no doubt a great aid in making a diagnosis as to whether metal is present in the eye or not.

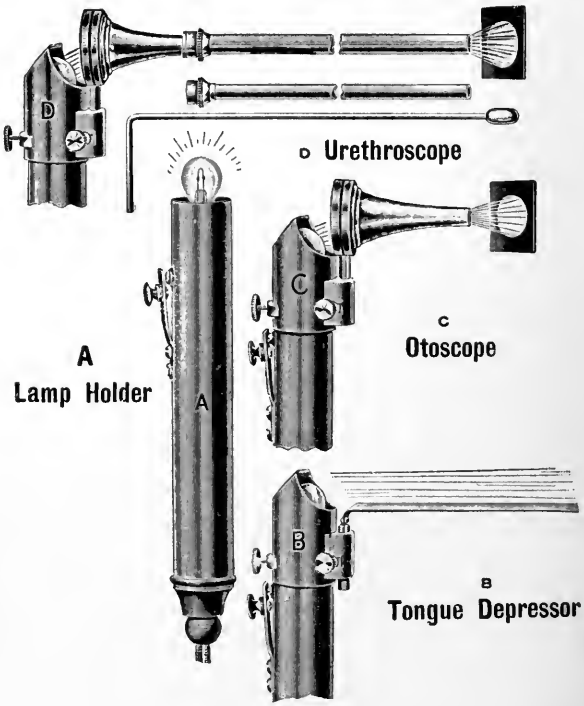
Small Eye Magnet.

The magnet has also been successfully used in the removal of a pin from a child's larynx or bronchus.

Electricity also plays an important role in a variety of mechanical appliances, such as electric drill motors, mechanical nasal saws and vibratory massage operators.

ILLUMINATION.

The electric light is used more generally than any other illuminating agent in the examination of the nose, throat,



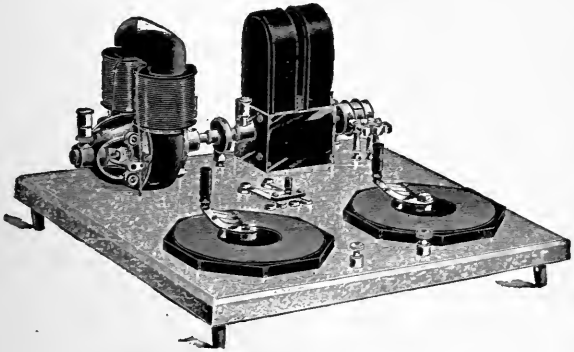
Illuminating Instruments.

ear and bladder. The incandescent lamp has its special advantage in this purpose, of which these illustrations give ample evidence.

SINUSOIDAL CURRENT.

The sinusoidal current is an alternating current generated by induction in a coil of wire which is rapidly revolved in the magnetic field of another coil and core.

This current can be secured from any apparatus having a permanent magnet or any coil having a temporary magnet. The rapidity of the revolutions of the armature determine the character of the sinusoidal current. It is best generated by an apparatus turned by an electric motor in order to get the greatest speed and the most regular curves or waves.



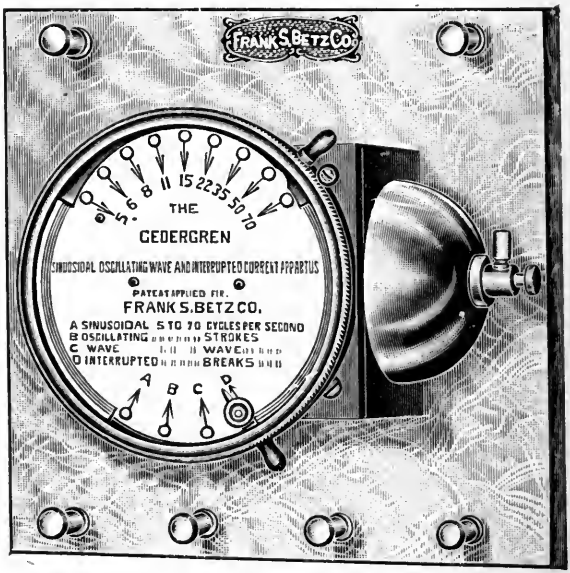
Apparatus for Generating Sinusoidal Current.

In an armature or coil which is revolving in a circle and making a revolution back to the starting point, always in the same direction and not stopping to swing back as the pendulum vibrator does, there is consequently no dead point, and the make and break is not felt painfully or with any shock. This produces a harmonic or sinuous wave-like contraction and a soothing or pleasant sensation, relieving pain and often producing anesthesia, by causing temporary paralysis or tetanization of the nerves.

The physiological effects produced by the sinusoidal currents are painless and have great penetrating power. The

constant alternation of the current prevents polarization of the tissues acted upon, and hence maintains the maximum exciting effect. Various effects are noticed according to whether the machine is rotated at a high or low rate of speed. When rotated slowly the contractions are vigorous and spasmodic, rather than tetanic in character.

Strong muscular contractions may be induced without the slightest sensation to the skin and without any pain whatever. With rapid rotation of the machine the current is capable of producing strong tetanic contractions similar to those of the faradic machine.



The Cedergren Sinusoidal Apparatus.

STATIC ELECTRICITY.

Static Electricity.—The ethereal theory presupposes that electricity in a neutral or mixed condition is present everywhere, pervading all space, penetrating between molecules, etc. When two dissimilar substances are placed in contact, one of them always assumes the positive and the other the negative charge. It was formerly thought that only a limited number of bodies could produce an electric charge when brought in contact with each other, but later investigation shows that friction between any two bodies of different substances will produce an electric charge.

The amount of electric charge or energy stored up, in either of these bodies, is not in proportion to the work done by friction, but only in the small work done in separating the bodies against their mutual attraction, which depends upon whether they are good conductors or not. If a charge is communicated to one end of a glass rod, it will remain there, and not pass to the other end, as it is a poor conductor. Metal is a good conductor and offers no resistance to the rapid distribution of the charge.

From the foregoing statements it is seen that negative and positive electricity are not generated, but merely moved from one body to another. It is impossible to bring forth one charge without bringing forth the other. There is a difference of potential between parts of the same body or between different bodies. The medium between the two forms of electricity is in a state of strain, as they are eagerly seeking to unite with each other and again produce a neutral condition.

Friction is not the cause of electricity, as is heat, but friction dries and warms the surface, which favors insulation, and thus prevents the escape of electricity. Whether the bodies be brought in contact by either rubbing or sliding friction, seems to be immaterial. The main thing seems to be to bring the various parts of the surface of one body successively in contact with the surface of a dissimilar body, and separate them in order to produce a charge.

To understand the workings of a static or influence machine, as used in therapeutic work, it is necessary to bear in mind that when an electrified body is placed in the vicinity of other bodies, insulated or not, it sets up in these other bodies electrical modifications; that is, variations in the distribution of electricity, acting upon them by influence. While acting on others, however, it is also acted upon. Its repartition of electricity is being altered. Electrical bodies with similar charges are mutually repellant, while electrical bodies with dissimilar charges are mutually attracted. The process of generating a static current is best described by means of the following illustration.

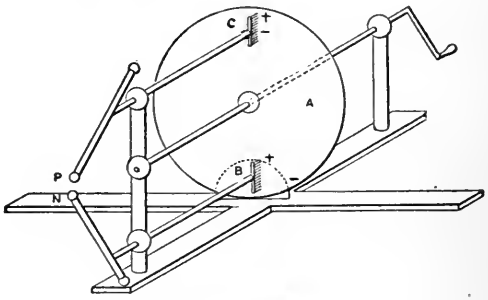


Diagram of Static Machine.

The initial charge of electricity is developed by friction; by induction on the plate the comb B will become positive and the knob at the end of the prime conductor will become negative. The comb, however, readily gives up its positive charge to the plate, so that the prime conductor BN is left negatively charged.

When the plate has made half a revolution that part that has been charged positively, from the comb B, arrives at comb C. Thus the two combs will always be at a different potential, and a steady flow of sparks will ensue between the ends of the prime conductors P and N. The electric charge passes from the plate to the positive comb and from the negative comb to the plate. When the machine is operated in a dark room the difference in the discharge from and to the different combs may be noticed, the purplish flame occurring on the negative side.

Induction can take place through some distance, and through materials such as air, glass, etc. When the electrically charged body is removed it will again return to its neutral condition, the inducing body having lost none of its charge. The smaller the distance between the two bodies the stronger the induced charge.

As some bodies permit induction with greater facility, the substance residing between the two charges is of importance. Dry air offers more resistance to induction than any other substance. Electricity can not flow through glass, yet it is able to act across it by induction. This fact is utilized when it is desired to have a high potential difference between the two charges.

According to the principles already explained, the Leyden jar is found to be a convenient condenser of electrical charges. One charge by attracting the other will not allow it to become free, but will keep it fixed and free from tension. The capacity of the two charges are correspondingly enlarged, but will, of course, possess the opposite potential.

The Leyden jar is made of glass, coated inside and out with tin foil, which serves to distribute the charge over the surface of the glass. A brass rod, passed through a lid of dry, well-varnished wood, is connected with the inner coating by means of a brass chain.

To charge the Leyden jars, connect them to the prime conductor of the static machine and connect the outer tin foil with the earth. The positive charge on the inner coating induces a negative charge on the outer coating nearest the glass, repelling the positive charge, which passes to the earth.

To prevent the charges on the prime conductor from uniting, a spark-gap is placed between them. This causes the charge to flow into the jars on the inner coating and induce an opposite polarity on the outer coating. These charges continue to flow into the jars, where they are held by induced charges on the outside of the jar. Both are bound, but can not unite and neutralize each other. When the difference of the potential between the charges of the two jars has reached such a value that it is able to overcome the resistance of the air gap, it will bridge it by means of a spark. When this has taken place, the inside charges have neutralized each other and the outside charges are free to unite. The current is of an oscillating character.

The discharge between the poles of the prime conductor tends to neutralize the electric charges on the latter, but the self-induction of the circuit causes an excess of current to rush to the respective poles, charging them the opposite of what they were, this condition being again neutralized by a spark, etc. The frequency of oscillations will depend principally on the volume of current supplied to the jars, on self-induction, the air gap and the resistance in the circuit between the jars.

PHYSIOLOGY OF STATIC ELECTRICITY.

We have in static electricity the remedy par excellence for treating the patient as a whole or locally, and there is probably no one agent at the physician's command by which so much good can be accomplished as by a skilfully handled static machine.

The more intimately the physician becomes acquainted with the nature of static electricity and the physical laws which govern it, the more readily will he comprehend its application.

Static electricity as generated by the modern machine is a current of extremely high voltage and a very low volume. This manifestation of electrical energy belongs to that class called "high-potential, high-frequency currents." When we consider that it takes about fifty thousand volts' pressure to force a spark across one inch of air space, the tremendous potential energy of a static machine becomes apparent, for the static machines used in therapeutic work are often capable of giving a ten or twelve-inch spark. It is by reason of this low volume that the current may be passed through the tissues of the body without inflicting injury and with only a moment's discomfiture. It is probably the most powerful stimulus to nerve and muscle that can safely be applied, to say nothing of the rapidity at which it imparts tonicity, lightness, buoyancy and firmness to soft, lax and enfeebled muscular tissues.

The physician well acquainted with his static machine soon finds that there are few physical ailments, except those of a surgical nature, which can not be greatly relieved by one or another of the static modes of treatment intelligently applied.

In studying its action or in applying it in practice, we

must remember that the principles underlying the use of static electricity are the same as those which govern the use of drugs, and that individual observation and experience must teach us what to expect. If static electricity would do in every case what it has done in some cases, it would indeed be a panacea or cure-all; but it is, nevertheless, a fact that its proportion of failures is not greater than that of drugs deemed most reliable in their action.

Electricity in any form is now recognized as a mode of molecular motion akin to light and heat. Every application of electricity to the human body, whether general or local, is accompanied by transformation of electrical energy into some other form of energy, either physical or chemical.

Investigation and chemical analysis have demonstrated that static electricity increases metabolism by mechanical as well as chemical processes. Static electricity causes a contraction of protoplasm, thus causing a mechanical disturbance of the molecular arrangement, which results in a modification and augmentation of metabolism and a modification of the processes of nutrition.

Static electricity regulates the various forces of the body by re-establishing the disturbed equilibrium in the different organic functions; it accomplishes this by its action on nerve fibers, cells and centers.

The statement is frequently made that "the relief brought on by static electricity is only temporary and not a cure." This is certainly due to a want of thoroughness and appreciation of the physiological effect taking place. It is a fact that what can be accomplished momentarily can by repetition be made permanent.

The physical culturist tells us that to exercise a limb will give strength. On the face of this it seems ridiculous, for by every physical effort the much-needed energy is dissipated. Nature, however, over night, not only replenishes what was lost, but adds a little more to it each day; so that an exercise which seems difficult to-day will become easier on each successive day, indeed become almost an unconscious effort. It is in some such way that static electricity affects the nerves. A nerve, being capable of vibrating at its own normal rate temporarily, can, by repeated efforts on our part, be made to assume its own rate of vibration permanently.

Static electricity does not replace destroyed tissue, but by its action induces muscular contractions, causing an onward flow of the blood stream. These contractions include the muscular coats of the vascular system. This increased circulatory activity, by carrying onward the various internal secretions, stimulates the internal glandular organs to an increased functional activity, assisting not only the secretory organs, but converting by-products into end-

Weakening Current. Operator's Foot on Platform.

products by the increased oxidation, and eliminating toxic matter through the skin, kidneys and lungs, thus clearing the path for nature and allowing her to do her work more perfectly. With this increased excretion and elimination of waste, nervous irritability is lessened and is soon followed by a relaxation of the entire nervous system. Casts and albumen frequently disappear from the urine.

"Pain is the cry of a nerve for better blood." One of

the cardinal dogmas of biology is that the structure of every living being is passing through a continuous transformation during its whole term of existence. That these transformations may be of a healthy nature, it is necessary that there be a continuous flow of nutritive fluid. A temporary disturbance in the blood stream brings about a diseased condition, and it is absolutely necessary to remove this condition of stasis before a healthy, normal condition

Static Insulation.

can be restored. Static electricity, by causing muscular contraction of the vascular system, is best calculated to relieve, temporarily at least, the congestion and hyperemia; pressure being thus removed, pain is diminished and a healthy metabolism is induced, thus checking and modifying the course of the disease, and even rendering patients suffering from incurable diseases fairly comfortable.

During the period of convalescence from any disease, the

body is practically below par and therefore in a condition to become the seat of morbid processes. During this period of vulnerability inherited predispositions are apt to manifest themselves. Though static electricity has no effect on germ life, it removes this lowered condition of vitality essential for germ growth; by inducing functional activities it assists in the absorption, and enhances the assimilation of whatever medicament has been administered. This is especially true

Negative Spray in Pleurisy or Intercostal Neuralgia.

in constitutional diseases, such as syphilis, Bright's disease, diabetes, etc., where it not only aids absorption but hastens elimination as well.

The author believes static electrification to be far superior to oxygen inhalations in uremic poisoning. He has repeatedly taken a patient delirious with uremic poisoning and placed him on an insulated couch and has seen him regain consciousness in from ten to twenty minutes, according to the severity of the intoxication.

In cases of diabetes and nephritis the author has had results with the use of static electricity and drugs, which utterly failed to respond to drug medication alone.

A man or woman subjected to a severe mental or physical strain may avert the final breakdown by a few properly applied static treatments.

Infants one and two years old suffering from gastric troubles and malnutrition have yielded to static treatments

Posture in Treating Neuralgia of the Shoulder.

after well-known specialists had failed to bring aid by means of drugs and carefully chosen diet.

Schoolgirls at the age of puberty may be supported and carried through this trying period with entire satisfaction; the woman who is passing through the menopause, accompanied by all its nervous phenomena (with no definite pathological basis), may be soothed and comforted, and have her perverted nervous functions restored to their normal course.

Old people in whom the powers of life are waning

brighten up wonderfully, both mentally and physically, after a few treatments.

Coincident with this increased activity we have increased appetite, restored digestion, renewed strength and vigor, creating a feeling of refreshment.

A person who has not witnessed the great amelioration of pain in lumbago, intercostal neuralgia or rheumatism can form no adequate conception of its merits.

Theoretically, static electricity may be employed in some stage of every disease, but finds its ideal sphere in such conditions as the following:

Malnutrition; Anemia; Neurasthenia—Nervous Exhaustion; Hysteria; Muscular Pain; Rheumatism; Neuralgia; Lumbago; Sciatica; Coccygodynia; Headache; Paralysis; Chronic Synovitis; Reflex Pain; Pre-bacillary Stage of Tuberculosis.

ESSENTIALS.

To be successful in the use of static electricity it is absolutely necessary to know the machine and how to keep it in working order. The usefulness of the machine itself will be what the operator makes it and no more. Brilliant results can be anticipated only from the combination of an effective machine and a skilful operator.

As atmospheric changes affect the nature of static discharges, the machine should be placed in a dry room, and should be evenly and solidly fixed to give steady and regular motion.

The loss by leakage through accumulation of dust and moisture upon the surfaces of the insulated parts frequently interferes very markedly with the efficiency of the machine, as the electricity is conducted away as fast as it is excited. Kerosene oil or gasoline are the best materials to use in cleaning the plates or the case of the machine when they have become dirty. After the machine has been cleaned, it can be dried out perfectly in a few minutes by the use of a freezing mixture.

Take a glass fruit jar that holds several quarts, and which may be tightly sealed. Fill this jar with a mixture of about one half cracked ice and one half salt. Then seal, wipe thoroughly and set inside of the machine on a plate, so that the condensed moisture on the outside of the jar may

be caught by the dish. Then close the case tightly. If it is desired to dry the case quickly, run the machine slowly to set the air in circulation. A deposit of ice or frost will form rapidly on the outside of the jar. Permit the jar to remain in the case until the coating of ice becomes quite thick. Then take it out of the case and remove the coating of ice. Replace in the case and allow a second coating to accumulate. Never allow the jar to remain after the

Electrodes for Applying Static Electricity.

coating on the outside of the jar does not freeze. If moisture does not collect on the jar, it shows the machine is dry, and if the machine refuses to work, it is a positive proof that something besides moisture is interfering with its operation.

Several pounds of thoroughly baked calcium chloride, placed on trays within the case of the machine, with doors tightly secured, will absorb the moisture as it enters the case. The

condition of the chloride will indicate the necessity of rebaking it (which should be done in a slow oven. It must not be boiled).

Ordinary calcium oxide (quicklime) may also be used with very satisfactory results. In a box made of strips of wood, with large opening all the way round, place about ten pounds of calcium oxide, and cover it well with several thicknesses

Grounding the Static Machine by Wire Attached to Upper Part of Case, Which Can Easily be Transferred to Opposite Pole.

of muslin to prevent the dust from getting on the plates of the machine. Caustic soda or caustic potash may also be used. The author prefers sulphuric acid, c. p. (ten pounds) placed in a dish in one end of the case. It keeps the case dry for a longer period of time than any other measure, and has been found to be most reliable in moist and warm climates.

A hygrometer will be found of value in determining the

condition of the machine from month to month, for under the same relative atmospheric conditions the discharge from a machine is uniform, or the machine is not in a normal condition.

Frequently the shellac on the surfaces of the rotating plates needs to be renewed. This may be done by applying over the rotating plates, a mixture of white shellac dissolved in alcohol to a syrupy consistency. Dry the machine out thoroughly after this performance, as it helps to dry the shellac properly.

A basin of linseed oil placed in the machine will absorb part of the nitric acid generated in the machine.

Keep the machine well oiled.

Ground the poles, connect with gas, water or steam supply pipe, or drive two iron pipes into the ground until they reach moisture. Two groundings are necessary. Bring the copper wire to within short distance of the machine along the wall and bend to terminate in a hook. Bring the other grounding for the electrode near the machine in the same way. Grounding the machine is the most important rudimentary principle in using static electricity. Always ground the electrode and prime conductor not in use.

The object in grounding is to create the lowest possible pressure at this pole, while the highest pressure is maintained at the other. Without this difference we can not get a current of high voltage.

The platform is an essential part of the static treatment by insulation and in the application of the wave current, etc., or there would be no accumulation.

Place the platform about two feet from the machine. The current is led to the machine either by means of a shepherd's crook or an insulated cord. These may be connected by a chain with the copper plate, fifteen by sixteen inches, under the feet of the patient, or by placing a metal conductor in the hands of the patient.

If the patient is too near the negative prime conductor, when the platform is connected with the positive pole and a strong current of high resistance is present, it may prove disagreeable to the patient. Place the patient so that the active prime conductor is opposite the head. This avoids irritation of the patient from woolen clothing with an opposite breeze.

The patient, if a female, should remove hat pins, and should not use metal or celluloid hair pins. Metal may cause unpleasant sensations and annoy timid patients, and celluloid pins have been known to ignite from a strong spray or brush discharge.

The current has no effect on a watch.

Movable Spray Over Solar Plexus for Nausea.

The chair on the platform should be devoid of all metals, nails or ornaments, as they may prove very irritating and annoying to the patient.

In moving about platform the operator should keep out of sparking distance of the patient, as an unexpected spark may greatly lessen confidence of patient, or cause him to cease treatment, as many have found out to their regret.

When the current is interrupted by sparks in any part of the circuit, the brass plate under the feet may become disagreeable to a patient who wears shoes with thick soles or

iron pegs in the soles. To avoid this the conductor may be held in the hands of the patient.

If for any reason the machine is stopped during the administration of treatment and again started or the speed accelerated, the passage of a single or infrequent long sparks at the spark-gap may produce unpleasant sensations of shock.

If the noise of the discharging rod annoys the patient, make use of the muffler.

As the polarity of the machine may change from side to side while at rest or in taking a new charge without apparent cause, it is necessary to have some manner of determining which is which. With sliding poles about an inch apart, start the machine slowly and observe the pole from which it passes. This is the positive pole.

With a spark stream about five inches long, ground one electrode. If it is the positive pole the current will be conducted to the earth and the spark stream will stop; if the negative pole is grounded, the stream will continue.

In a dark room, polarity may be determined by looking at the plates. Only a few stars are found on the metal comb on the positive side, while a heavy ultra-violet stream will be seen on the negative side.

When a machine changes polarity every week or so, or even while in operation, there is a loss of charge by leakage, and shows that the machine should be cleaned and the case dried.

Polish the metal surface of the electrodes and ball on sliding rods, so that the current glides off as smoothly as though lubricated. A chamois-skin is essential in keeping the electrode in good condition. Every irregularity interferes with a full flow of the current.

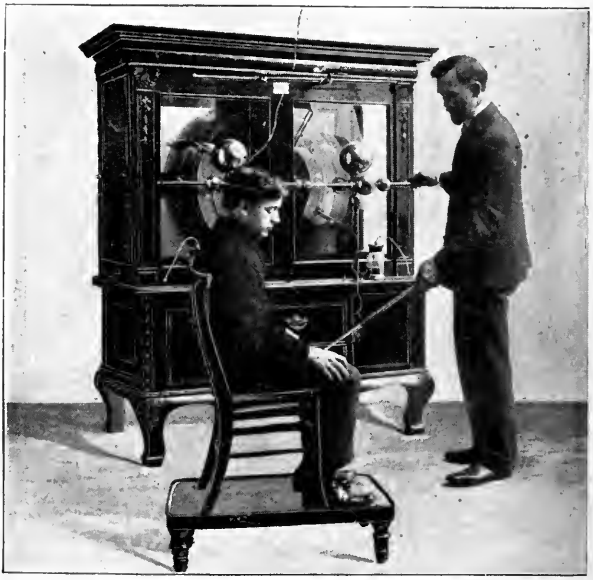
Every static machine will require renovation according to the amount of work done and care taken of it.

After thoroughly cleaning and drying the plates it will be well to cover the revolving plates with a coating of the best varnish.

The metal parts inside the case should also be lacquered. This is a difficult thing to do without taking the machine apart. When properly cleaned the machine is as good as a new one.

In static treatments we do not make contact with two poles, for if we do, then we either destroy the essential

accumulation if the patient is on the platform, or we must use a Leyden jar current, which is the same as the faradic, and, like it, it has no electrolytic or osmotic action. On the contrary, charged with but one pole, the pull is not inward but outward to the grounded pole, on account of the attraction by opposite electricity.



Treating Sprained Thumb by Wave Current.

To be a successful operator, it is necessary to know the sensation produced by the various modes of treatment, and how to differentiate between a tonic, a sedative and a counterirritant or rubefacient effect. Rudimentary skill in static application is quickly acquired through self-treatment, but skill can be acquired only by carefully studying the action of the current on different tissues and the varying resistance offered by different fabrics. Discriminate dose regulation by practice on yourself. The static current is not limited to one method of application, and, as in drugs, the therapeutic results may be obtained in more ways than one.

The action of local static applications exerts a powerful influence far beyond the area on which it falls. The surface stimulation of sensory nerves, as has been demonstrated, is transported to central ganglia, where it produces lasting effects.

You must be able to vary the speed of your machine or you can not vary your dose regulation, which you must, as you would a dose of morphine or strychnine.

INSULATION.

Seat the patient on the platform and connect the positive prime conductor with the platform by means of a conducting rod or cord, and connect the patient's feet with the conductor by means of the chain and foot plate or by holding the conductor in the hand. Ground the negative pole. After the plates have been set in motion separate the poles as widely as possible.

Positive Insulation.—The current of electricity, being a mode of motion, is conducted through the air in contact with the skin, and disassociates its molecular structures, upon the same principle as if a drop of oil were placed in a glass of water and stirred rapidly enough to break it up in minute particles. The more rapidly it is stirred, the finer the decomposition or disassociation of the structure. The large quantity of free oxygen or ozone thus developed is rapidly absorbed by the tissues. In consequence of this it has a wide range of usefulness as a tonic, especially in tuberculosis. We can appreciate this when we consider that all the various chemical activities occurring in the body are combinations of oxygen with food supply.

Positive electrification is more energetic than negative, on account of its higher voltage, and is correspondingly more valuable as a therapeutic agent.

With positive insulation the negative breeze often proves very irritating, and may be moderated by diminishing the resistance, removing heavy woolen clothing, etc. It is not irritating through cotton material or on the bare skin.

Negative insulation has no advantages over positive insulation, with the exception that the negative breeze is seldom irritating from without, and sparking seldom occurs, and for this reason it may be used with nervous and easily excited patients.

Patients enfeebled by recent illness, cases of anemia, neurasthenia and patients extremely susceptible to the weather on account of their debilitated condition frequently improve very rapidly under this treatment. When a person is "run down, overworked and fagged out completely," but is unable to leave business and seek rest, this form of treatment is of undoubted benefit, as it takes a great load off

Static Insulation.

the already overworked organs. The effect is less marked as we approach the normal state. It is applicable to any age, from the infant to the extreme limit of old age.

In cases of extreme nervousness and apprehension, no attempt should be made to do more than have the patient sit upon the platform in a condition of charge. This is especially true if a marked hysterical element enters into the case.

BREEZE.

The breeze of static electricity is a current of electrified air thrown from the point or points of an electrode to the body of the patient. The density of the current depends on the surface of the electrode and the number of metallic points implanted. The energy of the breeze depends on the speed

Stationary Breeze to Forehead.

of the revolving plates, the state of the air, the condition of the clothing and the manipulation of the electrode. The patient may be positively or negatively insulated; both the positive and the negative breeze are bland and sedative when applied to the bare skin.

Where insomnia is due to the irritation of auto-intoxication, the patient when placed under the influence of the static head breeze will frequently go to sleep in from five to ten minutes, and remain asleep while the soothing influence of

the static breeze continues, and frequently for hours afterward.

The breeze may be either movable or stationary. The movable breeze is usually the point or brush electrode in the hand of the operator, and may be moved back and forth with a slow or rapid motion over the region to be treated.

Through cotton, linen fabrics and on the bare skin the negative breeze is cool and sedative, but applied through

Head Breeze in Adjoining Room for Insomnia.

woolen fabric it may be made a stimulant and counterirritant, reddening the skin and causing sensations of warmth which may last for some time, and may be made to blister in a few minutes, if this effect is desired. Cold extremities, sluggish circulation, hepatic pain and pelvic pain frequently yield to this form of treatment. Irritant effects may be increased by increasing the motion of the plates and making an interruption between the prime conductor and the patient. When the hair is thick, the negative head breeze may be unbearable.

Metal ornaments and corset steels may cause burning or disagreeable sensations with the negative breeze.

SPRAY.

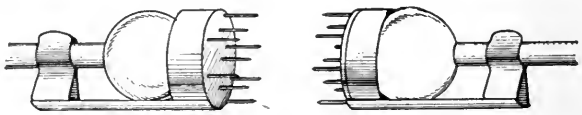
The static spray differs from the breeze only in the closer proximity of the electrode to the patient. It is more energetic in its action and therapeutic qualities than the breeze. It

Movable Negative Spray Over Kidneys.

intensifies all the effects produced by the breeze. It is more sedative and calming when these effects are desired, and more irritating and rubefacient when the latter effects are indicated. When powerfully applied and concentrated with skill, it relieves a great variety of painful conditions.

Owing to its simplicity and mildness, profound and unique effects, this mode of treatment deserves careful study, as operative technique plays an important part in the comfort of this application.

With the indifferent pole grounded, the patient may be either positively or negatively insulated, though it is well to bear in mind that the negative spray is more irritating than the positive. To obtain a counterirritant or rubefacient effect, the parts should be covered by woolen clothing or material of the same character. The irritating effect may be increased with the speed of the plates by interrupting the spray or bringing the electrode so close to the body that fine needle-like sparks will mingle with the spray. The spray acts as a sedative only on those parts which it reaches *en masse* and without friction.



These Shunt Terminals Permit the Giving of Positive Spray with Little Danger of Spark.

In giving the spray, study the point of your electrode, which will warn you when to avoid a spark which might disturb the patient. In giving spray, avoid all projections, such as the various angles of the face, that might draw off a spark. Slowly move up to where the violet-pencil discharge pours full upon the point you wish to treat.

As it is not necessary to use the platform when we connect the spray electrode with the machine, we are able to treat timid patients in another room. We can do this by placing a heavily insulated wire through the wall and connecting the cord from the machine to this. We connect our electrode cord to this wire, which has a hook in our room. The current may be intensified by placing the patient on an insulated metal plate connected with a gas-pipe, etc. (A large piece of sheet rubber may be placed beneath the metal.)

Cataphoresis is an impossibility with static electricity. The action of the static spray in hastening absorption of local applications to the skin explains what was considered cataphoresis by many.

The positive breeze or spray, on account of its cooling, agreeable, as well as bland and sedative qualities, is very grateful to the patient and may rapidly relieve such painful conditions as neuralgias, muscular rheumatism, hysteria,

painful inflammatory conditions and nervous headaches. The headaches not reached by the static breeze are usually due to some active continuous cause, such as anemia, neurasthenia, dyspepsia due to malnutrition, etc.

The ozone generated by this mode of treatment exerts a beneficial effect on mild cases of pulmonary tuberculosis. It must be borne in mind that the decomposition of the atmosphere results in the production not only of ozone, but also of nitric acid, which is an irritant. Either of these substances would undoubtedly destroy bacilli, if brought in

Static Breeze in Neighboring Room.

contact with them. These substances can be best localized by means of a stationary spray (from a wooden ball electrode) so placed as to give him the benefit of the decomposed air by inhalation.

The sedative positive spray finds a large field of usefulness in:

1. Acute rheumatism.
2. Acute swelling of joints.
3. Lingering pains of subacute rheumatism.
4. Simple conjunctivitis.
5. Simple laryngitis.

6. Simple coryza and hay-fever, where the antiphlogistic action dries up excretions of a serous or suppurating nature.

7. In nausea, spraying the region over the solar plexus and pneumogastric nerve frequently brings hasty relief.

8. It removes heat and itching from superficial inflammations, eruptions and burns.

9. It relieves the itching mucous tissues of the mouth from which diseased teeth have been extracted.

10. It not only relieves pain, but hastens the process of repair in fractured bones by relieving the condition of stasis.

The static negative spray may be used wherever a counterirritant is indicated, and is especially efficacious in:

1. Grip and malaria; this spray over the liver, spine and spleen frequently accomplishes great good.
2. Impaired sensation.
3. Chronic torpor of certain tissues.
4. Cold extremities.
5. Deranged circulation.
6. Bronchitis.
7. Injuries.
8. Pleurisy.
9. Nausea, etc.

A hot spray over the course of a nerve is very effective in relieving an attack of neuritis and affords prompt and wonderful relief in cases of gastralgia, cardialgia, nephralgia, ovaritis and neuralgia of the liver so common in diabetes.

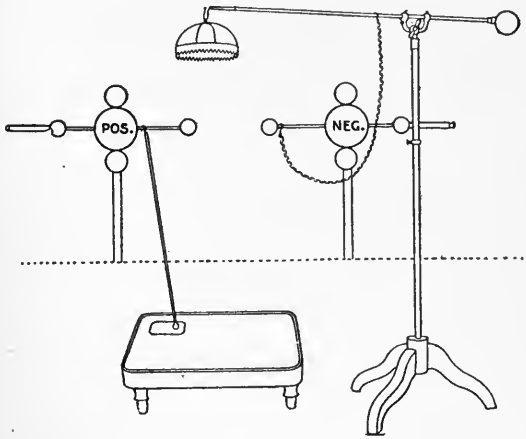
In treating an attack of neuritis or neuralgia of the face or hands it is well to cover the parts with a flannel cloth, as the skin is a very poor conductor and the tendency is to a dissipation of the charge.

The brush discharge is a discharge similar to the spray, a wooden (soft maple, white wood) ball or point electrode is used on the grounded pole, as it delivers a fine discharge without any disrupted qualities as sparks. (The electrode may be frequently soaked in water, as the discharge becomes less vigorous when it becomes dry; heating the electrode during cold weather increases the effect of the discharge.)

The intensity, volume and effect of this discharge vary with the speed, capacity of the machine, nature and size of the electrode, character of the patient's clothing and the atmospheric conditions. The effect of the brush discharge

on a wet surface or on wet clothing is entirely lost. Cotton or linen impairs its action, while woolen clothing over the surface to be treated favors strong effects.

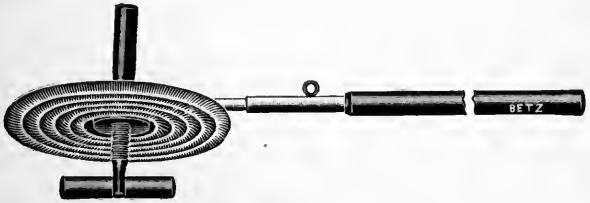
When applied for a long period the effect is at first rubefacient, and later vesicant, finally producing painful blisters.



Connections for Giving Positive or Negative Crown Breeze.

Open surfaces must be avoided, as most of the current will enter the raw spot and cause pain.

This discharge lessens local hyperemia and congestion by contracting the arterioles, thereby relieving pain and diminishing swelling to a marked degree. Metabolism is increased



Juettner's Prosphoric Static Electrode.

in the end organs, and healthy restorative action is induced.

The nature of this electrical discharge decomposes the atmosphere, developing ozone in so close a proximity to the skin or diseased tissue as to render the site of application distinctly aseptic by oxidizing organic life. It is owing to this property of the current that lupus, eczema, herpes,

acne and scabies are wonderfully relieved and cured by its action. Swellings associated with fractured bones, sprains and abscesses rapidly disappear. It has a wide field of usefulness in cases of gastralgia, neuralgias of a superficial nature, coccygodynia, pruritus and myalgias.

Ozone sprays heal granulations and deodorize fetid odor in sores.

A high frequency current may be obtained from the static

Positive Spray. Ulcerated Surface in Mouth.

machine by employing vacuum tube electrodes. The discharging spark-gap is essential, for without it there is no appreciative interruption, no frequency. The spark-gap between the balls of the discharging rod must be regulated to the condition treated. It is not necessary to insulate the patient as in other static modalities.

In the treatment of the air passages, medicated air, or medications held in suspension by the air, are used with more or less success, even with the very simplest forms of

treatment, such as sucking the air through a wash bottle containing the medication, or the inhalation of a medicated spray from an atomizer or a nebulizer. Nebulizers are used with more success for inhalations, because the substances held in suspension by the air are broken up into very much smaller particles than from an atomizer. In fact, there is considerable competition between manufacturers of nebulizers as to which nebulizer breaks up the medication the finest, producing a more perfect vapor for inhalation. The finer the particles held in suspension by the air, the finer or smaller are the air passages that may be reached.

Hughes Ionizer in Use.

The Hughes Ionizer is peculiarly adapted for use with a nebulizer, because the medicated air or vapor, in passing through the air chamber of the Ionizer, is acted upon inductively by the excited vacuum bulb, and undergoes changes which still further subdivide the particles held in suspension by the air to such an extent that they are rendered invisible. Connect the Ionizer to a nebulizer and it will be noticed before the current is turned on or the vacuum bulb of the Ionizer is excited that a cloud of vapor will appear from the opening of the Ionizer from which inhalations are to be made, but as soon as the current is turned on and the vacuum bulb

of the Ionizer is excited the cloud of vapor almost or entirely disappears, showing that the medication held in suspension by the air is so completely subdivided and incorporated with the air that when inhaled it will reach the very finest ramifications of the air passages.

If the medication used is alkaline in reaction it will completely neutralize the acid effects indirectly arising from excited nitrogen combining with hydrogen, thus the ozone, which is produced in large quantity, may be utilized without any of the irritating effects as experienced in the use of ordinary ozone generators. This is easily demonstrated by sucking air through the Ionizer without the use of any medication of an alkaline character. It will be noticed that considerable irritation is produced, invariably causing the patient to cough, but as soon as the air sucked through the Ionizer by the patient is made to contain medication, such as bicarbonate of soda or borax, the irritating effects of the inhalation entirely disappear. Deep, full inhalation may then be made without the slightest irritation.

The wide range of usefulness covered by a nebulizer is very greatly increased by the use of a Hughes Ionizer, and although the instrument is yet new, most gratifying reports are made by those using the instrument, as they get results promptly and in conditions which did not yield to treatment without the Ionizer.

SPARK.

Place the patient on the insulated platform, the indifferent pole being grounded. Before starting the machine, pull the sliding poles far apart. As a rule it is not necessary to connect the patient with the prime conductor, as mere insulation of the current on the platform is enough to give patient all the spark he can stand.

Use the grounded electrode for administration, as the spark, direct from the machine, is used only in cases of marked anesthesia. The spark is administered by throwing the metallic ball or point electrode with a quick movement to a point near the body, so that a disruptive discharge or spark takes place. The percussive discharge is a single discharge, thick, strong and clear cut. If the patient be negatively insulated, the spark is thicker, because the low voltage of the negative platform permits more current to

accumulate on the positive electrode before it breaks the tension. The positive spark is milder in sensory effect and less penetrating than the negative spark.

The spark is varied in size by the electrode; exactly as large or small bottles hold varying quantities, so varying sizes of electrodes hold greater or less quantities of electricity. The spark depends on the charge and capacity of electrode. The potential quantity of electricity is analogous to the

Posture in Treating Lumbago.

quantity of material fluid. The electricity resides on the surface of the electrode, and it is absolutely essential that the electrode be polished and smooth, as the current tends to divide and fly off the minute projecting points and edges. The size and length of the spark are indicated by the depth of the lesion and its chronicity.

A large ball electrode is rarely used except in cases of impaired sensation.

It is rarely advisable to administer sparks at a first sitting, if the patient is a stranger. After several treatments the system acquires a degree of tolerance and confidence.

The spark is not always found disagreeable, and a surprising number of patients will claim to really enjoy mild and skilfully directed sparks.

Posture in Treating Sciatica.

Sparks should be administered with some sense of regularity as to time and rhythm, for the tissues soon learn to anticipate the next spark.

Sparks rapidly following one another on the same spot cause unnecessary pain, and should be administered with an interval of time and change of base. Sparks should be avoided on all bony prominences, as the back of the hand, the finger nails, the dorsum of the foot, etc.

The breast, both in male and female, and particularly the nipple, is sensitive and should not be struck with a spark

except for sufficient cause. The genitals, most of all, must be avoided.

Sparks on face, head and breast must not be applied unless the machine is in slow motion.

Moisture being a good conductor, perspiration or wet clothing will conduct the electricity away and interfere with

Giving Mild Spark, with Electrode Not Grounded, but Held at a Varying Distance from Floor.

the action of the best machine. Over wet garments place a good non-conductor; even a newspaper will answer the purpose.

In administering sparks to the sole of the foot see that the shoe is dry, or it will form a spray instead of a spark. If the patient has on different thicknesses of clothing, draw off part of the current by means of the foot.

The static spark is the most active and far-reaching of all static modes, and produces wide-spread and strong muscular contractions, increasing molecular changes and

thus aiding both general and local nutrition. Sluggish and weak muscles are given renewed vigor; muscles and tendons long contracted are loosened and relaxed. Its action is especially beneficial in toning up the blood-vessels, for it causes their muscular walls to contract and empty the stagnant venous blood into the general circulation, thus stimulating and regulating the functions of nerves, muscles and visceral organs.

When employing sparks, be governed in acute painful conditions by the relief afforded, taking care to give no unnecessary sparks, but applying them directly to the lesion, where they are certain to be the most painful. The patient soon discovers that sparks so applied are followed by greater relief and enters into the spirit of the treatment.

In cases of pleurisy, sparks in the surrounding tissues restore mobility and relieve pain.

In bronchitis, mild sparks promote expectoration and shorten the attack very markedly. In other affections of the lung, it increases the capacity of the lung for oxygen by its effect on the respiratory muscles and centers.

In treating nerve affections, cause the muscles to be moved about and held in those positions that cause most pain, and then give the percussive spark.

Under the influence of long percussive sparks, thickened and edematous tissues, acute or chronic indurations and exudations are often resolved and soon absorbed, causing the tissues to take on a healthy aspect.

In fractures, sparks thrown into the joints will increase the mobility very markedly.

In chronic inflammation of joints, thick percussive sparks into the joint are very effective.

In locomotor ataxia give spark to plantar region of the foot. The number of sparks needed will depend on the tissues. It should be continued until they respond and become warm.

It must not be forgotten that there are people with hypersensitive skins as well as anesthetic skins, and a small spark will sometimes produce excruciating pains.

In old age, sparks applied all over the body have a wonderful rejuvenating and tonic effect on the body, and are a great aid to any medicine the patient may be taking.

In patients with sluggish circulation, the sparks are frequently followed by a mottled appearance of the skin, which may persist for two or four hours.

FRICTION SPARK.

The friction spark may be used during humid weather when the direct spark will not work. The patient may be positively or negatively insulated, and the active pole may be used either direct or grounded.

Movable Spray in Rheumatism.

The electrode is rubbed over the surface of the clothing, or the electrode may be covered with flannel and then rubbed over the bare skin. The discharge consists of a number of fine, minute sparks, varying from one-fourth to one-eighth inch, according to the thickness of the clothing. The positive spark is always milder than the negative, because it is given with negative insulation.

Place the electrode before starting the machine and separate the sliding poles gradually until the desired effects are produced.

The metallic ball electrode is, as a rule, preferable to the roller electrode, whose movements are restricted, and which does not slide freely in all directions as does the ball or blunt electrode, neither does it fit into the angles and depressions where you may wish to use it.

Wave Current. Electrode Under Feet.

Friction sparks have marked counterirritant and rubefacient effects, and may be used whenever counterirritation is indicated.

Friction sparks are a splendid stimulant to the capillary circulation of the skin, and as the fine sparks perforate the cuticle (just as a piece of cardboard is penetrated by being placed between discharging rods), they hasten the absorption of any medicament it is desirable to employ.

The influence of friction extends far beyond the reddened

skin, and reflex pains are often subdued by vigorous friction with the large brass ball over the region to which the pain is referred.

In paralysis, anesthesia, altered conditions of sensation, hepatic and ovarian pains, sparks are used with a great deal of satisfaction.

During the menopause, sharp counterirritation by friction over the cervical spine as well as around the pelvis gives a great deal of relief.

Friction sparks given from a rapidly moving wooden ball electrode over the affected surface frequently give prompt relief in rheumatism for about ten minutes.

In treating the spine or a larger surface, go over the tissues rapidly, and when treating a small surface, pause at short intervals, as the parts are very painful.

As a counterirritant, plain and simple static electricity can not be surpassed by any drug (all effects from slight warmth to vesication may be had); and the same principle that applies to drugs applies equally well to static electricity.

Investigation teaches that painful sensations travel along paths of least resistance on their way out (explaining reflex pains), and thus create a most direct route for the inward transmission of counter-electrical impressions that serve to annul pain.

Counterirritations of peripheral endings of sensory nerves are transported to the central nerve ganglia and are thus capable of producing organic changes; this shows how friction sparks operate in arresting cord disease. If, however, this relief does not go beyond primary palliation, the exciting cause has not been reached by the current and must be reached by some other means.

WAVE CURRENT.

Place the sliding poles in contact, ground the positive pole and connect the patient to the other pole. In utilizing this current, strips of flexible metal (block tin, etc.) or moist electrodes are applied to the affected parts beneath the clothing, and are connected to the machine by means of a flexible cord. Connection with the patient may be made at several places at the same time. The metal may be fastened to the cord by means of a spring clip or cuff holder. If the strip of metal is applied to the spine it is well to place the

patient on a chair with an extra high back. A pillow at his back will keep the metal in snug position. The muscular contractions or pain over the inflamed area will determine the relative size of the metal electrodes and the spark-gap.

The current should not be felt more at one place than at another. It may be necessary to moisten the surface when contact is first made to avoid stinging sensations. After treatment has continued, the spark-gap may be lengthened.

Wave Current. Electrode Over Cervical Spine.

This may be repeated several times during the treatment, which usually lasts from twenty to thirty minutes. The question is not how weak, but how strong the current can be administered without pain, to get the requisite local and internal effect on tissues or organs.

If there is a long spark-gap, do not come near the platform with anything that may draw off the current and give the patient a shock.

The tonic effect is in proportion to the length of the spark-gap.

This is the most useful of the electrostatic modes of treatment. Its superiority lies in the fact that it is a one-pole current of high or low potential, great or small frequency, is under perfect control, is painless during administration and potent for great good. The patient being insulated, he is repeatedly charged and discharged from the surface of

Wave Current. In Exercise of Wrist, After Fracture.

contact with the electrode, obtaining a local as well as a constitutional effect of general electrization peculiar to one pole.

In giving the general wave current, remove the shoes before putting the feet on the plate or insulate the feet by an excess of resistance by means of a magazine or other paper, so that intolerable sparks do not annoy patient's feet.

Profuse perspiration often follows an application; this is especially true in patients whose skins are active.

It lessens hyperemia and congestion, and relieves local pain by relaxing muscular spasm. It is very effective as a stimulant to general metabolism and a regulator of disordered nutrition exchange, and the so-called neuro-vascular gymnastics frequently bring about results superior to those of

Stimulation of Spinal Center by Interrupted Current.

general massage, because it reaches parts out of reach by ordinary manual manipulation.

In sciatic rheumatism we find that intense vibrations are required and the spark-gap must be opened to the limit of the patient's capacity. Place one electrode over the site of the nerve exit and another over the ankle. When the electrode touches the motor points it is extremely painful. The spark-gap must be opened gradually.

In neuralgia and neuritis of whatever nature place the

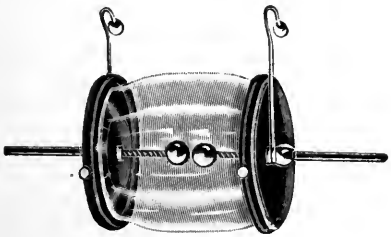
electrode over the congested and hyperemic spots, and especially over the motor points of the nerves.

In ovarian neuritis place the electrode immediately over the painful spot, on the abdomen and over the centers in spine.

In paralysis apply the metallic electrode to the spine and treat for about forty-five minutes with a large spark-gap.

In asthma place the metallic plate over the spine and chest in front. Make the spark-gap from four to eight inches, with an application of thirty minutes.

The wave-current treatment is very active and efficient in cases of gastralgia, angina pectoris, liver and kidney affections, pelvic neuritis, coccygodynia, irritable spine, etc.



Spark Muffler.

In prolapsus uteri or enlarged and hypertrophied uterus, a metal bulb within the vagina; in prolapse of the rectum or enlarged prostate, a rectal bulb appropriately placed within the rectum will frequently bring about astonishing results.

A swelling action may be brought about by placing the ball electrode over the muscle we wish to exercise, and by drawing the sliding rod just beyond full dosage and returning it quickly. This applies to the muscles of the hand, leg, thigh, arm, chest. This treatment, applied by means of an electrode over the perineum, stimulates the secretion, circulation, nutrition, and the nerve energy is powerfully stimulated.

By modifying our technique we may get all the vaso-constrictor effects of a rapidly interrupted fine coil current. The muscles can be slowly or rapidly contracted, this effect being regulated by the distance between the sliding poles

and the speed of the plates, manipulation of the electrode and duration of contact.

By applying a very small electrode over the eye, with a small spark-gap and the machine in slow motion, we obtain a wonderful tonic effect for tired eyes, blepharospasm and especially in that condition accompanying kidney affections, where glasses fail to give any relief. A half minute's treatment frequently gives relief for twenty-four hours.

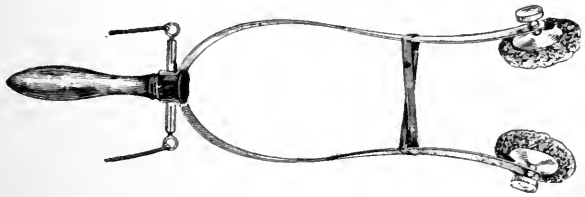
Leyden Jar Current in Chronic Laryngitis.

The application of this current can be localized to any part, great or small. The slowly repeated powerful interruptions are exceedingly stimulating, while the more rapid the interruptions, the finer and more sedative is the effect. It answers well for many of the local indications for sparks, while it seems to lack little of their power to rapidly remove localized or deep-seated pains in fibrous tissues. It is a comfortable method which will produce identical results in many cases to which sparks can not be applied.

LEYDEN JAR CURRENTS.

With the sliding poles closed and the machine in motion, gradually draw apart the poles after applying the electrodes. The passage of the spark between the discharge rods is accompanied by a painless contraction of the muscles in the region covered by the electrode. Use a sponge electrode moistened in a solution of bicarbonate of soda; the sponge must not be too large, as it destroys the efficiency of the current density, requiring too large a spark-gap, thus sacrificing rapidity and smoothness.

The Leyden jar current is regulated by the speed of the plates and the distance between the sliding poles. Though various sized jars may be used, we can so adjust the distance between the poles as to make the largest jars produce practically the same effect as the smallest jars.



Electrode for Treating Chronic Laryngitis by Means of Leyden Jar Currents.

If the current causes pain over a hairy spot, lubricate it with vaseline or soap and water.

There is no contrast of pole action as in galvanic electricity, though the positive pole has a higher voltage and a sharper bite on an abraded surface.

Leyden jar currents are used in the same manner and with the same electrodes as the faradic current. The difference between the effect of Leyden jar currents and the faradic currents on nerve and muscle is very little.

There is scarcely a pain due to traumatism, sprain, congestion or neuritis that is not benefited by the Leyden jar treatment. Its use is found chiefly in chronic cases, as in—

Rheumatism,
Rheumatic arthritis, small joints,
Gonorrheal rheumatism,
Gout.

Sciatica,
Chronic pharyngitis,
Chronic laryngitis,
Pains of various kinds,
Circumscribed burns,
Poliomyelitis—restores muscular tone and warmth to entire limb and prevents arrest of bone growth,

Leyden Jar Current to Spinal Center and Solar Plexus.

Edema of extremities,
Biliary lithiasis,
Occupation neuroses,
Chorea,
Locomotor ataxia—removes lightning pains and promotes feeling of well-being.

The author has found that the Leyden jar current is very efficacious in the treatment of a number of cases of relaxed kidneys. The accompanying gastric symptoms, as well as

the bearing-down and tired feeling, frequently disappear after two treatments. Two sponge electrodes about the size of the hand are used; one is placed on the back over the kidneys and the other over the solar plexus in front.

Many cases of Bright's disease are undoubtedly due to faulty digestion and chronic indigestion, with the consequent auto-intoxication. As these cases are less violent than the

High-Frequency Current in Appendicitis.

cases of nephritis following infectious diseases, they are ordinarily neglected, and attention is only drawn to the actual condition present by the mental and nervous irritability of the patient. This condition is greatly improved by local applications of the induced current, one electrode placed over the liver and the other over the kidneys.

The author has seen reaction from this form of current not obtainable from the strongest application obtainable from faradism, both coarse and fine wire coil. It may be used in the vagina, uterus and other internal cavities.

DOSAGE OF STATIC ELECTRICITY.

The dosage of current necessarily varies with the rapidity of the revolutions of the plates and in the manner of conducting the current to the patient.

The duration of treatment will depend on the pathological condition presenting itself. This condition will indicate whether the treatment should be repeated daily, or less often, and whether the treatment should be of a stimulating or sedative nature. It must also be borne in mind that a stimulating treatment for one patient may act as a sedative in another.

General electrification by insulation or the wave current usually requires from twenty minutes to one-half hour.

A sedative treatment, with spray or breeze, may last from ten to twenty minutes.

Stimulating and counterirritating treatments must of necessity be short and last from one-half to two minutes.

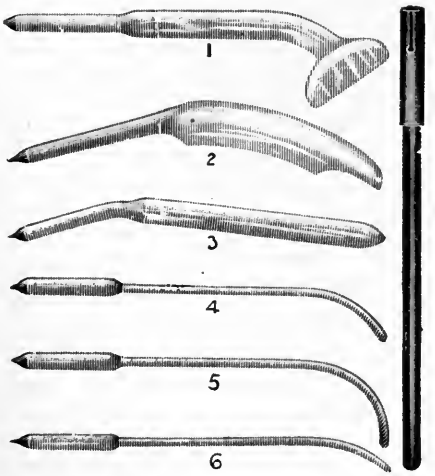
Acute and painful diseases should receive daily treatment until improvement permits of longer intervals.

Chronic cases must be seen at least three times a week.

An overdose or too prolonged treatment may be followed by weariness and a sleepy condition, never dangerous and always relieved by rest.

HIGH FREQUENCY CURRENTS.

At the present time two classes of apparatus are in use for the production of high potential currents—the static machine and the various modifications of the induction coil used in X-ray work, the voltage and frequency of alterna-



High Frequency Electrode.

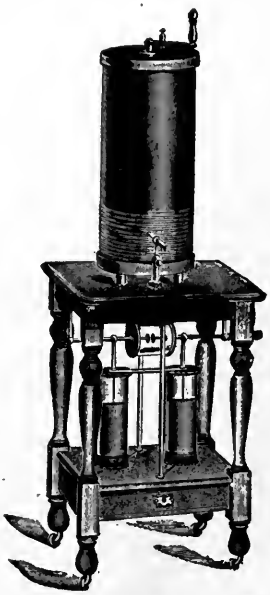
tions of which are still further augmented by means of the Leyden jars or Franklin plate condensers that connect the secondary windings of the Tesla coil or the Oudin resonator. The origin of the currents seems to be the external armature of the condenser, but they are dependent in a measure upon the current which charges the internal armature of the condenser.

The organism treated with the high frequency current receives, or at least becomes charged with, a current of one hundred thousand volts, the alternations (first positive, then

negative) of which would be the fabulous number of one billion or even higher per second.

When we remember that the greatest number of vibrations that can be appreciated in the production of sound is thirty-six thousand per second, we will admit that the term high frequency is well merited.

The alternations of an ordinary Rhumkorff coil are about



Oudin Resonator Attached to X-Ray Coil.

two hundred per second and the electromotive force of from ten thousand to two hundred thousand volts, while the alternations of the high frequency currents are millions per second and the electromotive force from one hundred thousand to one million volts, this, of course, depending on the means employed.

The dose ranges from one hundred and fifty milliamperes to seven hundred milliamperes. With high frequency such a dosage is not at all dangerous if judiciously applied, while it would be extremely dangerous if lowered to one hundred alternations, the usual rate.

It must further be remembered that the high potential is, in fact, obtained at the expense of the current, the latter diminishing in proportion as the potential or electromotive force is raised by each successive step up in the transforming apparatus.

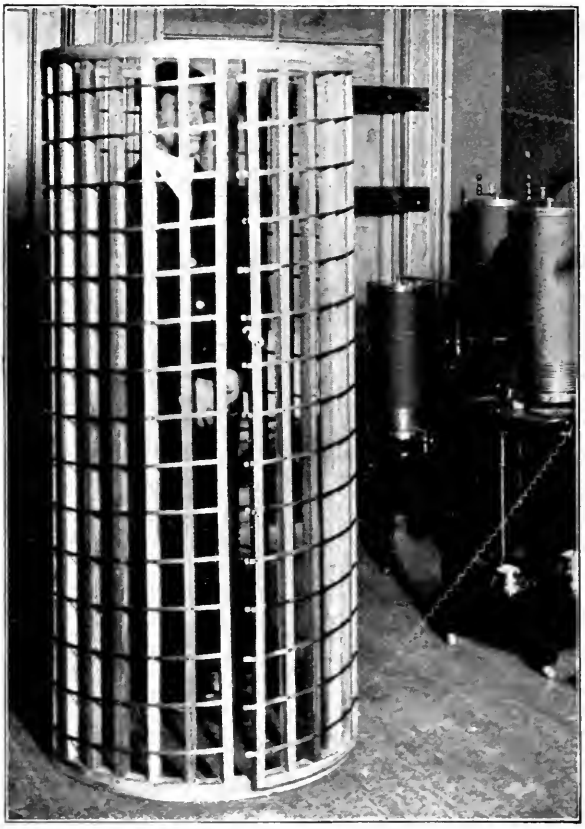
This current differs from all others. The energy produced is a transmitted vibration which is carried or conducted by all solid substances (glass or hard rubber and

High Frequency Current in Mastoiditis.

other non-conductors), irrespective of their electrical conductivity, and has been compared to a sound-wave vibration which passes through solid barriers by causing the particles to vibrate at its own rate of frequency. It passes through glass, though this would resist the passage of a continuous current even if the voltage were high. This explains the apparent ease with which the current passes through the body without giving rise to any unpleasant effect, resulting from the current overcoming the resistance. This current

produces a vitalizing and invigorating effect without undue stimulation. It is the nearest approach to vital force that has been produced.

According to Tesla, the innocuousness of these currents is



Auto-Conduction with High Frequency Solenoid.

accounted for by their not penetrating the body at the point of contact with the electrode, but perpendicularly to the skin and equally over the entire surface of the body.

D'Arsonval, on the other hand, believes that the motor

and sensory nerves are organized to respond only to vibrations of a certain frequency.

In producing muscular contractions a current of from twenty to thirty excitations per second is necessary. As the number of alternations increases the different contractions succeed in fusing together, the muscles becoming tetanized up to a rate of vibration of from twenty-five hundred to five thousand alternations per second. After this point has been reached tetany becomes less marked until no appreciable sensation is experienced.

When the number of excitations reaches a height which is distinguished as high frequency, all neuro-vascular reaction is arrested. It is possible that the motor and sensory nerves are so organized as to respond only to vibrations of a determined frequency, as does the optic nerve, the terminations of which respond only to undulations between four hundred and ninety-seven billions (red) and seven hundred and twenty-eight billions (violet) per second. To the infra-red and the ultra-violets we are blind.

In the same manner our auditory nerves are impressionable to vibrations of a certain rapidity only. Musical sounds corresponding to vibrations which are too slow or too rapid are not perceived.

The high frequency currents are applied:

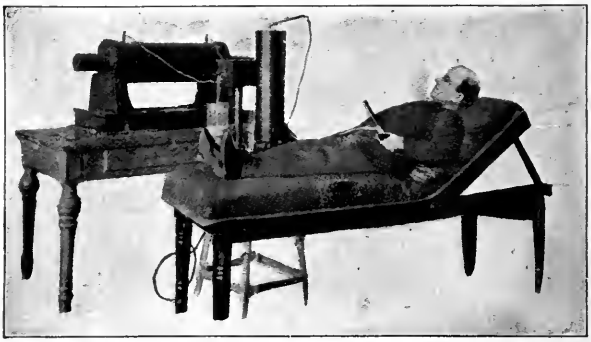
First: By auto-conduction, when the patient is enclosed in a solenoid of copper wire, the ends of which are connected with the terminals of a high frequency coil. The noteworthy method of this treatment is that the patient is not in contact with the solenoid. The solenoid may be large enough to envelop the patient entirely, or large enough to enclose an arm, a leg or the chest. The passage of the current through the cage induces, by mutual induction, high frequency currents in the tissues of the patient, which may be demonstrated by a spark being drawn from him at any part. That is to say, he is saturated by being placed in the field of the current.

If a lamp of twenty volts is used to close the circuit of a single coil of thick wire, it illuminates with a brilliant light at a distance of more than three feet.

When placed in the solenoid, absolutely no sensation is experienced, not even the slightest muscular contraction, but on placing a rabbit within a solenoid traversed by high

frequency currents, the vessels of the ear become rapidly dilated, shortly followed by a contraction equally energetic. Upon man the effects are similar and the skin soon becomes reddened and covered with perspiration. There is no increase in the body temperature, as excessive heat is lost by radiation and evaporation.

Second: By auto-condensation. This is achieved by making the patient one armature of the condenser, while the other consists of a large sheet of metal placed on a couch covered with cushions filled with insulating material, separating it from the patient, who holds in his hands metal

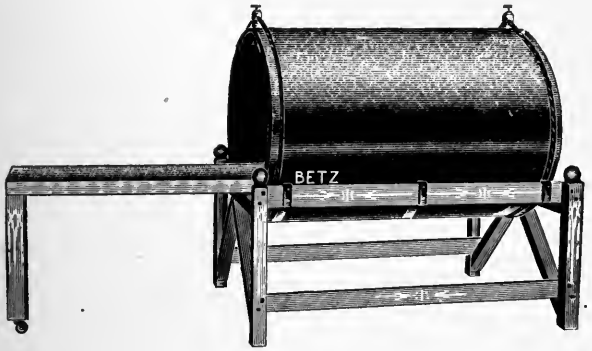


High Frequency Couch.

electrodes connecting with the other end of the solenoid. These handles should be large, and firmly gripped. The sensation of turning on the current is sometimes that of pricking by needles and pins, but usually passes off quickly, being at no time disagreeable. An ordinary armchair properly prepared may be improvised for the purpose of condensation, lining the chair with a metal sheet and placing the patient on insulated cushions. With efficient means, we may pass four to five hundred milliamperes through the body. The patient is charged and discharged at each oscillation of the condenser. The patient may be connected with only one end of the apparatus. This is usually termed the monopolar method; on account of the enormous voltage air ceases to be an insulator and the current passes without

conducting wires. In this method the connection is taken from the top of a resonator.

A resonator is a piece of mechanism whose construction is such that it is capable of vibration. Most of us have seen the experiment of two tuning forks, tuned to the same pitch, set close to each other. If one be set in vibration by a blow, the second fork will start vibrating by itself. Because it is vibrating in unison with the former, it will reinforce the sound given by the first vibrator. Similar phenomena can be produced in electrical apparatus and by electrical vibration. Oudin was the first to use a resonator in electro-therapy. His resonator was constructed of a



Body Diasolenic.

helix of wire of suitable length and diameter appropriate to the capacity of the inductor. When the solenoid was excited an induced current appeared in the second solenoid or helix, which by regulation could be made to vibrate in unison with the inducting solenoid. When the two solenoids were vibrating in unison a torrent of soft sparks would be seen emanating from the end of the induced solenoid.

The patient may be connected with the solenoid by means of two large hand electrodes. The current will pass through him by derivation, as, owing to the phenomena of self-induction, the solenoid will offer a great resistance. To obtain a perfect contact the handles may be wrapped in wet flannel or covered by a sponge. If the connection is imperfect, small sparks may be observed to pass. If we wish to

increase the area of penetration and lessen the obstruction of the skin a hand or foot bath may be used.

If the contact with the metal electrode is imperfect a small ulcer may be produced.

With local treatment, ocular evidence will be the guide. One must always bear in mind that local treatment, whether by effluve or otherwise, will, if persisted in for any length of time, cause inflammation on healed or healthy parts. The dosage requires as much discretion as any other therapeutic measure. It is frequently noticed that patients having pain at the commencement of a sitting may find it somewhat increased after energetic treatment. Defective

High Frequency Current in Acute Conjunctivitis Due to Cold.

contact between the apparatus and the patient may mean unpleasant sensations or even a shock.

Various shaped vacuum glass tubes are used as high frequency electrodes and owe their existence as electrodes to the therapeutical benefits derived from X-ray treatment. In X-ray therapy the benefits derived are undoubtedly due to the high mode of motion imparted to the rarefied air in the X-ray tube, and if this high mode of motion be capable of producing such remarkable therapeutic effects, will not a similar mode of motion imparted to the rarefied air of other vacuum tubes (made into various shapes and sizes so to be better adapted for treatment) produce similar effects?

Vacuum tubes used as high frequency electrodes are exhausted the same as an X-ray tube, as the results obtained

from their use depend largely upon the degree of vacuum; and it has been found by experience that a sufficiently high mode of motion should be imparted to the rarefied air in the tube to produce the same color as in an X-ray tube capable of showing the bones in the hand.

The high frequency electrodes are excited by an inductive action. Instead of conducting the current through the tube, the tube is provided with a metal socket or clamp to which one terminal of the high frequency apparatus is attached, and the strength of the inductive action, arising from the tube when thus excited, depends upon the regulation of the tension of the current produced by the high frequency apparatus. The inductive action arising from the tube may be employed in various ways. The distinctive work to which these tubes are adapted is similar to that for which the X-ray is employed, as in treating abnormal cell conditions involving superficial structures. The tubes are not adapted to treating deep tissue, as with the X-ray, and do not have any effect upon the deep tissue of a character like that produced by the X-ray; therefore they may be applied effectively in the treatment of superficial structures without fear of producing burn, thus doing away with the necessity of protecting healthy tissue. The only effect noticed from overexposure with these tubes is a slight dermatitis or sunburn effect, and the peculiar energy emanating from these high frequency tubes, similar in character to that emanating from X-ray tubes, may be employed with success in treating skin diseases, such as eczematous conditions, acne, lupus, minor epithelioma, etc., and in conditions involving the mucous membrane lining the cavities of the body.

Whatever is the true solution or explanation for the effectiveness of this current, it, nevertheless, remains a fact that the effects of the current are felt deep in the body and have a powerful influence over nutrition in a variety of ways.

Experiments prove that we have electrical currents traversing the body in every direction, and that the nerves are the carriers of the current. It is also true that everything that acts as a carrier of an electrical current vibrates. In perfect health the nerves are constantly vibrating. The rate of vibration is peculiar to the kind of current carried by the nerve. Whenever a nerve loses its normal vibratory tone, its function is impaired, but if placed under the

influence of the high frequency current the patient is subject to a series of vibrations, from a few to many millions per second. This being the case, every nerve in the body will find a current to which it will respond, and they will vibrate accordingly. A nerve once started vibrating normally usually continues to do so, and at least acts normally while under treatment.

The strong tonic action on the vaso-motor system flushing blood through the capillaries, opening sweat glands, relieving local congestion, causes a general sensation of warmth in the body.

Its effects are double: stimulation of the trophics, sedative to the sensory, tonic upon the unstriped muscular fibers locally, and cerebro-spinal and sympathetic nervous system generally.

Respiratory movements are augmented, and careful measurement shows an increased absorption of oxygen and increased elimination of carbonic acid gas, varying from fifteen to thirty per cent.

The inhibitory action of the current is proven by several experiments. Under its influence the excitability of the tissues to other stimulation is decreased; local anesthesia occurs to the point of penetration, and may last from one to twenty minutes; the sensibility of the skin to galvanism and faradism is greatly lessened after the passage of a high frequency current.

In consequence of the great quantity of ozone generated, this current has great bactericidal power, and has been found to destroy the toxicity of various toxines.

These currents, after a few minutes' application, will frequently relieve the severest pains, and are very effective in the various neuralgias.

Its action on the mucous membrane is demonstrated by the disappearance of some cases of persistent hemorrhoids, anal fissures and ulcers of the rectum. It not only allays the irritation, restores tone to relaxed fibers of blood-vessels, muscles and nerves, but restores the power of the impaired sphincter and removes the product of morbid nutrition. (If the cause, as torpid liver, etc., is still actively present, the relief will, however, be only temporary.)

Treating females about the rectum, near the menstrual period, sometimes brings on a premature flow. This fact

may be utilized in treating virgins for delayed menstruation, when vaginal manipulation is undesirable.

Nervous dyspepsia and atonic dilatation of the stomach, so stubborn to ordinary routine treatment, yield readily to treatment by high frequency currents. After a number of applications, varying from ten to twenty, the stomach shows a marked improvement in size and position, and in the process of digestion. The improvement is probably the result of the restoration of a normal circulation and blood supply to the gastric glands, the consequence of the return of the stomach to its natural size and position.

The improved circulation is probably due to the tone given to the tissues directly or indirectly through the vagus to the unstriped fibers which constitute the muscular walls of the stomach. This toning up enables the stomach to empty itself after each meal. The retention of imperfectly digested food ceases, and with this the absorption of the abnormal products of digestion and the consequent symptoms of auto-intoxication and neurasthenia. One writer reports favorable results in several cases of chronic diarrhea and dysentery.

Stout people lose weight during the continuance of this treatment, while the thin and emaciated gain steadily.

Acute indigestion is frequently relieved and the peristaltic condition of the stomach started by a few moments' treatment over the region of the solar plexus by means of a glass electrode.

Atonic dilatation, gastric indigestion and malnutrition in infants have in the author's experience responded, after a few treatments, when other measures in the hands of able men have failed. The treatment was applied by means of the vacuum tube over the solar plexus and over the entire spine.

The high frequency current has a powerful influence on the mucous membrane of the stomach and the intestines. A number of authors believe that these parts of the body may be best reached by applying one metal electrode to the surface of the tongue and another within the anus. Electricity passing along the lines of least resistance will pass mainly along the mucous membrane of the alimentary tract. Especially good results are claimed in gastric ulcers, chronic gastritis and chronic catarrh of the intestines.

These currents are effective in the various inflammatory

conditions, such as epididymitis, tonsillitis, beginning otitis media, and even mastoiditis. Marked relief is frequently obtained after one treatment, where, before the introduction of these currents, operation was the only resort.

In tuberculosis of the lungs the patient usually begins to breathe more freely after a local application over the chest of a shower from the vacuum tube about one-half inch long.

The action of high frequency by auto-induction on tuberculous guinea pigs has proved that an actual inflammation is produced around the pulmonary foci, and that finally this abates and leaves the lungs clear of bacilli. High frequency currents in any form are able to produce modifications in the tissues and make the body cells more resistant to the inroads of the tubercular bacilli. The leucocytes are usually greatly increased during the course of treatment.

This current is indicated in all diseases due to errors of nutrition, as obesity, diabetes, nephritis, gout, rheumatism, anemia and chlorosis. The best results in chronic cases are obtained by giving the treatment not only over the kidney and liver, but over the whole body. The duration of the treatment may be from a few moments upward, according to the subjective symptoms. A patient overdosed may feel a certain degree of lassitude, lasting more or less for several hours, or, on the other hand, may feel brighter or invigorated. The actual dose must be capable of variation.

AN ALTERNATING-CURRENT SOLENOID.

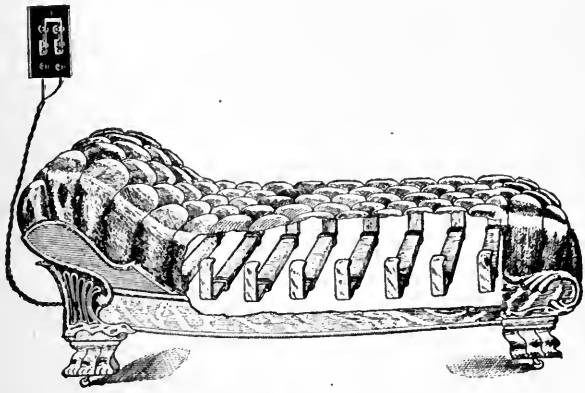
Wherever facilities exist for obtaining an alternating electric-light current this apparatus can be used. (The direct commercial current can not be used unless changed by a transformer.)

The apparatus consists of an induction coil, made to be worn around the body. The solenoid produces effects resembling the physiological action derived from a high frequency auto-induction solenoid. A small incandescent lamp held in the center of the solenoid will glow without contact with any circuit.

That electricity favors rapid growth in plants has been known for some time, but only recently it has been discovered that animal metabolism may be augmented by electricity, which is satisfactorily demonstrated by the fact

that guinea pigs and rabbits placed in an electrical solenoid will grow twenty per cent. faster, and be more robust than animals of the same litter not so exposed. The author can say from personal experience that it has a similar effect on children of backward growth, both physically and mentally, as the following case will show:

A boy seventeen years old had not increased any in height or weight since he was eleven years old. During this period of six years he had been under the care of able physicians in various parts of the country. The last two years had been spent in the mountains under the care of a physician



Alternating Current Couch.

that laid great stress on physical culture, etc. This treatment hardened the boy's nature, but did not assist his growth. The boy measured four feet nine and five-eighths inches and weighed sixty-seven and a quarter pounds. An X-ray examination showed that the ends of the boy's bones were not yet ossified, hence there was still hope for growth. The boy was otherwise in perfect health.

Under influence of static electricity, alternating solenoid and oil rubbings for one month, the boy grew three-quarters of an inch in height and gained three and a half pounds in weight. He was then taken to California in the hope that the mild climate of that country would help him grow now that he had a start. On returning at the end of seven months he was found to have gained about three-quarters

of an inch, or about one-eighth inch a month. He was again placed under treatment, and under the use of the solenoid alone (static electricity being omitted) and oil inunctions gained about one-half inch each month for the next five months.

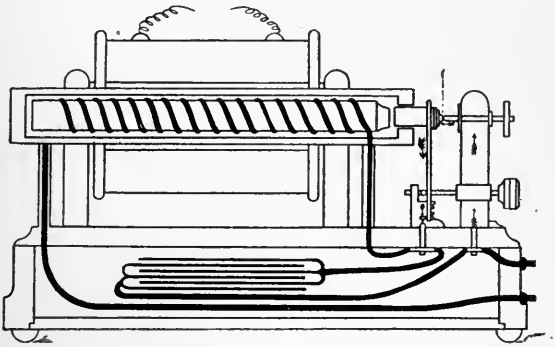
In the author's opinion oil is an important element in hastening growth, as is seen in children suffering from rickets. But that oil alone will not bring about such rapid growth was demonstrated by cases who had received oil rubbings for some time responding and making more rapid progress when the solenoid was used.

A couch may also be used with the alternating commercial current on the same principle as the solenoid. That magnetic waves surround the patient lying on the couch is shown by lighting a lamp held over the couch.

On a person in perfect health there is no apparent effect, while a patient tired or suffering from nervousness may become drowsy and gradually fall into a refreshing sleep. It stimulates the functional organs and the centers to nervous and physiological activity, and thus hastens elimination and promotes healthy tissue growth. As no technical skill is required to operate the apparatus, it can be placed in the patient's home and there employed under the physician's direction.

ROENTGEN OR X-RAYS.

The X-rays emanate from a mode of motion imparted to rarefied air in the tube, the tube being exhausted to about one two-thousandth of an atmosphere in order to leave the structures of air more free to move A thin substance may be stirred more readily than a thick one with the same energy, and as the mode of motion imparted to the structures



Rhumpfkorf Coil.

of the air must be a very high mode of motion in order to produce X-rays, it is necessary that the tube be properly exhausted, as a great deal depends on the vacuum in the tube.

So far the only means we have at our service for producing this intense bombardment and its consequent X-ray is the electric current. The X-ray is not some form of electricity, but is a higher rate of vibration even than light, and is the transformed energy of the electric current. This latter is simply the mechanism for its production. Any other form of energy, which would bombard the metal plate with sufficient intensity would also produce the X-ray, and it may be in the future some such other method may be discovered.

The apparatus used to excite an X-ray tube is either a static machine or one of the various modifications of induction coils. The Ruhmkorff coil transforms a low pressure current into one of high potential by means of an induction coil. To excite an induction coil it is necessary to bring two entirely separate and distinct circuits near each other, but not in contact. A current passing through one will, by mutual induction, produce an electrical current in the other, running in an opposite direction. If a break is made in the primary circuit, a secondary current is for the moment induced in the secondary circuit. If this make and break is done with great rapidity, the induced current will be one, continuously changing its direction; in other words, an alternating current.

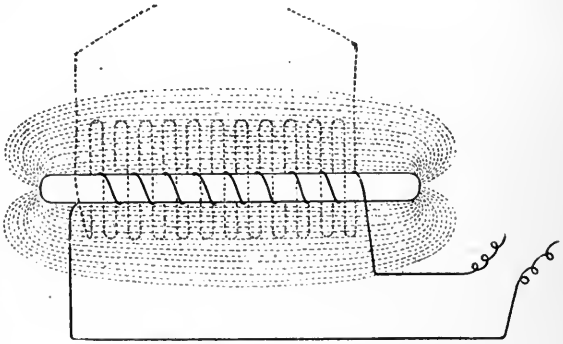
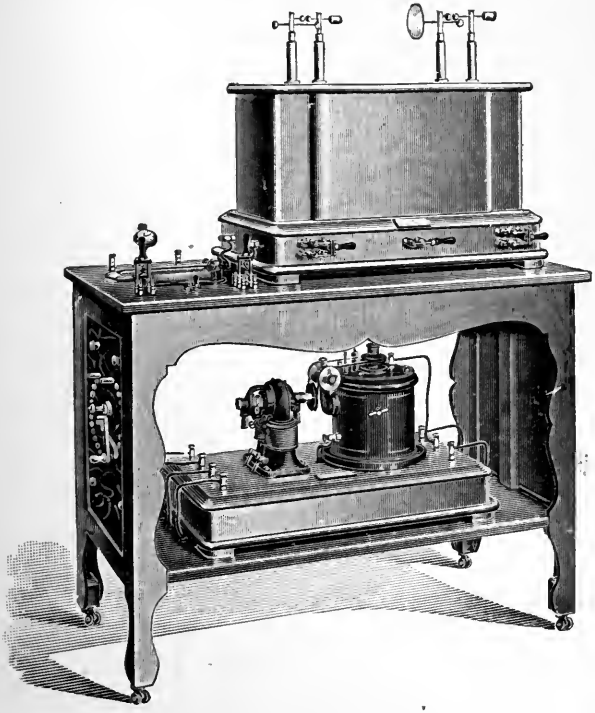


Diagram of Magnetic Field of Induction Coil.

The central core of a Ruhmkorff coil consists of a cylindrical bundle of thin, soft iron wires bound together and thoroughly insulated by being impregnated with paraffine wax. Around this core is wound the primary circuit, consisting of a comparatively short length of stout silk-covered copper wire, the whole being insulated with paraffine wax, and when cool pushed into a properly fitting ebonite tube to thoroughly insulate it from the secondary circuit. As the current is passed through the primary circuit the iron core becomes magnetized and emits lines of magnetic influence.

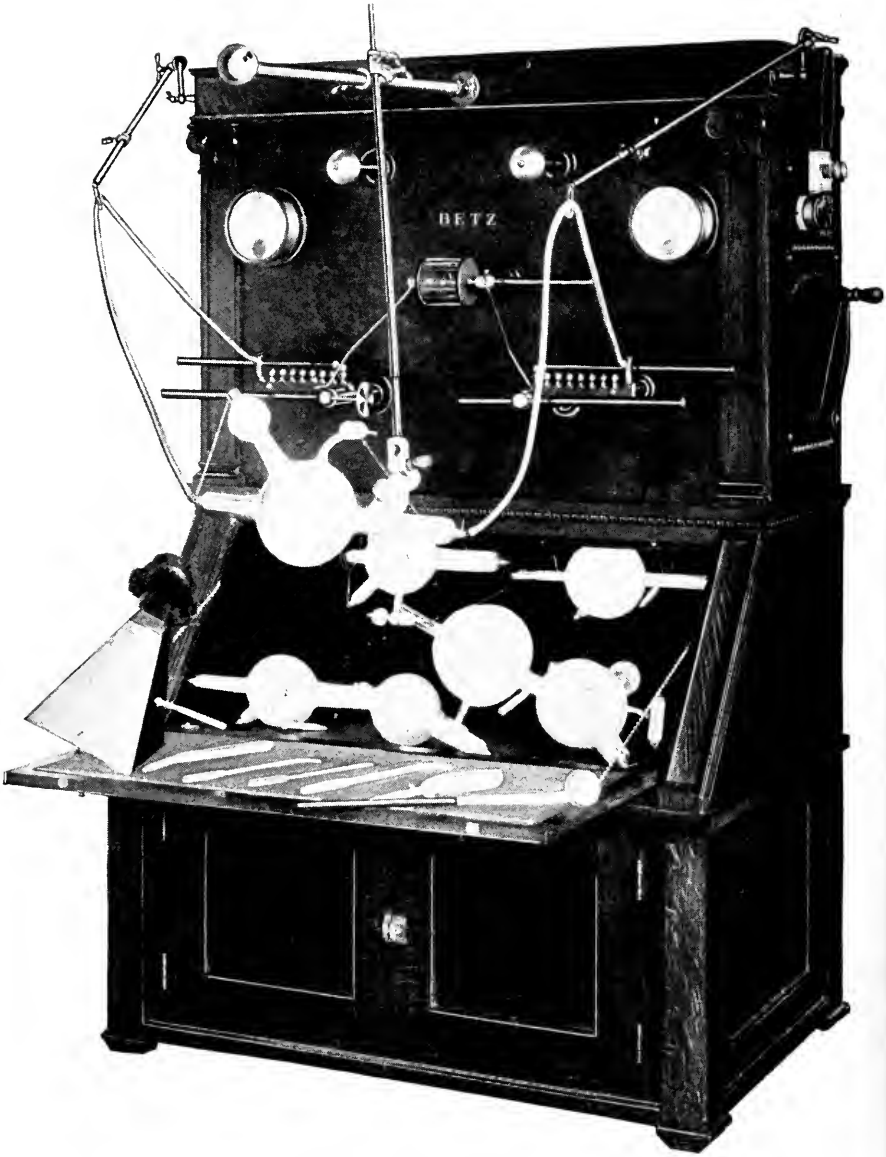
The secondary coil consists of many turns of fine insulated wire (No. 36), thirty to sixty miles in length, wound around

the primary and thoroughly saturated in paraffine wax. The secondary wire is coiled in sections to avoid the induction of the outer coil on itself, which, on account of the high voltage, is liable to take place, no matter how thorough the insulation. The wires are covered with silk and each winding is separated from the others by a layer of shellac. The windings of the



X-Ray Coil and Interrupter.

secondary coil are continuously being impregnated by the continuous flow from the iron core. The electromotive force of the induced current is thousands of times stronger than the primary current, on account of the great number of secondary windings. The strength of the current is reduced by the increased voltage, as well as by the constant change of its direction.



X-Ray Coil and High Frequency Apparatus.

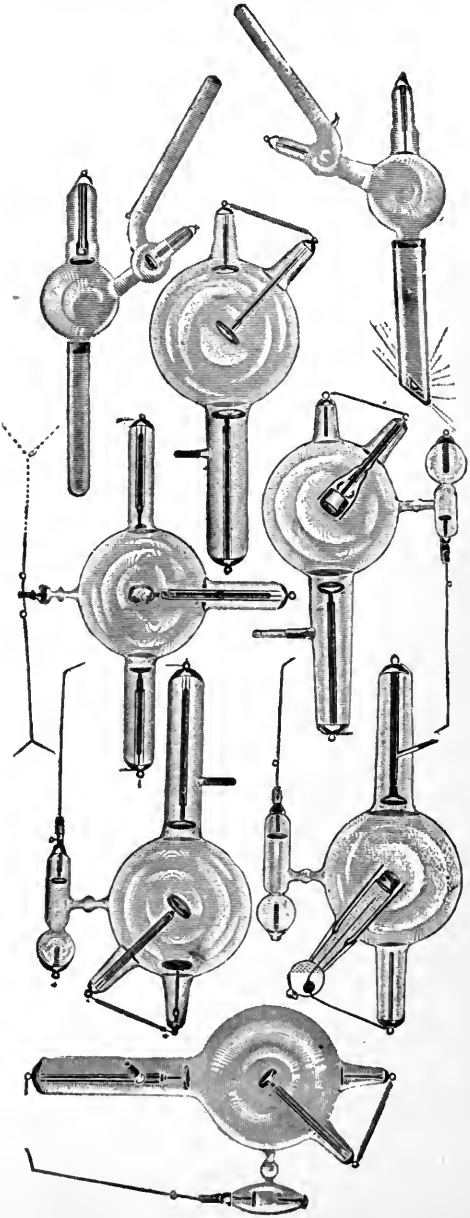
The breaking of the primary circuit momentarily produces by self-induction a slight current in the opposite direction. This self-induced current is absorbed by means of condensers, consisting of several layers of tinfoil, separated by sheets of paraffine parchment, the alternate sheets of the tinfoil being attached to one another. This absorbed current is discharged a moment later through the primary coil, thus creating a current in the opposite direction to the initial current, demagnetizing the core and greatly adding to the efficiency of the coil. A twelve-inch coil without condensers will barely spark two inches. High frequency currents may be produced with a six inch coil, but the best results can only be obtained with one of twelve or more inches.

The interrupters for the primary current in the coil machines may be divided into four varieties: The mechanical, the mechanico-electrolytic, the thermo-electrolytic, the electrolytic.

Light may be reflected, refracted and polarized; but not so the X-rays, which are the highest form of vibration we know of. The waves are undoubtedly too small to be reflected by any polish we are at present able to obtain, or to be refracted by any mechanism we are at present able to construct. The X-rays travel in straight lines and can not be bent or diverged by a magnet or any other known means. They induce chemical action—are photographic and cause fluorescence.

The apple-green hemisphere seen in an excited X-ray tube is the cathode stream which consists of molecules of gas, still contained in the tube, and the negative ions moving in a free path on account of the tenuity of the vacuum. They move in straight lines from the surface from which they are given off, therefore the cathode is made concave, so that the rays may converge to a point on the target. After these rays meet to form a pencil, they do not diverge, but continue in a straight line until they meet some resistance. Therefore the target should be a little beyond the true focus of the concave disc. The cathode stream may be deflected by a magnet in the same manner as the electric arc, but the X-rays can not. When the cathode rays bombard the target, there occurs a transformation of energy and the resultant X-rays are emitted in all directions from the point of bombardment.

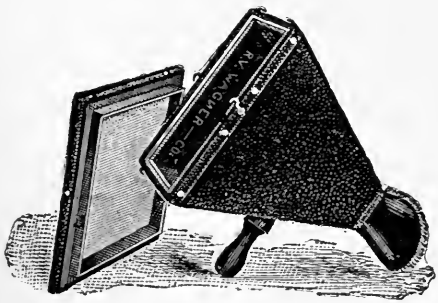
As the X-ray is invisible it is necessary to have some



X-Ray Tubes.

medium to translate or transform it so that its manifestations can be perceived by the human eye. This is done by means of the fluoroscope. This consists of a piece of cardboard covered with a thin layer of some fluorescent substance, preferably platino-cyanide of barium. For convenience, this is made the base, fluorescent side inward, of a pyramidal box, of which the apex is cut off and adjusted to the face about the eyes, so as to cut off all external light, in order that the fluorescent picture may be more distinct.

Why the platino-cyanide of barium becomes fluorescent we do not know. We recognize the fact that it does so and make use of it accordingly. Inasmuch as the X-rays pass through substances in inverse proportion to their density, it follows that the denser substances will cast the deeper shad-



Fluoroscope.

ows, and these lights and shadows make the picture on the fluorescent screen and photographic plate. Since the X-rays diverge from a small point on the target, the nearer the object is to the tube, the greater will be the magnification, and vice versa.

When the current is continuous, the higher the vacuum the greater the penetration, because as the molecules have a freer path they strike the target with greater force, and consequently the X-ray is more intense.

One thing not to be overlooked in an X-ray tube is the degree of resistance which the glass forming the bulb of the tube offers to the X-ray. As the ray emanates from inside the tube it must pass through the glass forming the bulb of the tube before it can have any effect therapeutically or

otherwise. Consequently, a tube that has the proper degree of vacuum and excited with proper electrical energy might be nil, so far as any therapeutical effects are concerned, if a glass of high resistance to the ray be used for the bulb. A bulb made of leaded glass would be equivalent to the use of a thin sheet of metal or screen between the tissue treated and a good tube.

To test a tube in this respect, examine it with the X-ray in the same manner as you would your hand, and you will find that a poor glass tube casts a denser shadow upon a fluoroscope than a good tube. A tube blown very thin, and of the proper quality of glass, greatly increases the penetrating power as well as the efficiency of the tube. The difference is readily distinguished if the tube be examined with the X-ray. No one would think of making X-ray exposure through a thickness of metal and expect good therapeutical results.

All X-ray operators employ the same general technique. The static and coil machines seem to be on an equal footing as far as the results are concerned. The same may be said of the great variety of tubes now in use, but one can never be certain of securing good tubes until he has given them a trial.

The X-ray operator should have several tubes and should learn their capacity and their moods. In general, the size of the tube should correspond with the capacity of his machine. There are advantages in having tubes of different patterns, according to the purposes for which they are used. Those that have a specially good focus (the target reddening at or near its center) should be reserved for *skiagraphy,* for radiotherapy does not require good definition.

Most new tubes possess a low vacuum and gradually become hardened through use and lose their usefulness for therapeutic purposes. By heating the tube equally a few minutes over a spirit lamp, the vacuum is quickly lowered and the tube rendered soft. After a tube has been treated in this manner, it requires but little use to reduce it to the same degree of hardness which it previously possessed. Eventually the tube becomes so hard that it is impossible to reduce it to the proper degree of softness.

Old tubes that have a tendency to become too low or too high while being used may very often be made to serve well by the employment of a single or multiple spark-gap, or if they are persistently too high they may be baked in an oven.

When the shadows of the forearm or hand on the fluorescent screen are so black that the bone shows scarcely or not at all, the vacuum is too low for fluoroscopy (Fig. a), though

Fig. a.

a skiagram may be made with a very long exposure. When the bones of the hand or forearm appear very black on the screen, the vacuum is low (Fig. b), and when these appear

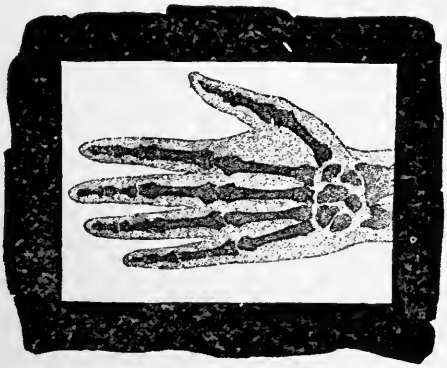


Fig. b.

very light, their outlines distinct, the vacuum is very high (Fig. c).

When the sparks pass around the tube from pole to pole, the vacuum is too high and the tube is in danger of being punctured (Fig. 1).

When the fluorescence in the tube is a rich green and is easily seen in a well-lighted room, the vacuum is usually low (Fig. 3), and when the fluorescence is less bright and its coloring yellowish green, the vacuum of the tube is high and has great penetrating power. Pictures of the hand lack

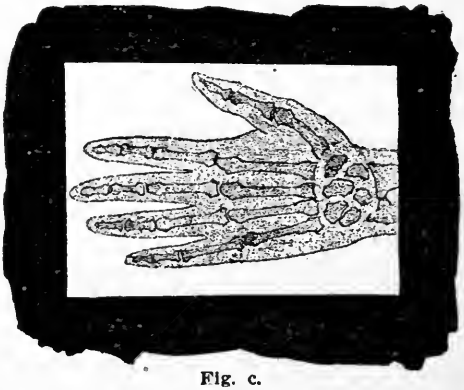


Fig. c.

contrast, the soft parts of the bones being easily penetrated (Fig. 2).

The color and brilliancy of tube fluorescence depend in part upon the volume of current employed, but also upon the age of the tube.

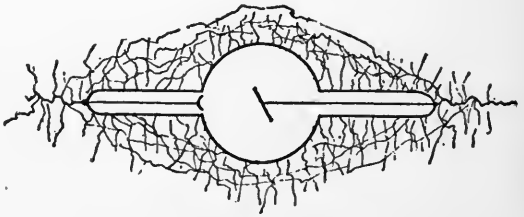


Fig. 1.

Tubes that have been much used lose the brightness of their fluorescence and in them the vacuum may still be low when the coloring is yellowish green (Fig. 4).

When the target of the tube quickly heats with a moderate current, the vacuum is low, but if without a water-cooling attachment the target remains cold with a considerable volume of current passing through the tube, the vacuum is high.

If there is a blue light in the upper part of the tube above the target, the vacuum is low, and the greater the amount of this blue light, the lower the vacuum (Fig. 5).

If the blue light passes between the cathode and the target, the vacuum is very low, and the tube must be cautiously regulated or it will be ruined.

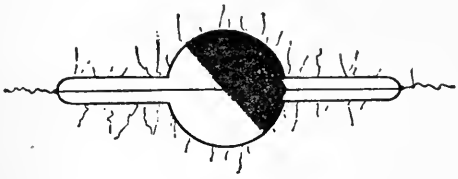


Fig. 2.

If the blue light is replaced by a violet light, the tube should be set aside for several days to rest.

If the violet light passes between the cathode and the target, the tube is probably punctured.

If sparks arc across between the poles, the tube has been punctured. In very old tubes this violet light may pass between the cathode and antecathode without the immediate

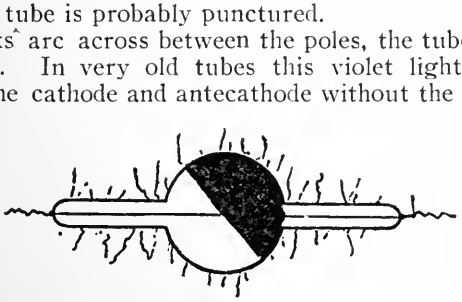


Fig. 3.

usefulness of the tubes being necessarily impaired, though they have passed the stage where they may be considered good.

When the spark jumps between the lead wires, the vacuum is too high or the wires are too near together.

By the above-mentioned signs the operator, as a rule, can determine the tension of his tube while it is in operation without exposing his hand before a screen. In therapeutic work the practice is fairly general to use low vacuum for surface lesions and high vacuum for more deeply seated diseases.

The value of X-rays is no longer limited to the elementary study of the skeleton lesion, nor their use confined to a few experts, but are passing into the hands of the profession at large, where, with other instruments of precision, they properly belong.

To interpret the findings of an X-ray examination experience is needed, but this is true of the stethoscope, the

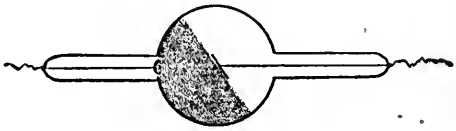


Fig. 4.

ophthalmoscope, cystoscope and other instruments for examining the interior of the body.

One practiced in fluoroscopy can, with moderate illumination, discern on the screen details which another, whose eyes are not trained, can not see at all, even with bright light.

Fluoroscopy has its marked limitations. Many details may be found upon a plate which the screen entirely fails to show, and even fractures may be overlooked if one limits his investigation to fluoroscopy.

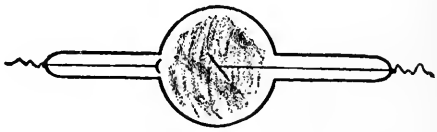
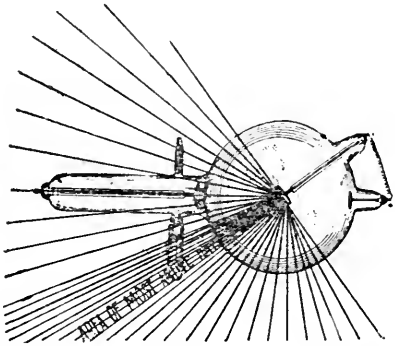


Fig. 5.

In making a skiagram for locating foreign bodies, as well as fractures, it is well to make two or more pictures. (It must be remembered that the picture on the screen is a shadow of the part examined and that there are many sources from which errors may arrive.) This will enable one to locate the trouble exactly. It is even desirable that the operator develop his own plates.

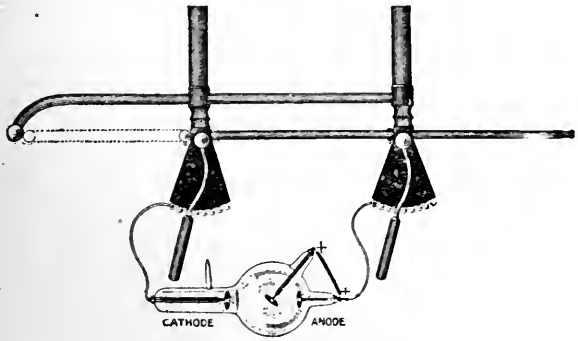
The tube which allows the operator to see the shadow of his hand on a screen at a distance of fifteen to thirty feet can not be depended upon to make a good picture at a distance of two feet. When the vacuum is such as to give a

satisfactory picture on the screen, it is higher than it ought to be for the best results with plate exposure of the same parts. In making a skiagram the length of exposure rather



than the vacuum should be varied to allow for differences in density.

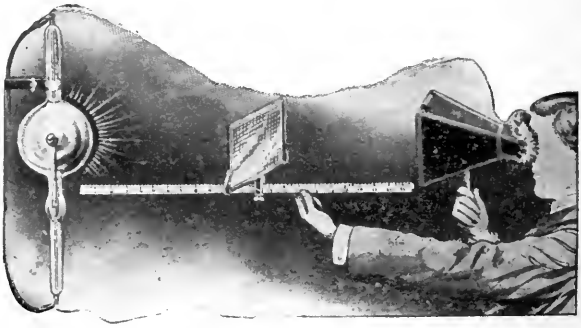
In skiagraphical work, it is desirable to have a tube with sharpness of definition or focusing powers. To make a



Pole Changer and Tube Regulator.

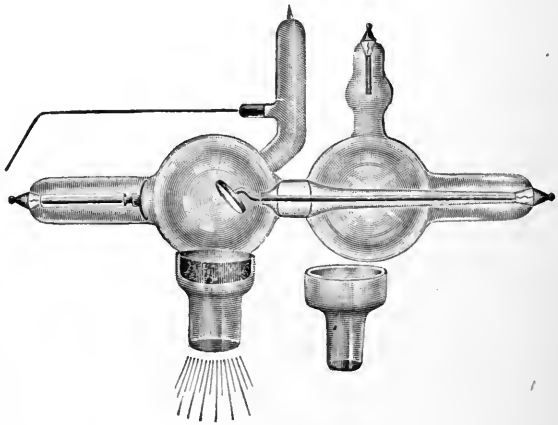
test hold the fluoroscope about two feet from the tube and hold a twenty mesh wire sieve between them. The nearer it is necessary to bring the screen to the fluoroscope, the poorer the focus, and the farther away, the more accurate the focus. A tube now on the market has the anode mounted

on a threaded stem which can be magnetically operated through the glass, moving it up or down or circumferentially with the surface of the tube to obtain an accurate focus.



Examining Focus of Tube.

The most satisfactory tubes for use are those constructed in such a way as to permit regulation of the vacuum in the tube.

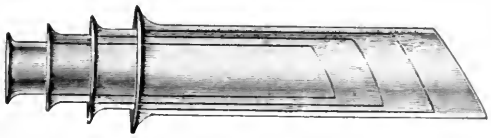


New Safety X-Ray Tube.

These tubes contain two regulators, one giving off a gas under the influence of the negative wire, thus lowering the vacuum; the other, being composed of an irido-platinum spire

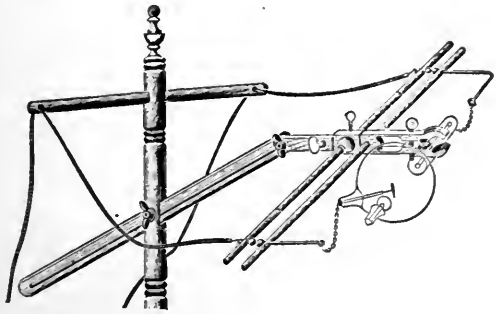
wire, absorbs the free corpuscles in the tube, gradually raising the vacuum to the desired point.

In the field of internal medicine the X-rays are a valuable aid to our methods of examination. This is especially true in abscess of the lung, pleurisy with effusion, pneumo-thorax,



Celluloid X-Ray Specula.

pneumo-pyo-thorax, subphrenic abscess, pericardial effusions, hypertrophies and dilatation of the heart, displacement of the heart, calcareous deposits at the valves, atheromatous patches in the aorta and thoracic aneurism, whose presence could not be demonstrated by means of percussion or auscultation.



Pole Changer.

In making examinations of the chest for diagnosis of tuberculosis in its early stages, we must constantly bear in mind the normal conditions for comparison. We have to discriminate shadows of the chest, neck, shoulder, clavicle and ribs, and not consider the circumscribed shadows as due to pulmonary atelectasis. The rays frequently show the disease to be more extensive than has been mapped out by the usual methods of examination.

After many repeated observations, loss of mobility of the diaphragm seems to be the earliest indication of tubercular mischief in the lungs.

In children a simple bronchitis may be differentiated from a bronchial pneumonia or a croupous pneumonia, and enlarged bronchial glands may be frequently noticed.

The X-rays are also a valuable aid in locating foreign bodies in the lungs. These, unless removed, may cause a septic pneumonia or septicemia.

Following the exhibition of bismuth, the patient's stomach may be outlined and the peristaltic action of the intestines may be studied.

In orthopedic work the X-rays are based upon a positive and scientific basis, and have become a necessity, because so much of its sphere has to do with diseases of the bones and this is what the X-rays are most prominently used for. In a swollen or extremely painful joint or limb the X-rays permit us to see the condition of the bones and thus prevent tubercular joints, etc., from being classed as rheumatism. This will prevent many stiff joints. A skiagraph will show the difference between osteoarthritis with enlargement of the bones from rheumatoid arthritis, where the disease is due to the cartilaginous portion, and where the bone frequently diminishes in size as the disease advances.

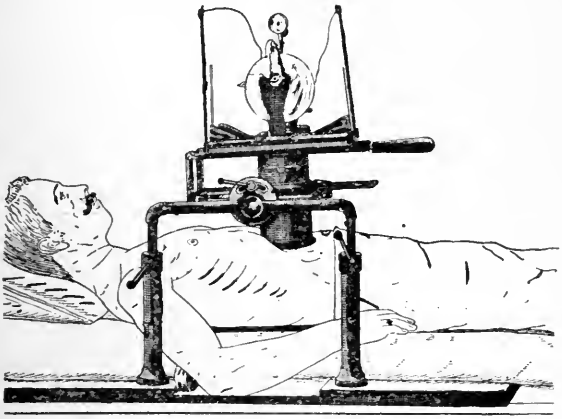
An interesting case occurred in the author's experience. A boy seventeen years old who had failed to grow even a fraction of an inch in height since he was eleven years old had, on physical examination been declared by eminent authority to have reached his full height and that further efforts in that direction would be without avail. The boy was examined by means of the fluoroscope, which showed the epiphyseal and diaphyseal cartilages had not yet become ossified. Under electrical treatment and massage the boy gained one-half inch a month while under treatment, but would cease growing when treatment was discontinued. In two years the boy grew seven inches.

The X-rays may be extremely valuable in helping us to clear up the diagnosis of obscure nervous diseases, as a callous formation might simulate a number of pathological conditions.

One of the greatest diagnostic achievements and the most exacting work of the X-rays is the search for renal, urethral

and vesical calculi in the living body, making an exploratory operation unnecessary. Gall-stones may also be photographed when of phosphatic formation.

The compression method as first adopted in Germany is a device by which pressure is exerted by a directing tube through which the rays are aimed at an exact target. This not only enables you to reduce the thickness by compressing the soft parts, but also enables one to push aside the obstructing part, enabling the rays to better reach the kidneys and bringing the objects sought nearer the photographic plate. It also serves to fix the parts on the table. This apparatus



Compression Apparatus in Use.

has the advantage of permitting us to use small plates, which are comparatively inexpensive. A high degree of sharpness also is obtained, as voluntary and involuntary movements are out of the question. The tube is always the same distance from the body.

The principal advantage of the compression tube is that it permits radiographs of the head, shoulder, hip-joint, lumbar vertebra, etc., to be taken, which compare favorably with dissected bones.

This apparatus with the use of a penetrometer which has been standardized by the German government, enables the operator to duplicate results almost exactly, as he can accurately determine the penetrating power of his tube.

The penetrometer consists of a small fluoroscopic screen arranged in an oval-shaped box with six circular platinum disks, set in a lead plate. Each of these platinum disks is of a different density, hence determines the penetrating qualities of the rays.

Since the introduction of the X-ray and its wonderful power to penetrate opaque substances, its efficacy has been demonstrated in the treatment of certain affections which have hitherto eluded both the physician and the surgeon.

The list of diseases in which the rays have been used with varying success at the present time includes epithelioma, carcinoma, sarcoma, psoriasis, eczema, hypertrichosis, sycosis, nævus, lichen planus, pruritis, dermatitis of an itching nature, keratosis, acne and keloid, leukemia, pseudo-leukemia, pain in malignant growths and tubercular joints, superficial parasitic diseases and neuralgias, and rheumatism of a subacute nature in the joints. The X-ray is one of the most certain, definite and effective remedies for the relief of pain, and the anodyne effects of the raying are not produced by local anesthesia, but change the disordered sensations into orderly and normal ones.

One operator has found that deeply penetrating rays have arrested the progress of degenerative changes in tabetic patients, possibly causing an obliteration of the cells of low vitality and stimulating a more healthy action and increased resistance in the normal tissues. At any rate, he succeeded in arresting the lightning pain, reducing the ataxic symptoms, causing a return of the knee jerk and an improvement in the general condition.

No one should undertake the use of this agent who is not reasonably familiar with its physical, physiological and therapeutic properties. In the hands of a safe and reliable operator it is capable of great good, while in the hands of one ignorant of its properties it may do much harm.

The technique of X-ray therapy is not a science; it is an art, and can not be learned from books. It is the product of experience, and experience only teaches us the demands and particular needs of each individual case.

Making exposures for therapeutic purposes requires fine and careful discrimination, and should be dispensed very much the same as any other drug.

The X-ray exposure at first must be tentative, to discover

any so-called idiosyncrasy of the patient. There is no doubt that with the same apparatus, same tubes and same length of time of exposure no two persons will respond exactly alike. What will have a stimulating effect on healthy tissue may cause a slight reaction in diseased tissue. It is not the X-ray so much as the judgment in administering it that cures.

The vacuum of the tube is of prime importance. Tubes may be classified as low, medium and high. A low tube is one that will carry the current of the generator without backing up a spark, when the prime conducting rods of the machine are from one to two inches apart; such a tube as this is used in the treatment of skin lesions, such as acne, eczema, sycosis, hypertrichosis, favus, etc.

The medium tube is one that will carry the current when the poles of prime conductor are between two and four inches apart. It is used in the treatment of glands, cancers near the surface, etc. Most work in radiography and fluoroscopy can be done with this tube.

A high tube is one that will carry a current without backing up spark when the distance between the poles of the prime conductor is over four inches. The tube is used in the treatment of deep lesions, as in affections of the pelvic organs, tuberculosis of the lungs, osteosarcomata, etc. The X-ray only acts when absorbed by the tissues. The intensity of action is in proportion to the quantity of rays absorbed during application, and this depends upon the amount of rays given off by a given tube and the duration of the exposure, as well as the distance separating the tissues from the anticathode. The quantity of light received obliquely diminishes in proportion to the angle of its inclination upon the surface which it meets, consequently move the tube about and give all parts the same exposure; otherwise an ulcerative radio-dermatitis may occur in the center and only a slight reactionary symptom occur on the periphery.

The low tube should be placed about three to four inches from the surface to be exposed, while where the large areas are to be treated time is gained by treating small area at a time.

With the medium tube a distance of four or five inches is ample; with the high tube, a distance of five to six inches is usually about right, though the higher the vacuum of the

tube the farther away from the parts treated must it be placed. The farther the tube is removed from the body, the less the difference in the quantity of rays absorbed by different areas.

The high tube is used for the treatment of internal troubles, as prolonged exposure may be made without danger of causing superficial sloughing of tissue.

Great care must, however, be taken not to expose the brain to the high tube, as serious results may follow.

The time of each exposure depends upon the generator. In using a sixteen-plate glass machine exposures of ten to twenty minutes are as a rule deemed sufficient, while if a twelve-inch spark coil is used, eight to ten minutes will suffice. Allowing the energy to concentrate on the parts a little at a time at frequent intervals permits nature to use it, while too long and vigorous treatment at one time may do much harm. Many operators begin with daily treatments until a dermatitis appears, which is usually in two or three weeks. In some cases tanning will produce the desired therapeutic effect, while in others, nothing short of a dermatitis will bring about success.

After a dermatitis appears treatment is suspended entirely until the parts have recovered, then the treatments are again resumed, exposure being made every other day.

In the treatment of pelvic troubles the author believes better results are accomplished by treating the parts directly either through abdomen or perineum than by the speculum method through the vagina or rectum, as by this means only a small field is exposed; and the contiguous glands which are always involved do not receive the needed stimulating effect of the X-rays.

The X-rays have a decided inhibitory influence on the majority of diseases. In carcinoma of the intestines, where life has been threatened with intestinal obstruction, the symptoms have been relieved, tumor reduced inside and life prolonged for variable periods. On the other hand, pain and suffering have been alleviated in the majority of cases. Rapidly progressing malignant and inoperable tumors have been indefinitely held in check and those that have recurred after complete disappearance have in some instances again responded to further treatment.

Under the action of the X-rays the hair follicles and glands

become functionally inactive and at the same time are impaired by the cutting off of the nutrition furnished by the normal blood supply. Characteristic contractions of protoplasmic structures are produced. The arterials contracting deprive the skin of the usual blood supply.

Protect the parts of face and head not being treated, by means of lead foil. Always apply the protective to the patient in preference to the tube, as any motion of the patient will remove the part we wish to treat and another part will receive the exposure. In treating the face also protect the projecting shoulder if it is nearer the tube, as it might be burned weeks before the part actually under treatment shows a dermatitis. The operator must be particularly careful to protect any abraded tissues he may have about his hands, as they form a fruitful culture field for the infections with chronic malignant diseases.

If, for any reason, a diabetic patient is exposed to X-ray treatment, it must be remembered that the reaction of the X-rays is out of proportion to what takes place in other patients, on account of the weakened condition of the tissues, and gangrene is very apt to supervene.

A large number of theories are advanced as to how the X-rays exert their curative properties, but it yet remains for the investigators to reveal the facts, and when once decided what X-ray does to living tissue, there still remains to decide how this affects the cancerous growth, and this latter decision can never be reached until we know what cancer is. The theory accepted by many operators is that its action is largely that of a mechanical irritant. The X-rays have no antiseptic action, except in so far that the irritation produced by the rays brings more blood to the parts. The mild leucocytous thus established enables the living tissue to cope with and conquer pathological cell proliferation. Examination of tissues removed after having been subjected to the action of the Roentgen rays demonstrates that the alteration produced corresponds to certain areas whose nutrient vessels had undergone changes. The lining membrane of the blood-vessels is primarily acted upon.

When an increased number of leucocytes is found in those cases undergoing X-ray treatments, an improvement is usually noticed, whereas when they become less in number than when the treatment was begun, then a continuation is

useless. A combination of X-ray treatments and internal medication gives the best results, the internal treatment consisting in securing the proper degree of alkalinity in the system, the administration of either arsenic or thyroid extract, or both.

An increase in the amount of nitrogen products eliminated is detected shortly after raying and for a few days following, and may account for the fatal ending following the use of X-rays. Lassitude, complete anorexia, cephalalgia, palpilation vertigo and insomnia are symptoms which frequently follow the disintegration of neoplasms, and are due to the absorption of the debris; open ulcers with abundant secretion are less apt to show toxic symptoms when treated. On account of the retrograde action of the growth and the consequent toxemia, eliminative treatment should be instituted as soon as the X-ray treatment has begun.

The liver, the kidney, the skin, and such organs as are intimately concerned in the elimination of poisons, should be stimulated to activity. The use of calcium sulphide and iodide of potass seems to be a great favorite with many X-ray operators.

In the treatment of Hodgkin's disease and other ailments where it is necessary to X-ray the entire body, the patient may be exposed to the rays at the proper distance and intensity daily from three quarters of an hour to an hour without suffering harm; on the contrary, gaining in health all the time.

Examination of lymph glands after prolonged treatment shows them to be greatly sclerosed; this undoubtedly explains the reason why cases of exopthalmia goiter are favorably affected by this form of treatment. It reduces glandular activity, and reduces absorption by the effects it has upon the lymphatics; as these conditions take place we find marked improvement results in the various symptoms; nervousness, exopthalmos and tachycardia steadily decrease.

The X-rays are apparently a valuable aid in the treatment of pulmonary tuberculosis, though by no means a curative measure. Hemorrhagic cases have made surprisingly quick recoveries, wonderful improvement taking place in eight to twelve weeks. Fibroid cases are very slow healing and it is doubtful if X-ray exposures have any effect. The temperature is frequently relieved, but beyond this there is no notable change.

Sarcomas yield more readily to treatment than carcinomas, yet sarcomas of the bone are not very hopefully affected by the X-rays.

Carcinomas of vascular regions as the anus or rectum are very obstinate in their behavior to the X-rays.

In carcinoma of the mammæ the X-ray has proven itself very serviceable and in operative cases the results now are far more favorable than formerly, if the X-rays are used before and after the operation.

In the treatment of cancers, it may be put forward as a broad general statement that the earlier the disease is discovered and X-radiation employed, the more confident we may be of success, for two reasons:

First, because the new growth is cut down and restricted more easily than when more matured.

Second, because the cancerous particles have not had time to migrate from their initial foci and spread the disease widely in districts which may be inaccessible. Every case of cancer should be treated with the X-ray at once, before surgical operation, and every case operated upon should be treated as soon as possible to prevent a return of the disease.

The universally disastrous results or sequences of operative procedure are due to the failure of reaching all the infected area. If the tumor is well advanced, X-radiation may produce retrogression of the growth, but even though this is so, there still remains a vast mass of diseased tissue, which it is desirable to get rid of and which should be removed by the knife.

The cancer cells that infiltrate the organ, being of lower vitality than the cells of the surrounding normal tissue, break down and are absorbed into the circulation and are thus eliminated. The same fate awaits the cells which infiltrate the glands. If exposures are carried too far, not only cancer cells but all tissue rayed will suffer a like fate. Having arrested the growth of the tumor the surgeon is called on to remove the offending material. This saves the patient much suffering, if not danger of toxemia which might happen if removed by absorption alone.

To avoid an overexposure one had best proceed in a methodical manner, keeping a memorandum of both the distance of the tube from the part exposed and the time of the exposure. One may begin with a distance of ten inches for

a ten minutes' exposure, diminishing one inch for each treatment until the distance is five inches from the exposed area. The time may be gradually increased. The object is to create a mild dermatitis, taking care not to induce such an irritation as would result in the destruction of the skin or subcutaneous tissue.

This dermatitis is not unlike the tanning of the skin when exposed to the rays of the sun. Several treatments may be given before this bronzing or tanning effect is appreciated. As a rule no therapeutic effects are noticed until it is established. The number and lengths of treatment it has taken to produce this dermatitis will be an excellent criterion of the patient's susceptibility. The operator will get the best results by regulating the length and frequency of exposure so that the bronzing may continue and become more pronounced without producing an actual burn.

Desquamation usually follows this dermatitis, and the patient has a slight burning after the treatment, which usually wears off in twenty-four hours. Should the exposure be too frequent and long, an actual and aggravated burn will occur, penetrating the tissues beneath the skin, and in some instances be followed by large sloughs.

Overzealous radio-therapy is to be avoided and condemned. The operator should never neglect to inquire of the patient about sensations experienced in the region being X-rayed. The first sensation of an impending X-ray burn is a sense of tightness in the region irradiated. Following this symptom and frequently coincident with it, there may be an itching of the part, redness and a sense of heat. In the presence of such symptoms no further exposure should be made until symptoms subside. This may take a few days or a few weeks. When treatment is begun, the first treatment should be short, two minutes with a coil and ten with a static machine every other day for a few months. Then an interval of four or five days is given to see if there is a tendency to a dermatitis. If not, another is made, still a short one, and three to four days allowed to pass. If at the end of this time no symptoms manifest themselves prolonged exposure can be made.

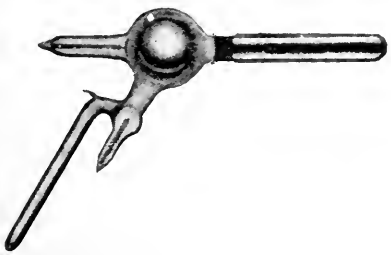
It seems that individuals who are sensitive to the sun's rays are likewise sensitive to the X-rays. Idiosyncrasy, here as elsewhere, plays its part.

It is necessary that the operator take some precaution to protect his hands and body.

When treating an extensive affection of the face, as acne, particular pains should be taken to completely cover the hair to the margin as well as the eyebrows, thereby avoiding accidental alopecia.

In treating epithelial growths of the face protect the parts not involved. It is always wise to screen the trunk when the face is being treated, and vice versa.

As the axillary glands are usually involved in cancer of the breast, it is usually well to give one radiation from the front and one radiation from the side at each treatment.



Jacket X-Ray Tube for Treating Cavities.

As it is impossible to say how extensive a cancer infiltration has become, the greater the area treated the greater the chances are of safety to the patient. If only the tumor itself is treated it frequently happens that the lymphatics draining the diseased tissue become larger, though the treated area becomes smaller. The futility of a shield in such a case is obvious. We want to reach all the carcinoma cells if we can, and the so-called shield does not shield the patient, but the carcinoma cells.

Of what use to treat a local sore and neglect the outlying section, which in its turn is certain to carry off the patient. In short, it is important to cause the radiations to reach the tumor and its lymphatics from as many directions as possible.

When an open ulcer exists, there is a danger of secondary infection in the treatment itself, for if the Crook's tube be examined, especially if it was one of high vacuum, it will be found coated with dust and dirt particles. These are positive particles corresponding to a similar shower of negative

particles, which are projected into the ulcer and which may lead to the secondary infection alluded to. For this reason it is well to cover an open ulcer with a layer of absorbent cotton during the treatment.

Too vigorous an application of the X-rays, by breaking down diseased tissue and throwing it upon the lymphatic circulation in large quantities, may cause an auto-intoxication which, if persisted in, may cause speedy death. There is also the possible danger that in the breaking down some of the living tumor cells may be carried to remote parts of the body, causing metastasis.

We are not justified to use the destructive power of the X-ray to cause necrosis in the manner of the old-fashioned cancer pastes, etc. We must always remember that cancers may arise from X-ray burns, and that a number of X-ray workers are at present so afflicted.

The so-called X-ray burns do not yield to treatment by antiseptics; in fact are always made worse by the ordinary dressing as applied to heat burns or surgical wounds. After sterilizing the parts by means of a saturated solution of permanganate of potass the parts should be protected by sterilized oil to keep out the germ-laden atmosphere.

X-ray burns may require weeks, months and even years to heal. An X-ray burn is not a burn as applied to a heat burn, which takes place in a few seconds. It as a rule takes the X-ray burn weeks and even months to reach its height.

An arc light (twenty-five amperes) projecting parallel rays from a parabolic mirror has demonstrated its great value in preventing X-ray dermatitis. Whereas it formerly occurred in from three to five weeks, X-ray treatment can be kept up indefinitely.

The X-rays diminish the resistance of the skin and the light from an arc lamp increases it, thus restoring the resistance of the skin without diminishing the effects of the ray upon the parts beneath.

Discontinuance of the X-ray treatment does not always mean a cessation of the curative process. The effects of radiation are frequently prolonged for several months after the last exposure, showing that the X-rays have a cumulative action.

VIBRATORY STIMULATION

The essential question to the individual who contemplates the treatment of disease by means of vibration, naturally is: How are the results sought to be accomplished?

Viewed from one point, all disorders of whatever sort are due to defective nutrition. It is the first step in every abnormal process, or indeed it may be said without overstatement that it constitutes the whole of it. The integrity of an organ, as well as the maintenance of its functions, depends on a suitable supply of nutriment, both in quality and quantity. If it were possible for us at all times to know what is at fault, to be at hand when the nutritive processes first begin to depart from physiological paths, and to have at our command the means, together with a right knowledge of their application, to set these processes right, both our pathology and our therapeutics would reach their ideal stage. But, as a rule, the abnormal goes on and we often recognize it only at a later stage, and here it is that we begin our process of repair, if perchance repair is possible.

The deeper the insight one acquires of the nature of physiological action in living tissues, and of the causes and influences that tend to divert that action beyond the limits of health, the more simple and rational will be the therapeutic means employed to remove the causes and check the morbid tendencies.

Action brings waste, and time and rest are needed for the reconstruction of the wasted substance. Often, through disregard of physiological laws, repair takes place slowly and laboriously, and at times even a cessation of efforts at repair may occur.

The nutrition of the body is decided by the quality of circulation in the minute lymph channels outside of the capillary walls. It is through these channels that the stream of plasma from the blood reaches the tissues, and it is here that the destructive germ or poison is seized upon by the phagocyte and torn apart to be digested; and the detritus, robbed of its infecting quality, is discharged

into the blood to be finally eliminated. The minute size, situation and function of these channels render them peculiarly susceptible and liable to obstruction. Impurities which readily circulate through the heart and arteries without inconvenience frequently lodge in these channels and obstruct them, greatly to the concern of the organs or tissues affected.

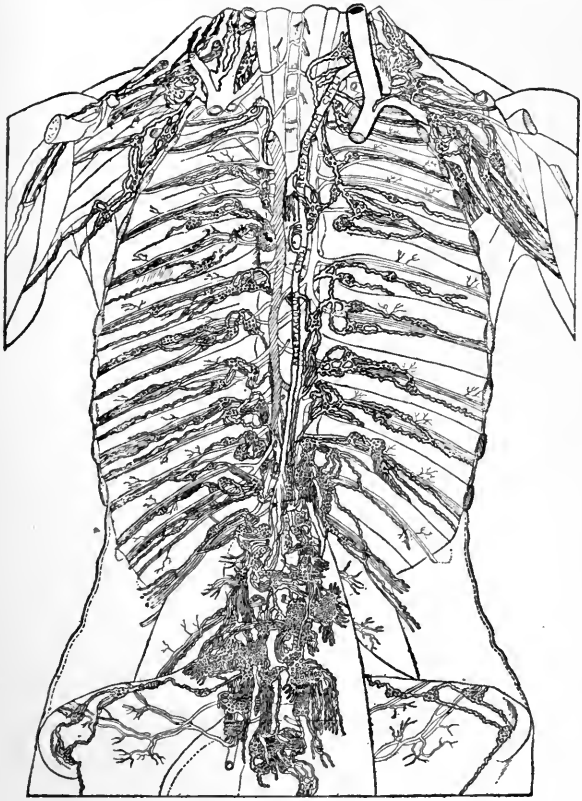
When the roadway over which the poisonous products must pass is clogged, drug-stimulation of the heart, liver, kidney and spleen frequently does not meet with the success we desire, and nature must be supplemented and complemented in another way.

In looking about for possible causes of disease which might interfere with the flow of nerve energy, we find contracted muscles playing a very important part. The muscles do not, as a rule, contract as a whole, but as separate fibers of several muscles, which accounts for the appearance of knotty or welt-like masses under the examining finger.

Contractures of muscles or muscle bands may be brought about in many ways—the most common cause being undoubtedly change in temperature, seasonal and climatic variations, etc. It is a recognized law of physics that cold contracts and heat expands muscular texture. These diametrically opposite states are prime factors in the production of many diseases. They influence the character of the changes of the elements that take place in the system, as well as the circulation of the fluids that contain them in solution.

Thus we see that a draught of cold air on a part moist with perspiration may be the starting point of a series of abnormal conditions, and a common cold may assume a serious phase when looked upon in this light. Contractures of muscle fibre may further be brought on by a constant irritation of the nerve supplying the contracted muscle. This irritation may be caused by impure blood due to faulty elimination, as found in auto-intoxication, fatigue, rheumatism, grip, malaria and similar abnormal conditions. Excessive use or overwork of one set of muscles, beyond the point of fatigue, is a very frequent cause of contracted muscle fibers. Thickening of the ligaments,

following some strain, wound or injury may act mechanically in shutting down upon the parts and cutting off blood and nerve supply. It is a common thing for scar tissue



Receptaculum Chyli; Thoracic and Abdominal Lymphatics.

Study of this chart shows why the deep cervical glands on the left side are always more or less involved in auto-intoxication from intestinal disorders.

to catch some nerve filament in its connective tissue and thus cause irritation and pain when it begins to contract.

That contractures of fine muscle bands, or ligaments, may be the cause of disease and not the result is also

easily demonstrated, for immediate improvement and recovery frequently follow the removal of these abnormal contractures.

Glands and Lymphatics of Cervical Region—Lymphatics on Posterior of Sternum.

Nerve tracing and spinal localization are frequently worth more than taking the pulse and respiration.

Contractures of muscle bands interfere with the distribution of lymph, blood and nerve impulse, as is easily

noted by the difference in the temperature of the parts, following the distribution of certain nerves. The action of these contracted muscle fibers may indeed become traumatic, in certain cases wounding a nerve or setting up nervous trouble, often causing degeneration.

Pressure from a contracture upon a nerve fiber may cause a break in the continuity of the semifluid axis cylinder and the damming back of its current upon the center of supply; or the contracture may produce sluggishness in the flow of fluids, thus influencing a change in the nerve structure with consequent disturbance of function.

We readily appreciate that disturbances must follow any interference with the nervous system, when we realize that the sympathetic nervous system controls the action of the motor system, and that in turn regulates the caliber of the arterial system. Contractures induced by the irritation of a nerve through a sympathetic filament may cause nerve waste to go on to the extent of threatening the destruction of the body, without the perceptible sensation of pain or even the knowledge of the patient.

The irritation upon the nerves or blood-vessels may be just enough to act on the ligamentous structure sufficiently to irritate them to the extent of a slight hyperemia. This condition, if long continued or frequently repeated, may cause an increase in the epithelium and connective tissue of these parts.

That a slight irritation may cause serious trouble is obvious in sprains and dislocations, which are frequently worse than fractures on account of the presence of thickened connective tissue following the subsidence of the inflammation. An irritation at any given point causes nature to throw a greater food supply to this point, thereby causing a thickening of the ligaments binding the bones or vertebræ together. Too much nerve force in one place reacts on the muscles there, causing them to contract. Nerve force acts in the nature of a stimulant to the terminal sensory nerves.

A muscular contraction anywhere, no matter how it is brought about, is a constant drain on our stock of energy. If the contracture becomes one of a chronic nature, the

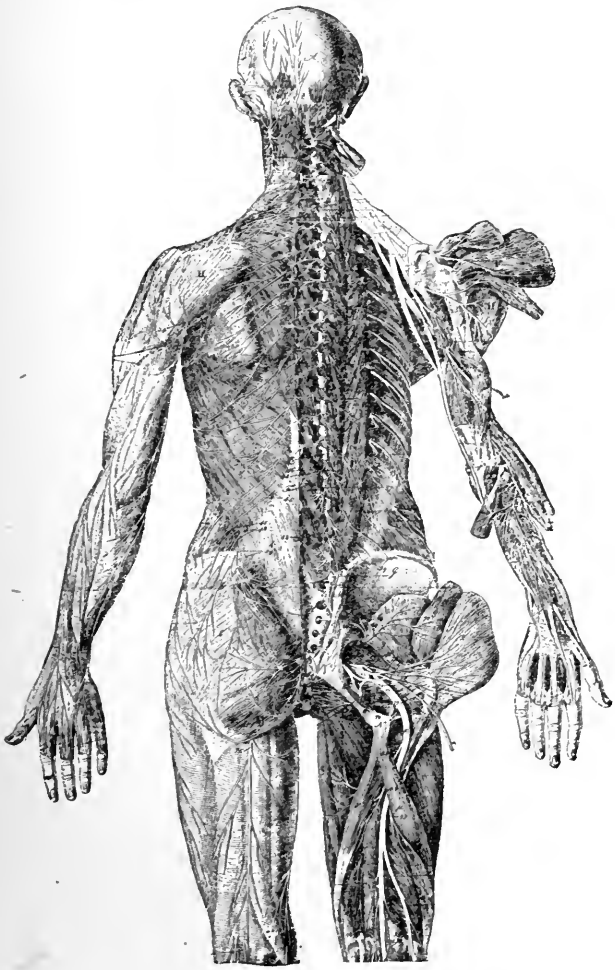
dissipation of energy frequently reaches an astonishing degree; in fact, may cripple the entire system.

The brain of man has been compared with a power-house in which there are many dynamos. Wires lead out from these dynamos to all parts and every organ of the body. The various organs and parts of the body have been compared to motors or engines that keep up their action by the energy they receive over the wires from the dynamos in the brain. The food we consume is a fuel which contains latent energy. Digestion prepares this fuel for admission into the blood. The blood carries it to the nerve centers or dynamos, where much of it is finally burned up, consumed, and the latent energy which held the food together in its fuel form is transformed into nerve energy, which is conducted by the nerves to very part of the "human plant."

All known phenomena are due to energy, which has different forms of manifesting itself. Fuel has energy in a latent state. It is burned in a furnace, and the energy that was latent becomes manifest by being transformed into heat and mechanical motion through a steam-engine. The dynamo transforms this mechanical motion into electricity, and as long as the medium is appropriate, this energy continues to manifest itself as electricity.

Energy is never annihilated or lost; it manifests itself in different wave lengths, such as electricity, heat, light, magnetism and nerve force. The medium and surrounding conditions determine the form in which it manifests itself, and what is known as nerve force—that which performs all the functions of man—is one of the forms of manifested energy. There are storage centers in the human plant, called ganglia. Muscles also have energy stored in them, but all such storage centers are dependent on the human power-house.

Every process carried on in the human body requires a certain amount of energy. Every organ and minute part is an engine, in itself powerless to perform any function whatever, and is as dead as an engine without steam or a motor without electricity. But when endowed with energy, each part does its work, performs its function, the same as an engine or motor when properly energized. Every organ acts just as its energy supply dictates. If the function of



Distribution of Deep and Cutaneous Nerves on Back of Trunk.

a part is normal, it is because the dominating supply of energy is normal. If the function is weak or feeble, it is because the energy supply is feeble; also, if the function is overdone it is due to an oversupply of energy. Disease

is nothing but perverted function, due either to nerve pressure or nervous strain or exhaustion.

Pressure upon a leash of nerves as they emerge from the foramina of the spine may modify their function greatly and even shut it off altogether. Removal of this pressure is frequently followed by so rapid a cure that we hesitate and wonder if some one was not mistaken.

The dynamos in the human brain are intimately connected by conductors, so that, when an organ or part is called upon for excessive work, the dynamo that presides over this part furnishes the excess of energy needed by robbing all of the other dynamos of their energy or working power. Thus all other parts of the body, for the time being, must suffer from the lack of the functionating power they are deprived of. Thus an organ may functionate improperly without it or its dynamo being at fault, simply because some other dynamo is taking its needed energy to supply the overtaxed functions of some other organ.

The occasional overtaxing of a function may not result in much observable injury to other parts; but, through oft-repeated and continuous experiences, the excessive function becomes a habit, and more or less continuous in its excessive demands on the common energy fund, continuously depriving other parts of a healthy functionating power. Thus we can readily see that organs can be diseased without the cause being in them or their governing nerve centers.

To illustrate, we may have a small lighting plant capable of furnishing electricity to illumine seventy incandescent lamps of sixteen candle power to their proper brightness. Should we, however, replace one sixteen-candle-power lamp with a three-hundred-candle-power lamp we would immediately notice a marked dimness in the other lamps. Examination would show nothing amiss with our dynamo, nothing amiss with our lamps, especially so with the robber which outshines all the rest.

A similar condition may and frequently does exist in the human body, the organ at fault varying with the individual. The most common robbers of our bank of energy are the eye, the stomach, the genital organs and the brain.

Of all the organs in the body, the eyes are most capable of demanding and getting an excessive share of the general

fund of nerve energy. The patient frequently finds himself running down, and when referred to the oculist returns with the verdict that vision is perfect, though in reality the eyes may be robbing the human power-house of enough energy to cripple the work of every organ in the entire body.

Overwork or abuse of any organ causes an excessive action of the secretory and trophic nerves supplying it to such a degree that they appropriate nearly all the nerve force given off by the nerve trunk from which they spring. This deprives the other branches of their normal power, and the organs that they supply become correspondingly weakened. The nerves to the ligaments that hold the two vertebræ of the joint in place and prevent them from slipping and pressing against their nerve trunk are among the smallest, but

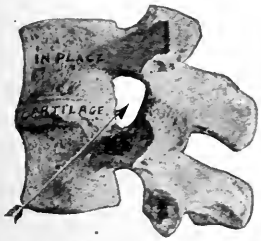


Fig. 1.

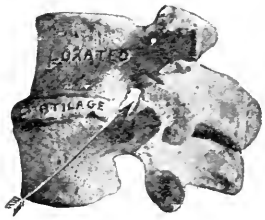


Fig. 2.

by no means the least-important branches (considered etiologically) of the spinal nerve. When these small nerves are unable to transmit their normal amount of energy, owing to their being attracted in other directions, the ligaments settle into an atonic condition that renders them incapable of the proper performance of their functions and leaves the spinal nerves in imminent danger of irritation and compression by the displacement of the vertebræ. If slippage occurs, the pressure of the bone shuts off a portion of the nerve current in the already weakened nerve, and precludes the possibility of cure by removal of the primary cause itself.

Careful scientific investigation shows that in disease of the internal organs manifestations of this condition will be made by tenderness in widely removed parts, because of

a fixed relationship between the diseased organ and the region manifesting the tenderness. Such investigation will reveal the fact that the soreness is not in most instances associated with the skin alone, but that the tenderness is found in the underlying muscle beneath. The physiologist explains the association between topographical tenderness and visceral disorders, by the assumption that the nerves supplying the regions thus related have their origin within the same segment of the spinal cord.

On examining the spine we frequently find that a slight contraction of spinal muscles has caused the spinous processes to deviate a little to the right or to the left of the ones above or below. Spinous processes may protrude beyond the general outline posteriorly, and in some instances merely a depression shows the location of the spinous process. The bones may have moved on their axes, either to the right or left, or have been pulled slightly forward or backward, a condition that must necessarily pull the surrounding structure with it and cause pressure on the blood-vessels and nerves passing under or into them, thus abridging their function. These deviations from the normal may be traced back to some slight traumatic injury, exercise persisted in after fatigue or some previous disease which so affected the muscles along the spine as to cause them to pull the vertebræ to one side. A previous illness may primarily have affected the spinal centers and they acting reflexly would naturally communicate the trouble to the muscles supplied by the nerves arising from that same portion of the cord. The muscles on one side of the spine are frequently atrophied, and under such conditions a tonic contraction of the opposite muscle is sufficient to pull the bones to that side. Slight irritation of a nerve by the pressure of a distorted vertebra, throws too much blood, nerve force and life to this spot thus affected, setting up an irritation which, if long continued, results in a thickening of the ligaments and perhaps permanent injury to the parts concerned. Constant irritation or stimulation in a region of high sensibility inclosing central connection with a viscus will produce both functional and structural disturbances in the viscus, as well as sensitiveness in the region irritated.

Consider, for example, the action of disease of the liver,

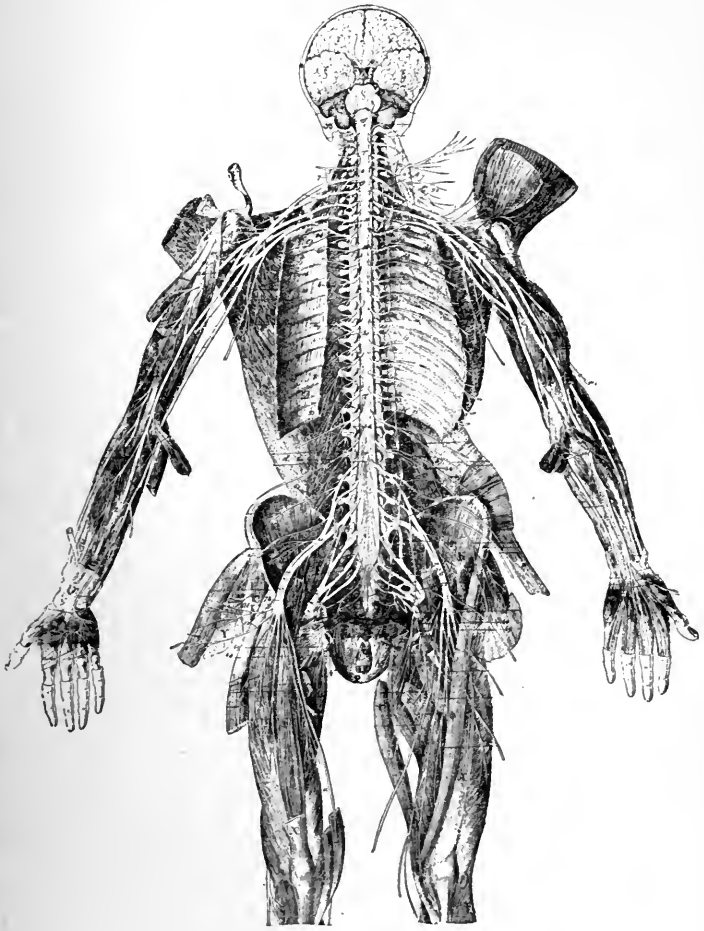


Diagram of Spinal Nerves and Plexuses

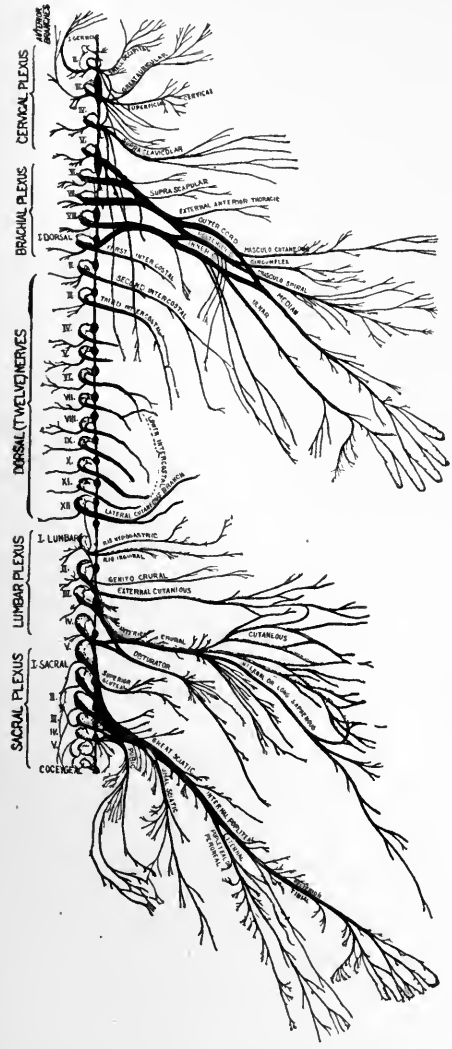
spleen or lungs upon its area of the spinal column. Irritation of the liver is frequently reflected to the right intercostal muscles, causing them to contract. It will then be found that the ligaments and muscles at the spinal attachment of the involved ribs are irritated as disclosed by ex-

treme sensitiveness to deep pressure. The circulation within the cord throughout the irritated area becomes more or less compromised and lowered nutrition of both nervous and muscular elements speedily follows. The muscles lose their power to longer maintain the spine in proper equilibrium, in which case the spine will be slightly deviated to the opposite side.

If the spleen were the seat of irritation or disease, substantially the same resulting pathological condition would be established upon the opposite (left) side of the body. The same involvement of ribs, muscles and ligaments would occur, but with even more distressing and disastrous consequences. The reason for this is obvious, when it is remembered that the contracted muscles in the area on this side may inhibit nerves which control the functionation of the pancreas and that these nerves are also liable to reflect its pernicious influence to the sympathetic nerves which control the secretion of the digestive juices of the stomach, and may affect the action of the heart. In irritations, therefore, of the dorsal region on the left side, it is by no means rare to find in association the following symptoms: Hyperacidity and flatulency in stomach and intestines, gastric catarrh due to a disturbance in the secretion of hydrochloric acid in proper proportion, pain, impaired digestion and assimilation. In the above conditions, points of tenderness will be found at the angle of the ribs, and treatment should be applied accordingly.

If the irritation should happen to be located in the right lung or pleura, it might be communicated to the intercostal muscles. The ribs would become depressed and the same spinal condition already described might ensue; but there frequently occurs also in this connection, pain in the deltoid region, shoulder joint and arm, with more or less impairment of function. The reason for this will be readily evident by recalling the anatomical fact that a branch from the second and third intercostal nerves communicates with the arm, and the sympathetics of this area influence the nutrition of the parts above mentioned.

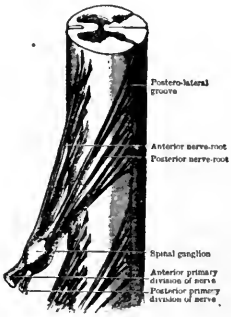
A depression of the clavicle caused by contractured muscles may bring pressure to bear on the nerves or blood-vessels passing between it and the first rib, and be the cause of a series of very unpleasant symptoms.



Spinal Nerves and Flexures, with the Sympathetic Nerve Connections.

As in the spine, abnormalities may occur in the ribs at any point through the thorax. The most frequent abnormality of a rib is a depression of its sternal end. This is invariably followed by irritation of the intercostal nerve and its branches, interference with the intercostal circulation due to compression of the vessels, and irritation of the muscles and ligaments at the attachment of the rib to the vertebra. If a rib is deflected, its edge may be easily detected by comparing it with the flat surface of a normal rib, or comparing it with the same rib on the opposite side.

The correction of malposition should be one of the first steps taken to bring about a cure.



Roots and Origin of the Seventh Dorsal Nerve.

Many semi-invalids who are not really ill, but at the same time do not possess a satisfactory degree of health, owe their condition to their avocation or occupation which tends to an undue and disproportionate activity of some parts of the physical system to the detriment of others, and this partial lack of functional activity may be a potent cause of ill health on account of the relaxed or contracted condition of certain muscle fibers or muscles on certain nerves.

There are cases every day under the physician's observation, presenting conditions that have endured from childhood, which predispose to abnormalities in adult life and are due to easily recognizable disturbances of the nervous mechanism of different parts of the body. If these conditions are corrected, and if nature is only in a measure helped over

the hard places, she will take charge of matters and we can feel assured that the ultimate result will be satisfactory.

A flabby muscle is usually an indication that the disease has progressed to a considerable degree.

The gravity of an injury along the spine does not depend upon its great extent, as a slight twist may cause a great deal of trouble, while a deformed spine may be congenital and cause no trouble whatever. It is not the extent of the injury to the spine that determines its gravity, but the amount or intensity of nerve force displayed at any given point. Degeneration may follow a slight lesion of the nerves, such as compression, over-extension and the like. The separating of the molecules in the white substance of Schwann may have the effect of setting up a secondary degeneration similar to that resulting from a division of nerves. It is impossible to send a communication over an electric wire without continuity of contact. Similarly it is necessary to have perfect freedom of communication along a nerve between the terminal end and the nerve center.

Briefly stated, the nervous system which unites and coordinates the various organs and tissues of the body and brings the individual parts into relationship with the external world is arranged in two systems termed the cerebrospinal and the sympathetic systems, working in harmony with each other.

The cerebrospinal system consists of the brain, spinal cord and the nerves emanating from them, and controls motion and sensation.

The sympathetic system consists of a double chain of nerve centers, connected by nerves situated on each side anteriorly of the spinal column extending from the base of the skull to the end of the coccyx, and communicating with the cerebrospinal system. It is the center of the vasomotor system and is the central station for reflexes; it automatically exercises action and control over the circulation and functionation of the several viscera. It serves as an indicator of abnormal action in the various organs of the body, the indication being manifested in the muscles overlying the anterior branch of the spinal nerve, through contraction and muscular irritation. The sympathetic system controls nutrition, growth, secretion, and modifies the action of the other set of nerves.

A careful study of the nervous system will be amply repaid. So far-reaching and important are the effects of the nervous system upon the physical well-being of mankind, that a careful, comprehensive study of its manifold functions is in every case a forerequisite to intelligent diagnosis. Therefore, as a lawyer consults his authorities before venturing an opinion, so also should the physician consult his anatomy and physiology before beginning the treatment of any particular case.

The circulation of the blood is under the influences of the vasomotors, the nerves which primarily control the functions of the cerebrospinal system. The vasomotor nerves are of two kinds, vasoconstrictors and vasodilators, being distributed chiefly to viscera and cutaneous vessels. The vasoconstrictors decrease the lumen of the blood-vessels and being in a state of constant action, they bring about a tonic or hypertonic effect. They act both locally and generally. In addition to the general vasomotor center in the medulla, there are subsidiary centers located at the varying levels of the spine or the true vasomotor reflex centers.

Constriction of the arteries produces a diminished flow of blood through these main channels, as this influence leads to an increased flow of blood through the veins. Vasoconstriction, by increasing the resistance to the blood passing from the arteries into the capillaries and veins, increases the work of the heart—the effect being proportionate to the degree of constriction and area affected. The increased amount of work may however be counterbalanced by diminished arterial tone in some other part of the organism, chiefly through the inhibition of the vasoconstrictors of the abdominal splanchnic.

Arterial tone is the result of the condition of the blood which stimulates the vasomotor centers, and of the general relation between the thermogenic and the thermolytic centers. Any stimulation or irritation of a sensory nerve will increase the action of the vasomotors.

The vasodilators increase the lumen of the blood-vessels and act locally; they diminish the blood pressure everywhere, the general fall being proportionate to the area dilated and the amount of dilation. Their most marked effect is, however, to flush out the capillaries in the dilated

areas. The vasodilators are chiefly distributed to skeletal muscles and to other local structures and glands.

It must not be forgotten, however, that there are vasomotor reflexes in the sympathetic centers which control the rhythmic activity of many vessels of the body during health.

When we bear in mind the fact that the heart is closely connected with the sympathetic system, we realize that trouble almost anywhere may have an important effect on the heart and circulation. Thus it is a well-known fact that irritation in the rectum, accompanied by a contracted sphincter ani, may in some cases cause a rapid and irregular heart. Dropping of the acromial end of the clavicle may mechanically shut down the circulation through the subclavian veins, and among other symptoms may cause an angina pectoris. In examining to find the cause of an irregular heart, it is well to examine not only the heart, but everything which might affect a vessel coming from it. The clavicle and the first and second ribs are a frequent cause of trouble, on account of their attachment to the scalene muscles. Contractures of these muscles (rheumatic or otherwise) tend to draw the ribs upward and thereby bring pressure to bear upon some of the blood-vessels or cause interference with the nerves of their spinal attachment.

Mild mechanical stimulation of the centers in the spine from the third cervical to the fifth dorsal increases rapidity and force of the heart-beat and contraction of the blood-vessels.

The heart's action may be slowed by inhibition or pressure exerted in the superior cervical region. Pressure on the spinal nerve inhibits the impulses from entering, and thus allays outgoing ones. The sensory fibers of the heart arise from the upper dorsal region. Removal of any irritation to these will quiet an excited condition of the heart. Relaxation of these muscles in first, second and third dorsal will also frequently quiet an excited condition of the heart. Thus raising the left arm and lifting the clavical with pressure exerted in interscapular region often allays palpitation of heart instantaneously.

The restraining influence of the centers in the medulla may be reflexly increased by stimulation of almost any

afferent nerve, particularly the abdominal sympathetic, producing slowing or stoppage of the heart through impulse from it passing down through the vagi.

In acute cases and usually as preparatory treatment in chronic condition it is necessary to reduce muscular contraction. This muscular contraction is in many cases a reflex effect of stimulation of branches of afferent nerves, other branches of which are distributed to the muscles of the spine.

The arteries of the several regions of the spine supply both the cord and the spinal muscles—the same branch dividing to supply both. Physiologists tell us that there is an inverse relation between the vessels of the superficial and those of the deeper structures. This being the case we see that the contracted muscle on the surface, by closing or lessening the size of the lumen of these vessels, causes the oversupply to be sent over the other branch, producing a hyperemic condition in the cord. This hyperemia of the cord leads to an abnormal activity of the parts immediately controlled from this area. The contractions of the muscles may have primarily been the result of changed conditions in the viscera. Nevertheless the removal of these contractures tends to restore a normal circulation to the organs through the vasomotor effect.

The sympathetics are the great vasoconstrictors and viscero inhibitors to the solar plexus and its related plexuses. Pressure on the solar plexus quiets an over-excited heart and thus aids in equalizing the circulation. Vibratory pressure brought to bear upon the splanchnics and mesenteric vessels causes them to become constricted, the reverse condition following in the cutaneous capillaries. It is important to remember this, as it serves to regulate the temperature by irradiation and evaporation of the products of the perspiratory glands. The thermogenic center, located in the corpus striatum, may be influenced by pressure exerted upon the vertebral artery, aided by downward pressure upon the sheath. This causes less blood to be sent to this center, aids drainage and assists in reducing temperature.

Stimulation of the vagus relaxes the heart muscle and slows down the heart-beat, dilates vessels and gives them more time to repair waste.

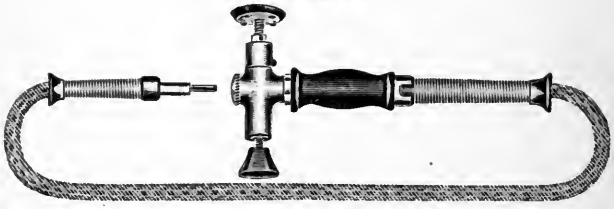
Pressure exerted on the basi-occiput reduces the flow of blood to the brain; quiets the irritated meningeal nerves; reduces pressure in the arterial twigs which nourish the vasomotor centers; modifies the rate of the heart by diminishing the impulses from the augmentor center situated near the vasomotor center in the medulla.

There is an extensive field for the application of electro vibration, and experience has shown that the physician who is master of the known facts of physiology and anatomy will often be able to give immediate relief from pain by the simple application of the well-known law of physiology, that pure blood and normal nerve supply give health.

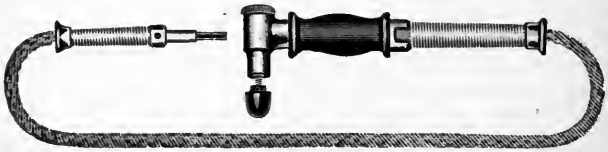
In manual massage it is necessary to know when to employ the various movements necessary for success. So, also, is it essential to success that the operator of an electric vibrator shall employ the various vibrations suited to the parts and adapted to the relief of the pathological changes to be overcome.

It is strongly urged that the novice operate first on himself before attempting the treatment of the patients, that he may obtain a true significance of the various vibrations; otherwise he may do them irreparable injury.

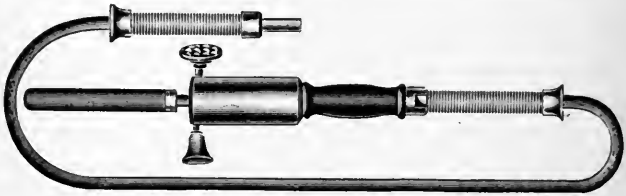
For the application of vibration in a scientific manner it is absolutely necessary to know the normal human body in order to permit the recognition of any abnormal condition or even slight deviation from the normal. It is also of vast importance to know the various centers. Reasoning according to centers is frequently going from effect to cause, from periphery back to center and vice versa. Even if the lesion has been found to be in some particular organ, the particular center governing the affected part should receive attention. Go over your patient carefully; find out if one or more muscles are contracted; if so, do they draw across important blood-vessels or nerves. Examine all the joints, ribs, clavicles and other suspected trouble sources. Do not be carried away by general symptoms. Pain upon the surface of the body, not accompanied by any rise of temperature, may indicate a distant origin of the trouble, usually in the spine. The seat of pain is not always the seat of the lesion. When there is an impingement upon the origin of a nerve, the pain may be referred to the distribution upon the muscle or surface of the body.



The Cologne Double Handle.



The Cologne Single Handle.



Overall's Rotary Vibrating Handle.

If the pain is in the head, find out if there is pressure upon the nerve ending in the painful part, or if it is due to an impingement of nerves ending in the stomach. If the latter is the case it is plainly discernible that the spine needs attention at one of the splanchnics ending in the solar plexus. This treated, the pain in the head usually ceases.

The author had a patient who complained of a chronic pain in the upper right side of her head, which bore a close relation to a rheumatic affection of the left leg. Pain in the head disappeared on treating the limb in which the pain had seemed trivial in comparison to her headache. As illustrated by this case, contractures and pain in distant parts are none too trivial to overlook.

Failure or success depends on the skill, technique and the intelligence of the operator.

No set rules can be made as to the methods which will be applicable in all cases, any more than it is possible to prescribe a given drug for universal symptoms. Treatments and methods must vary according to the cases treated; some cases must be treated longer than others. A treatment of fifteen minutes may be required by one patient, while a few minutes will suffice for another. Always begin with mild pressure on vibratode, giving a soothing effect, and gradually work up to the required intensity.

In most cases it is advisable for the patient to be clad in a loose robe, and all parts except those treated should be covered. There should always be an interval of about an hour between the time of treatment and the previous meal.

There are three important factors to be borne in mind in the administration of vibration: Stroke, speed and pressure. Each of these has a modifying effect on the other.

The stroke should always be graduated to the parts treated and speed to the indication of the case.

Increasing the speed increases the effect and alters the quality of the vibration, making it either slow and coarse or fast and fine.

Pressure causes deeper penetration and diffusion of vibration. Light, moderate or heavy pressures are modified by the length of the stroke and the speed of the machine. Great speed with medium stroke may produce the same effect as slow speed, short stroke and great pressure.

Pressure of an alternating character lightly applied is stimulating (tickling of the skin, for instance). Its action is like the make and break in an electrical current. Stimulation if performed too long or too hard will, after it has run its course, result in the nerve refusing to respond to any stimulus or irritation. The degree of force must be applied in proportion to the degree of irritability of the different parts of the body and must be greatest in the least irritable parts. Always bear in mind that motor nerve fibers are paralyzed sooner than sensory nerves by continuous pressure. Also that light pressure stimulates and that heavy pressure lessens nerve conductivities, induces sedation, benumbing and eventually paralyzing the parts. Thus we see that inhibition consists in an exaggeration of a stimulating effect prolonged.

The patient should always assume a relaxed position during treatment; in fact, it should be our effort to bring about relaxation of contracted tissue by means of vibration before giving a stimulating treatment. Interrupted vibration with deep pressure against the grain of the muscles will usually cause the contracted muscle to relax.

Those points which respond best to the faradic current are likewise the ones which respond most energetically to mechanical stimulation.

Stimulation applied to a motor nerve, instead of muscle, brings about a greater contraction, and one whose duration increases according to the nearness of the cord to the point at which the stimulus is applied to the nerve.

Stimulation of the specific end organ of an afferent nerve more easily produces a complex movement than stimulation of its trunk.

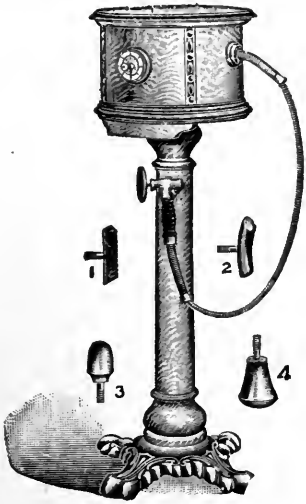
Stimulation of a nerve, or nerve center, causes immediate results inducing muscular contraction and dilation of the blood-vessels, permitting the vessels to empty themselves and let new fluids rush in. The chemical changes that take place are manifested by the glow of the tissues and the well-being of the patient.

It is a scientific fact easily demonstrated that the equilibrium between the nervous system and subordinate tissue can be maintained by mechanical influences.

Normal function and secretions can be brought about

by stimulating the nerve filaments and centers which control the circulation of the fluids to these organs, as well as the centers which control the elimination of toxic materials from the body.

In applying stimulation to the spinal centers we use the ball vibratode and apply it on either side of the spine between the transverse processes, being careful to avoid the spinous processes. The impulse thus set up is communicated at the juncture of the anterior and posterior roots



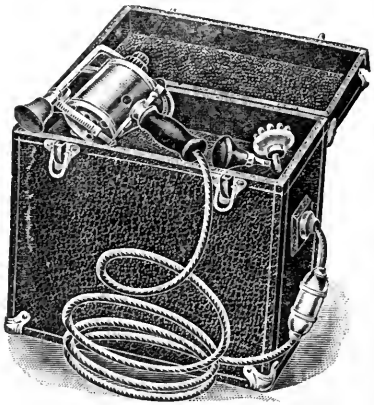
Betz Vibrator.

in the intervertebral foramen to the anterior division of the spinal nerve, and on through the rami communicates to the sympathetic nerve. Duration of application is twelve to fifteen seconds. The tendency of the beginner is to treat the patient too long or too often.

Massage and mechanical exercise have been maturing as therapeutic measures for centuries, until they are now placed on a well-defined physiological basis and have attained a high and definite place in therapeutics. Vibratory friction of more recent origin makes application of the principles of scientific massage. The invention and use of

the electric vibrator make the application of these laws of physiology much less laborious than manual massage, and may be used in place of manual massage where the physician does not have the assistance of a skilled masseur. The results of vibratory friction as applied in office practice can not, however, be compared to those following scientific manual massage as given by a first-class operator.

In applying vibratory friction the patient should lie on the table perfectly relaxed, as muscular tension interferes with the effect sought. It is applied by moving the multiple point or brush vibratode over the various parts of the



Kelley Bedside Vibrator and Case.

body with varying degrees of pressure suited to the particular part or condition under treatment. If the skin is delicate, talcum powder should be dusted over the surface.

Vibratory friction has a marked influence on the lymphatic circulation. It causes more leucocytes to become phagocytes; breaks up minute adhesions, thereby permitting a freer circulation and drainage, which naturally increases bodily resistance. The lymphatic vessels, most numerous in the muscles fascia between and around the muscle in the subcutaneous tissue, are readily acted upon by vibratory friction, but the lymphatics of the neck, the mesenteric, mediastinal, axillary, inguinal, popliteal and cervical gland should receive especial attention in all cases of faulty met-

abolism. Bacteria reside mostly in the lymphatics, and recent investigation has demonstrated that bacteria can not withstand continuous vibration.

Experiments have demonstrated greatly increased excretion of moisture, as well as dissipation and elimination of heat, as a result of vibratory treatment.

Vibratory friction is an important aid in the treatment of inflammatory conditions, hastening, as it does, the elimination of toxic material and promoting the absorption of local edema. The increased blood supply following the removal of obstructions increases the nutritional activity of the parts, rendering them more firm, more elastic. Following an injury, vibratory friction rapidly diminishes the tense hardness due to local stasis and removes the thickening of the ligaments, tendinous and muscular parts when the function of a limb is impaired.

When we realize the fact that twenty-five per cent. of all the blood in the body is contained in the muscular structure and all metabolic processes depend on muscular energy, we appreciate the necessity of having these tissues in a normal healthy condition.

Vibratory friction may be followed by the application of the roller vibratode applied with moderate pressure and speed, as it produces heat and stimulates functional cellular activity.

Vibratory stroking, lightly applied with a short stroke but great speed, has a sedative and soothing action and is indicated in cases of neurosthenia, insomnia and like disorders.

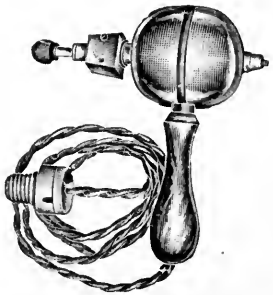
In separating approximated ribs place the disk vibratode, adjusted to its shortest possible stroke, at the posterior angle of the rib—that is, an inch and a half or two inches from the spinous processes—and bring pressure to bear at this point. The operator puts the other hand over the patient's shoulder, well down on the thorax anteriorly and lifts at this point. This serves to spread the ribs apart, and if the muscles have been thoroughly relaxed they will remain apart until further irritation causes the muscles to contract and brings them together again.

Depression of ribs at their sternal end, brought about by the act of coughing, or through violent contractions of

the diaphragm, may usually be drawn into place by stimulation and consequent contraction of the pectoral muscle. Vibration of the ribs themselves sometimes relieves the spinal contracture and permits the parts to assume a normal position.

As a large part of diseased conditions have their origin in the digestive tract, it is a matter of no small import that physicians know the nerve influences which carry on the various processes of digestion and assimilation.

Nausea and vomiting are frequently relieved by firm pressure exerted over the solar plexus. Pressure applied an inch to the right of the fourth dorsal vertebra relaxes the pyloric orifice of the stomach, permitting the offending



Atlantic City Portable Vibrator.

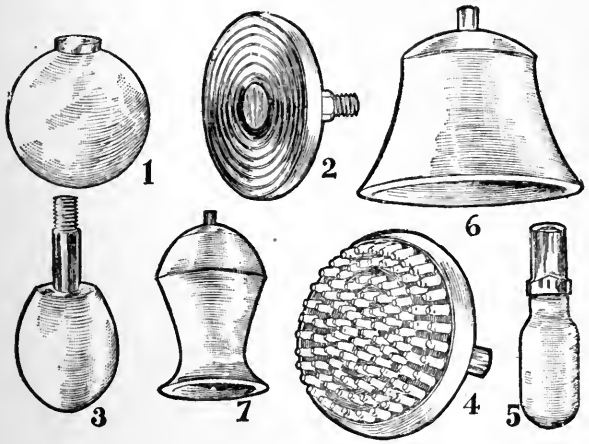
material to find exit into the intestinal canal, which as soon as accomplished causes nausea to disappear. By placing the patient on his right side with knees well elevated, the stomach being filled with water, the operator can readily, with the left hand, raise the stomach and empty its contents into the small intestines after having opened the pylorus.

Hiccough.—Inhibition exerted on the nerve on each side of the neck just above the collar-bone, or against front part of transverse processes of third, fourth and fifth cervical vertebræ, frequently gives instant relief.

Atonic Dyspepsia.—The cure of this trouble must be brought about by supplying good healthy blood to the diseased structures all along the intestinal tract. Deficiencies in the proportion, quantity and quality of the glandular secretions are directly attributable to some trouble in the

nervous system which controls the organs in these locations.

The necessity of perfect freedom from pressure is apparent, hence an important part of treatment lies in removing anything which might interfere with the action of the pnemogastric, splenic and vasomotor systems. Therefore raise the clavicle, free the muscles about the neck, as well as all other abnormal contractures of tissues along the line down to the sphincter muscles at the lower outlet of the body.



Applicators for Vibratory Massage and Stimulation.

Stimulation of the spinal centers should begin at the first and second dorsal vertebræ (to stimulate the pulmonary plexus) and continue down the spine to the tenth dorsal vertebra; have the arms stretched high above the head and bring arm down suddenly at each pressure. Having treated the splanchnics we turn the patient on his back and stimulate the liver, and vibrate every part of the alimentary, beginning at the ilio coecal valve and following the course of the colon; repeat this several times, as it tends to restore normal capillary circulation in the relaxed and distended muscular fibers. The lacteals are more active and absorption takes place more rapidly when the blood

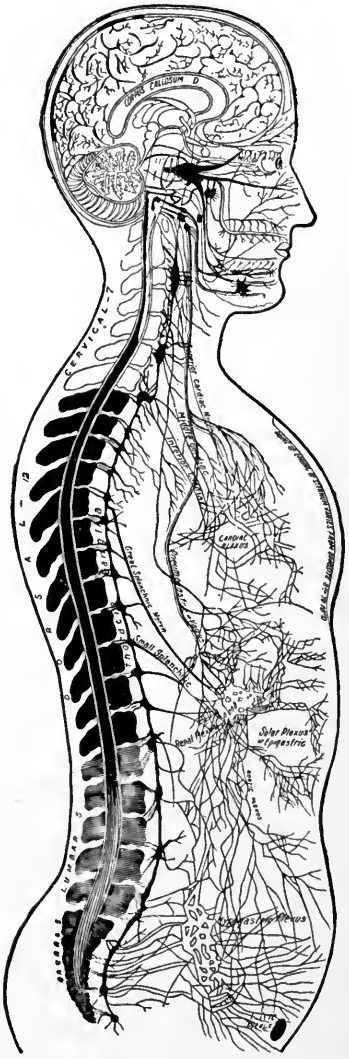
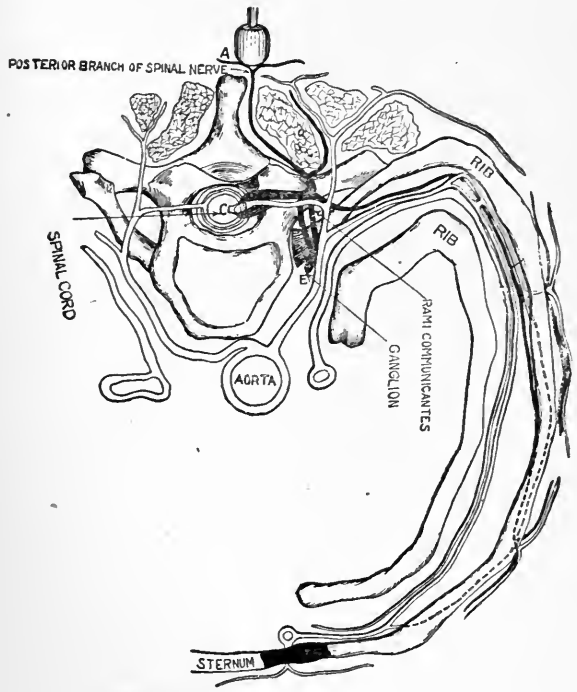


Diagram of Sympathetic and Cerebro-Spinal Systems.

circulates quickly and freely through the blood-vessels. Salol reaction has been found in the urine thirty minutes after taking, with massage, and in forty-five minutes without it, which shows that massage hastens the food from the stomach.

Colic, pain in the bowels, can frequently be relieved



Application of Vibrator to Spinal Nerve.

instantly by bringing the body into such a position as to stretch the region of the splanchnics. This may be accomplished by stretching the body backward over the edge of a table, or chair, and holding it in this position for a moment or two. Stretching the right arm strongly upward while pressure is being exerted on the spinal processes of the right side from the fourth to the eighth dorsal may also

give relief. The arms should be let down quickly as point of pressure is lowered on spine.

Deep vibratory pressure against the splanchnics inhibits them; pressure over solar plexus also frequently stops colic.

Chronic Appendicitis.—Our primary object here is to relieve the pressure and congested condition existing about the lumen of the colon. It is often a matter of surprise to see astonishing results follow manual and vibratory manipulation when other means have failed. Discretion and caution are necessary in the treatment of these cases, and relief may at times be brought about by gentle, persistent, patient and thorough manipulation. Vibrate entire abdomen gently to remove all source of congestion until toleration is obtained; relax all the muscles about the right iliac fossa, then gently draw the intestines upward out of the iliac fossa. These manipulations, in conjunction with colonic flushing, frequently bring about complete cure.

Hemorrhoids.—In treating this trouble we must bear in mind the various causes which might bring about an obstruction of the hemorrhoidal veins. The liver, spleen, colon and sigmoid must be considered. Excessive irritation of the sphincter muscles, and pressure upon the inferior hemorrhoidal plexus of nerves, may produce them. Inflammation and congestion of adjacent structures, may also cause them by interfering with the return circulation. It is also well to examine the parts locally with an anointed finger to see if there is a displacement of the coccyx. If this should be the case, it can be adjusted by grasping the last two or three sacral vertebræ between the thumb and first finger and bringing the proper amount of pressure to bear upon them.

The treatment of the hemorrhoids consists in relieving the pent-up congestion. This may be accomplished by using the flexible vibratode, which should be inserted while in motion, and has taken the place of the rectal bivalve formerly used to divulse the sphincters. The Pennington vibratodes should be used when the local tenderness will permit their use.

Pressing on the sacral nerve desensitizes them and makes internal treatment less painful. This takes off the pressure and flushes the capillaries and does unaccountable benefit in many other ways.

Diarrhea.—Taking for granted that the offending material has been removed from the bowel, our effort should be to allay irritation.

The first step in this process is to see that the reflexly contracted muscles about the neck and along the spine are all relaxed; this may be accomplished either by means of the vibrator or by manual manipulation. Bending or springing the body backward and holding it for a moment will relax the ligaments in the lumbar region. Having relieved the irritation produced by contracted tissues about the nerves, we proceed to inhibit the motor nerves in the neck by holding them firmly for a few minutes. Deep forcible pressure in the region of the splanchnics inhibits the excessive production of secretions. Pressure below the solar plexus along the mesenteric plexus reverses persistaltic movements, while pressure along the left side of spine from sacrum to the first lumbar also inhibits. Pressure opposite the lower two ribs on each side inhibits them through the sympathetic.

Stimulation along bile duct increases flow of bile and thus tends to allay irritation.

Hernia.—Usually produced by relaxation of muscular fibers, due to strain. This is a common affection where little is done beyond the wearing of trusses.

Exercises which tend to equalize the force of retention will frequently restore the parts to a normal condition, if persistently followed. Vibratory treatment consists in relaxing the abdominal muscles in such a way as to equalize the tension of their muscular fibers. Improvement in some cases is very rapid, each treatment showing a marked lessening in the size of the rent. Three treatments a week are sufficient.

Constipation.—In the treatment of this trouble due regard must be given to the causes which have brought about the condition. Experiments have shown that the movements of the intestines depend largely upon the amount of blood in the intestinal walls. Peristalsis being almost entirely a reflex action depends for its existence upon the supply of fresh blood which affects the nervous plexuses found in the intestinal walls. Anerbach's plexus is found between the muscular coats of the intestines and is concerned with

the motions of the intestines, while Meisner's plexus, located in the submucous coat has to do with the secretions. Thus we see that anemia may be a primary cause of constipation.

2. Neglect on the part of man to respond to nature's suggestion soon creates a tacit resignation on the part of the bowel to await the convenience of the subject until the next day. Thus the habit duly cultivated becomes a fixed habit. Consequent upon this retained effete matter a toxic condition ensues which is usually designated as a torpid liver, though in reality it is an innocent but much-abused organ.

3. An insufficient quantity of water taken by the patient is also a frequent cause. In order to hold in solution the inorganic substance and disorganized material so that the debris may be disintegrated and carried out in the channels set apart for this purpose, there must be a sufficient quantity of water introduced. One cup for every ten pounds of weight is the advice of an eminent authority.

The nerve supply of the intestines is through the sympathetic nervous system, from the dorsal vertebra down. To get at the vasomotor of the mesenteric vessels from the splanchnic, we must reach the sympathetic all the way down the spine.

Stimulation of the pneumogastric nerve increases the vermicular motions of the bowels. Stimulation of the vagus in the neck causes contraction of the pylorus and stomach and produces a flow of gastric juice.

Stimulating the splanchnic arrests spontaneous pyloric contractions and relaxes the pylorus.

Vibratory treatment of the second, fourth and fifth lumbar and fourth sacral, which control the splincters, relaxes them and thus frequently aids us to overcome constipation.

Place the patient on the table, with knees elevated, to relax the abdominal muscles. Then for ten to fifteen minutes thoroughly apply vibratory friction, with the multiple point vibratode, over the entire abdomen, working from the umbilicus as a center outward. This greatly increases peristalsis and glandular activity. Internal rectal vibration may also be applied with moderate speed and stroke. The sphincters are frequently unduly sensitive and contracted.

The vibratode should be introduced into the rectum while in motion to avoid shock.

This treatment, as a rule, causes complete relaxation and for ordinary purposes is as effective as rectal dilation with the bivalve, while the shock to the nervous system is much less.

After applying the vibratory treatment, reach down in the iliac fossa and straighten out the patient's sigmoid.

In using vibratory massage over the liver, be careful not to bruise it.

Disturbances in the respiratory tract practically all arise as the result of capillary congestion of the mucous and submucous membranes caused by muscular contractions arresting the return of venous blood to the heart.

The application of a well-recognized principle of physics that heat relaxes and cold contracts tissue, is largely responsible for many so-called colds in the head and chest. This condition usually appears shortly after the individual has been unusually warm and possibly slightly moist about the neck and chest. Exposure at this time to a draft of air chills the parts and causes a subsequent contraction of muscular fibers which bind the terminal nerve filaments in the upper dorsal region. This action results in prevention of the normal reflexes to the brain through the pneumogastric and sympathetic nerves to the lungs, and in contractures of the chest muscle that obstruct the return of blood accumulated in the capillaries and intercapillary tissues.

In all troubles of the upper respiratory tract we find pressure upon the jugulars, or one or more muscles of the neck will be found to have its fibers contracted either on the veins themselves or on the nerve supplying the muscle through which it passes to reach the mucous membrane.

In affections of the lungs, the nerves accompanying the blood-vessels are usually pressed upon by the contracted muscular fibers, making stasis in the capillaries inevitable.

Muscular contractions and consequent stasis being largely responsible for the symptoms present, the remedy suggests itself. Reduce the contractions and remove the irritation from the sensory nerve and stimulate the vasomotor areas.

Bronchitis.—In the treatment of respiratory affections general vibration of the chest is indicated with special treatment for specific indications. In applying vibration to the chest, raise the arms above the head, thus elevating the ribs and thereby favoring chest expansion and relaxation of intercostal muscles. In women, vibration to the breast must be avoided. Use uninterrupted vibration with fairly deep pressure.

For cold in the head vibrate sides of nose, ear, temples, forehead, and desensitize the facial nerves at points of exit from foramina; also vibrate glands of the neck and axilla.

In applying vibratory friction to the chest, have the patient breathe deeply with forced exhalations; this permits deeper vibratory treatment over the deep structures, especially so over the solar plexus, which should always be stimulated as a valuable adjuvant to the other treatment.

Our treatment of the spine in respiratory affections is given with the intention of relaxing the spinal muscles, to give vent to the pent-up congestion and accumulated secretions. Apply treatment to either side of the spine from the first cervical to the seventh dorsal.

Stimulation of the vasomotors—the pneumogastric and phrenic—will stimulate the diaphragm and increase the depth of respiration, thus promoting absorption of oxygen and elimination of CO_2.

The vasomotors (constrictors) of the blood-vessels to the lungs come from the second to the seventh dorsal vertebra.

Pulmonary Tuberculosis.—In most of these cases we find luxation of the ribs and a flattened thorax (dropped ribs) which set up an irritation in the intercostal nerves, leading to a constriction of the pulmonary vessels. The general or local anemia of lung tissue thus produced weakens and devitalizes the tissue, affording a favorable foothold to the pathogenic bacteria, for it is a well-known fact that bacteria can not grow in healthy tissue.

The vasomotor spinal area for the lung (second to seventh dorsal) and particularly the region of the second, third and fourth thoracic ganglia are most likely to

suffer from lesion in this trouble. Contractures of the spinal muscles brought on by an acute attack of rheumatism or bronchitis thus frequently prove to be the starting point of a pulmonary tuberculosis.

In applying treatment remove all obstructions to the normal nerve and circulatory activities and thoroughly relax the tissue. Raise the clavicle and ribs to allow the greatest area of expansion and so increase the blood supply to the lungs. The cough may be relieved by toning up the pneumogastric, phremic and cervical sympathetic nerves. This is done by treatment applied along the trachea and anterior thorax. Finally teach the patient how to breathe correctly.

Tonsillitis pharyngitis and other affections of the throat may be treated by stimulation of the superior cervical ganglion; vibratory massage with the bell-shaped vibratode (or the operator's hand, which may be used as a vibratode because it permits the fingers to go down between the muscles) hastens recovery, as it is a great aid in dissipation of the congested circulation; so also is local massage to the fauces. This is accomplished by means of the forefinger inserted in the mouth just posterior to the last tooth. Press against the posterior region of the soft palate, letting the finger slide along its border to the opposite side and back again.

Pleurisy.—Stimulate the spine from the seventh to the eighth dorsal vertebra. Raise the arm on the affected side as high as possible to assist in spreading the ribs. Vibratory friction in the direction of the lymphatics and contiguous glands, supplemented by interrupted vibration, will hasten the absorption of the effused serous exudate.

Asthma is generally the result of reflex nervous influences and when treated as such frequently gives immediate response to treatment. Our aim in treating these cases is to relieve the obstructed nervous circulation between the ribs, the intercostal muscles and along the spine. This is accomplished by deep vibration on either side along the entire spine. It not only relieves stasis in the spine, but influences the abdominal plexuses and aids the circulation of venous blood and lymph in the viscera. Bending

the body backward assists in relieving intervertebral pressure, and by raising the ribs gives vent to accumulated secretions in the lungs and permits freer exhalations at once.

That one organ frequently thrives at the expense of another is nowhere better demonstrated than in the relief frequently obtained by patients suffering from asthma, when the vision is repressed by the fogging method and their internal rectus muscles rested by wearing prisms, base in. The author has done some pioneer work along this line at the bedside and has frequently seen instantaneous relief follow when the spasm was at its worst, by the simple application of glasses, the pulse frequently falling from 140 per minute to 80 per minute in less than ten minutes' time. The author's aim in these cases was not to bring about perfect vision, which would have been exceedingly injurious—just the contrary results were sought.

As the normal vision is twenty feet, anything inside of this distance requires the internal recti muscles to pull the eye in; this, if continued for hours, uses up an enormous amount of energy. Consider for a moment the energy expended in holding your hand in a clenched or contracted condition for a short period of time and the accompanying tension which spreads over the entire body. A very similar condition ensues when the ciliary muscle is focused upon a near point for hours at a time. That this is true is evidenced by a lowering of the pulse of from fifteen to thirty beats per minute by the wearing of prisms (base in) alone for fifteen to twenty minutes after close eye-work extending over several hours.

Physical labor induces health, while occupations requiring close use of the eyes tend to break it down. Strong men leave country life and take up office calling, where close range of vision is required, and their nervous systems usually break down. The difference in the physical condition between man and woman has been attributed to the fact that woman spends her life indoors doing things requiring close vision, whereas the callings of men afford a longer range of vision.

The author's attention was directed to this line of investigation by an oculist, who very much regretted that the only patients who consult this class of specialist are

those who consult him because they realize that their vision is becoming defective. He believed that many nervous troubles have their origin in the loss of energy, dissipated by long hours of close vision, and suggested that as a general practitioner coming in contact with a large variety of cases I would make investigations along this line at the bedside.

The results thus obtained have in many cases been startling and lead the author to believe that a large field for clinical investigation is still before us. The author is aware of the fact that many well-known specialists of nervous diseases claim there is no such thing as eye strain. Clinical demonstration along this line, however, is so easy that no arguments are needed.

The why and the wherefore of the relief thus obtained is evident when we consider the nerve supply of the eye. The nerve centers that innervate the muscles that adjust the eye, in conjunction with those in the outer part of the brain and with that vast area where vision itself takes place, take up fully one-third if not more of the entire gray matter of the brain, occipital lobe, large part of the parietal and frontal lobes of the brain, also third and fourth ventricles and the aqueduct of Sylvius, deep in the middle of the brain. Therefore, in resting the eye we see that a large portion of the nervous system is influenced.

All diseases are emphasized and made worse by anything that irritates and depletes the nervous system, and any disease will be relieved by the removal of the energy robbing strain. This being the case, it is well to see to the fact that our patients suffering from nervous prostration do not spend their entire time reading or doing fancy needlework. It also explains the benefit derived from sea voyages, where long vision is the rule, and the patient sitting above deck always feels recuperated from his journey.

Rheumatism.—In conjunction with drugs, hot air, electric light, baths and electricity, mechanical vibration is a great aid in restoring the parts to their normal condition, as it disintegrates newly formed granulating tissue, removes local stasis and forces the white corpuscles and transuded plasma into the lymph current. It increases nutrition by accentuating nature's own processes and thus stimulates the activity of all the metabolic processes.

In the treatment of this trouble it is essential to stimulate the bowels, kidneys and liver to activity, since in the various forms of rheumatism the digestive and circulatory system may be deranged and the tissue fluid have undergone pathological changes.

In muscular rheumatism, vibratory stroking or rotary vibration should be applied, beginning superficially with gradually increasing pressure, the application in each case becoming deep vibratory friction. The affected muscles should be stretched and elongated by working against the grain of the muscle to throw more blood into the parts and thus help carry away the diseased substances.

In articular rheumatism apply vibration with multiple point, or rubber-covered disk, above and below the painful joint, gradually bringing the strokes nearer and nearer the joint with increased pressure. After above treatment has been applied, use interrupted vibration to the joint directly, beginning with very mild pressure.

Spread the joints to admit free access of blood and nerve energy.

After time has elapsed for repair, use resistive motions, as flexion, extension and other natural movements.

Lumbago.—Contractions and deviations in the lumbar spine are the usual cause of pain in this region. If long continued, marked interference with the vasomotor and trophic nerves ensues, with lowered nutrition in the organs with which they are connected. Frequently we find this condition associated with many distressing pelvic disorders. Treatment consists in inhibition and relaxation of contracted muscles.

Sciatica.—In the treatment of this trouble it is necessary to try and locate the cause, if possible. The author's experience leads him to believe that a large proportion of these attacks come on consequent to acute indigestion, colic, pain in abdomen, diarrhea, constipation and other like disorders. The effect in these cases being of a reflex nature, transmitted over the solar plexus, back along the splanchnics and thence to the spinal nerves with which they are connected; thence back over the peripheral termination of these nerves to the skin and muscles of the back. The spine of most patients is abnormally rigid in these cases,

though it may, on the other hand, be abnormally mobile and relaxed.

In treating this trouble we should aim to free the nerve along its entire course from contracted muscle fibers. A peculiarity of the sciatic nerve is found in the fact that it is pierced by an artery which supplies it with nutrition. Any contraction of the pyriformis muscle is apt to restrict the blood-vessels, thus decreasing its nutrition. The lesion may be in the nature of a strain, a congested muscle or a tightened ligament, thus drawing the vertebræ together. Where the lesion is undiscoverable, give rotary vibratory treatment to the entire body, giving special attention to the muscles of the hip and upper portion of the thigh, which should receive deeply interrupted vibration over painful spots, beginning lightly and increasing as tolerance is developed or pain lessens and disappears; continue gently, manipulating from side to side to relieve the enlargement of the vessels, also of any other sensitive area in spine. Rectal vibratory treatments are also of value, especially in those cases due to fecal impaction. Vibration to the liver and spleen anteriorly is also indicated. Treat the spine on either side from the sixth dorsal down to the fifth lumbar. The operator will also find that rotating the limb outwards tends to relax the muscles throughout the whole course of the nerve, while turning the leg inward relaxes the pyriformis and those short muscles—the external rotators—which may impinge upon the nerve. The sciatic nerve may be stretched by raising the limb up as far as possible, keeping knee straight and pulling down on toes. This treatment tends to loosen the dorsal as well as the lumbar muscles.

Mental disorders are often relieved when vibratory stimulation is applied according to indications; spinal and local sensitive areas indicate contractions which should be relaxed.

Headaches associated with gastric derangement are frequently relieved when all the muscles about the neck have been relaxed. Raise the clavical and stimulate the liver, stomach and bowels and inhibit the superior cervical ganglia; vibratory stroking should be applied to the forehead, sides of the face and especially all branches of the fifth nerve. Pressure on basi-occiput will limit the flow of blood to the brain and thus bring about relief.

Neuralgia.—Remove all pressure from the nerve, or nerves, involved in the production of pain. Always treat the parts high enough to reach the impingement of the nerves involved. Pain, as a rule, does not originate where we feel it; it is usually the end nerves where the pain is felt. Stimulate the center in the spinal cord from which the affected nerve is given off.

Occupation Neurosis.—All the numerous occupation neuroses, such as those of musicians, telegraphers, seamstresses, barbers, drivers, milkers, cigar makers, penmen, etc., are in reality starvation neurosis and manifestations of a more or less severe obstruction of nerve supply. The occupation which brings about these conditions usually requires the elevation of the right shoulder, resulting in drawing the upper ribs together and approximating the clavicle and first rib in such a manner as to bring pressure to bear upon the brachial plexus. Treatment consists in stimulating the cervical ganglia and brachial area. Thoroughly vibrate the upper shoulder, neck, back and chest; raise clavical, ribs, etc. Change faulty position of holding pen, brush or other implement of occupation.

Insomnia is always due to perverted cerebral circulation which causes certain cells to be unduly irritated. Treatment consists in thoroughly relaxing the muscles of the neck to relieve cerebral congestion and finally inhibition of the superior cervical ganglia; through its connection with the medulla we influence the general circulation of the body, in that it affects the vasomotor centers in the medulla.

Chorea.—Vibratory stimulation of the spinal centers and abdominal organs is of great aid in the treatment of this trouble.

Hysteria.—Where due to a nutritional disorder of the nervous system, great relief is often obtained by vibratory stimulation applied to the spine. Relaxation of the contracted fibers of the sphincter ani by means of the rectal vibratode is at times followed by marked improvement.

Locomotor Ataxia.—Treatment consists in thoroughly freeing all parts from pressure, special attention being directed to the parts obstructed on the structures involved. The only way to reach these lesions is reflexly through the sympathetic nerves. The great trunks coming out of the

skull, namely the spinal accessory, the pneumogastric and the cervical ganglia on both sides of the neck and clear down the spinal column receive special attention. Stimulate the flow of blood from one end of the spine to the other. Give attention to local symptoms according to their nature.

Hemiplegia indicates that something has interfered with the nerve and blood supply to the limb, and our efforts should be directed to restoring the parts to their normal condition, relaxing all contracted tissue and using vibratory stimulation of center in spine and stroking to the limb involved. Put the leg through the various motions which tend to free the blood supply. Flexing the leg on the thighs bent on the adbomen stretches the quadriceps extensor muscle and frees the femoral artery, anterior veins and anterior crural nerve. Pushing the toes down or up exercises and places both anterior and posterior muscles of the thigh on a stretch. Frequently it is important to stretch these muscles. Relax all tissue about Scarpas triangle as well as those in the popliteal space; in fact, remove rigidity wherever found, especially in the region of the spine.

Varicose Veins.—The nerves, blood supply, the lymphatics and glandular supply of the entire leg should receive vibratory friction to carry off the detritus left along the course of the diseased vessels and around the ulcer. Treat the sciatic nerve with the view of contracting the muscles and forcing the blood from the site of its engorgement and so temporarily relieve the congestion. The sciatic nerve exercises a marked influence on the vessels, as well as on the muscles of the leg; its origin in the spine should therefore receive special attention. Marked sensitiveness is frequently found over the splanchnic area, the result of a weakened condition of the vasomotor nerves in this area. Treat the entire spine in these cases, giving especial attention to the fifth lumbar vertebra.

Abscesses.—Interrupted vibration applied to the glands and lymphatics contiguous to the affected area hastens the elimination of waste and toxic materials. The liver, spleen and kidneys should also be freely stimulated.

Urethritis.—Stimulation of the vasomotor area of the affected parts will bring about a more efficient blood flow,

thus aiding in the destruction of the invading microbe. Stimulation of the glands and lymphatics draining the affected parts increases their activity and hastens the elimination of the toxines caused by the microbe.

Bubo, following Urethritis.—Treat lymphatics as above and stimulate eighth and twelfth dorsal and fifth lumbar spinal nerves.

Acute Sprain or Fracture.—Vibratory friction to the swollen parts usually gives great relief from pain, diminishes the swelling, shortens the period of repair, favorably affects absorption and circulation and prevents stiffness. Under the author's manipulation it gave the greatest amount of comfort imaginable to an elderly gentleman suffering from a fractured femur which was being treated by extention. The relief from pain following vibratory friction was greater than that following the administering of an opiate.

Goiter.—Vibrate and thoroughly relax all contracted muscles about the neck and desensitize all sensitive points in the cervical and dorsal regions, using deep, firm pressure. Next thoroughly vibrate the lymphatics with the multiple point or rubber-covered disk vibratode. Stimulation of liver and spleen is also indicated. Stimulate the vasomotor area in spine to re-establish nerve connection between the sympathetic and motor nerves and thus start the fluids out. Raise the clavicle and manipulate the gland upward, kneading the gland.

Fever.—Vibratory friction with moderate stroke and pressure, applied from the beginning, in fevers, is found to be a great aid in hastening the patient's recovery. The impulse and friction accelerate the flow of lymph through the tissues, while the stimulation of the peripheral circulation prevents fatigue, general irritability, cerebral congestion and keeps the patient mentally brighter.

The glands of the body should receive deep interrupted vibration, while the various spinal centers should also be treated.

Pelvic Diseases.—The pelvic organs are so located that weakness or prolapse of the abdominal organs, intestines, stomach, kidneys and liver in particular can readily interfere with their health. Hence in the treatment of pelvic troubles particular attention should be paid to the correction of the

abdominal condition; when accomplished, the pelvic disturbances will frequently right themselves. Apply treatment over the parts anteriorly as well as through the proper spinal connections. Look up nerve connections.

The uterus and ovary may be affected in much the same manner as other parts of the body. We find these organs suffering from faulty innervation or blood supply. We can often trace disturbances of menstruation, inflammation, etc., to an impinged or irritated spinal nerve supply. Occasionally an incipient curvature of the lumbar or lower dorsal spine will be found, which in many cases is undoubtedly the cause of the so-called reflex pains in the back and thighs.

Menopause.—Deep vibratory friction with the multiple point, or rubber disk, accelerates the flow of blood and tends to lessen the heat of the interior of the body. Interrupted vibration, with moderate pressure applied to the solar plexus and umbilicus, has a marked effect in equalizing the circulation and ameliorating the various symptoms complained of during the period. If the treatment is too prolonged we lose the effect of the treatment.

Enuresis.—Relax and stimulate over the middle lumbar vertebra, as well as the second, third and fourth sacral.

Spinal Curvature.—The curvature in a large number of cases is caused by an abnormal muscular contraction on the concave side, due to a primary irritation of nerve filaments ending in that part.

In treating this condition we must take into consideration the fact that the vertebræ may have changed in form and become flattened on one side, and the vertebræ, even when replaced, are bound to return to their abnormal positions unless the ligaments which hold them in place are strengthened by a proper amount of nourishment or blood and nerve supply.

Vibratory treatment will greatly augment orthopedic measures, such as tension or traction on the vertebræ intended to separate the vertebræ to allow free ingress of blood. In fact, mild cases may be cured by vibratory measures alone.

Thoroughly relax the muscles on the concave side and

stimulate the already relaxed muscles on the convex side. Begin treatment at the bottom of the curvature and work up; the lower vertebræ are larger than those above and therefore more stable.

Attempt to replace one vertebra at a time. There is danger of producing an inflammation of the psoas muscle if the treatments are too harsh or too severe at the eleventh and twelfth dorsals and the first and second lumbar vertebræ. The muscles at this point are easily irritated.

Hepatic Insufficiency.—Irritation of the liver is frequently reflected to the right intercostal muscles, causing them to contract. If this is the case it will be found that the ligaments and muscles at the spinal attachment of the involved ribs are very sensitive to deep pressure. If continued for any length of time the muscles subjected to irritation contract and draw the body toward the affected side, the circulation within the cord throughout the irritated area becomes more or less compromised and a lowered nutrition of both nervous and muscular elements speedily follows. Treatment consists in relaxing the contracted intercostal and spinal muscles. This is usually accomplished by using vibratory friction with long stroke and deep pressure applied thoroughly over the ribs. Treatment may require from one to three minutes. Treat the liver anteriorly, being careful not to bruise it. Abdominal treatment should be directed especially to the hepatic and sigmoid flexure. Repeat treatment on alternate days until ribs are replaced and spine is straightened.

Diabetes.—Remember its mental origin and stimulate the liver and kidneys thoroughly.

Convalescence from exhausting disease is greatly assisted by proper vibratory spinal treatment, as well as by vibratory stimulation of the entire glandular system.

Ear.—Impaired hearing due to cold, full feeling in the ears, otalgia, tinnitus, nervous deafness, non-suppurating inflammation of the auditory tract, and suppurative otitis after the suppuration has ceased, are successfully treated by mechanical vibration.

To affect the vasomotor of the head we vibrate the superior cervical ganglia.

The superior cervical ganglion may be reached directly

by applying pressure at the upper part of the anterior border of the sterno-cleido-mastoid muscle in front of the transverse processes. It may also be reached indirectly through the spinal connection at the upper cervical vertebræ.

Vibratory friction, or massage, of all tissues surrounding the ear and neck increases the circulation through the dormant lymph and blood-vessels and thus hastens the absorption of the products of inflammation, stimulates the secretions, restores muscular tone and strengthens the exhausted nerves.

In treating the tissues surrounding the ear, always use the soft rubber or cup-shaped vibratode. In acute disorders daily treatments are required, while in chronic conditions treatment every other day is the rule.

Eye.—Affections of the eye, not due to the presence of a foreign body, may be favorably influenced by mechanical vibration. Thoroughly relax everything and remove every pressure which may affect the circulation. As the fifth nerve contains some trophic fibers of the anterior eye and has a vasomotor effect on the retina, it is important to see that this nerve is free from contractions in the supra-orbital, infraorbital or mental foramina.

The cervical region is in close connection with the muscular action of the eye, and it is here that treatment should be applied when the cause of the trouble is due to eye-strain. The superior cervical ganglion, which through the carotid and cavernous plexus is distributed to the parts surrounding the eye, should also be stimulated or inhibited as the conditions may indicate.

The spinal nerves should be treated as low down as the fifth dorsal, mainly for the nutritional effect.

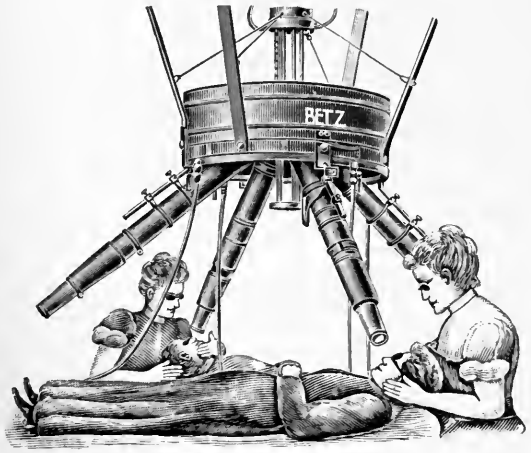
The ciliary ganglia lying at the bottom of the orbit between the rectus muscle and the optic nerve may be stimulated by slight pressure anteriorly applied by means of eye attachment.

C., Cervical. L., Lumbar. D., Dorsal. S., Sacral.

Arteries	Circulation influenced by stimulation or inhibition at	....	1	to	6	C.
Brain	Blood supply, controlled	....	1	to	6	C.
	Cervical brain	1	C.	to	5	D.
	Abdominal brain	7	C.	to	3	L.
	Pelvic brain	9	D.	to	5	L.
Face	Vaso-dilators	....	2	to	5	D.
	Vaso-constrictors	....	1	to	6	D.
Eye	Recti of eyeball	....	2	to	3	D.
	Ciliary center	....	2	to	3	D.
	Vaso-constrictors of retina	....	2	to	3	D.
	Vaso-dilator of ant. part of eye	....	1	to	2	D.
Esophagus	Treat between	....	8	and	9	D.
Nose	Catarrh	....	1	to	6	C.
Nutrition center		6	D.	to	5	S.
Larynx		....	1	to	3	C.
Heart	Rythm	....	3	to	4	C.
		....	1	to	3	D.
	Vaso-motor of valves	....	2	to	4	D.
Lungs		....	1	to	9	D.
Diaphragm	Hiccough.....inhibit	3	4	5	C.	....
	Treat at	....	11	and	12	D.
Liver	And gall-bladder	....	6	to	12	D.
	Torpid.....on rt. side	and	6	to	7	C.
Stomach	Cardiac orifice	....	6	to	7	D.
	Pyloric orifice	....	4	to	5	D.
	" " rt. side	....	8	to	9	D.
Intestines	Duodenum	....	....	....	1	L.
	Jejunum	....	1	to	5	D.
	Ileum	....	5	to	11	D.
	Cæcum	....	1	to	4	L.
	Colon	....	1	to	4	L.
		....	5	to	11	D.
	Induce peristalsis, stimulate	....	9	to	12	D.
	Diarrhea, strong inhibition	....	11	to	12	D.
	Defecation center	....	2	to	5	L.
Receptaculum chyli	To dilate.....stimulate	....	5	to	12	D.
Kidneys		6	D.	to	2	L.
Urethra	Bladder	....	4	to	5	L.
Testes	Vas. def. and seminal vesicle	10	D.	to	5	L.
Penis	Spermatic center	....	....	....	2	L.
	Erection center	....	....	....	2	L.
Prostate gland		5	L.	to	3	S.
Ovaries	Circulation controlled	....	9	to	11	D.
	Pain	....	....	....	10	D.
Uterus		1	L.	to	3	S.
	Cervix	....	....	....	9	D.
	Os	....	1	to	5	S.
	In contractions	1 L.	10	to	12	D.
	Vaso-motor	12D	2	to	5	L.
	Amenorrhea.....stimulate	....	2	to	5	L.
	Dysmenorrhea.....inhibit	....	2	to	5	L.
	Morning sickness.....stimulate	....	4	to	5	D.
Vagina	To relax	....	....	....	4	S.
	Vaso-motors	12	D.	2	5	L.
Paralysis	Upper extremity	5	C.	to	1	D.
	Vaso-motors	....	5	to	6	D.
	Lower extremity	....	1	to	6	C.
	Vaso-motors	from 2 D. down.				

LIGHT.

It has long been known that impure air and darkness breed disease, but it is only recently that we have learned why and how light exercises its power. Investigation has demonstrated that it is not warmth but light which enables more complicated tissues to be formed from simple ones. The importance of light on living organisms, plants and animals



Genuine Finsen Light.

alike, is well known to all. Lack of light causes disease and vice versa. We find the least illness and the most healthy conditions in places to which light has most ready access.

The existence of three different kinds of rays has been clearly demonstrated, and it is possible that others exist.

1. *Heat rays* (four hundred and ninety-seven billion vibrations per second), found near the red end of the spectrum, are for the most part invisible and do not impress the eye, but powerfully impress the nerves of the skin.

2. *Chemical rays* (seven hundred and twenty-eight billion vibrations per second)—violet and ultra-violet—make slight impression on the eye, but stimulate the skin in a remarkable manner, cause sunburn and bring about chemical changes or combinations in the tissues. The sun's rays have no chemical quality in and of themselves, their action depending upon the surface upon which the rays strike. The germ-destroying power of light is equal to the sum of its vibratory forces. It is these rays that make it possible to photograph smallpox and measles before they become visible to the eye. Ultra-violet frequencies are made visible by their action upon fluorescent substances (the ability of certain substances to absorb energy of radiation at one length and to emit it at another).

3. The *luminous rays* are centered near the yellow portion of the spectrum and are those which powerfully impress the optic nerve.

That light exercises a powerful influence over plant and animal life is well known. Plant growth seems to depend on the luminous rays, flowering on the ultra-violet and the aroma on the heat rays.

The turning of flowers, leaves and even stems toward the sun conclusively proves the influence of light upon vegetable organisms. Continuous exposure, however, proves injurious to plants, which require rest from sunlight as do animals. Plants exposed to the direct rays of the arc light wither, the interposition of glass, however, has the same effect as the atmosphere has on the sun rays. This action is readily demonstrated by placing a green leaf under an arc light, protecting one half with glass. The unprotected part will turn brown, while the other will remain green.

Experiments show that electric light, properly employed, compares favorably with sunlight in its power to promote protoplasmic activity and to inhibit the action of bacteria. It acts as a tonic to plants and enables them to endure adverse conditions which they would not otherwise resist.

A very important character of light in connection with its use for curative power is its power of destroying bacteria. Various animals have been inoculated with diphtheria and other germs. Those animals kept in the dark died in from two to three days; those exposed to the rays of light resisted the effects of the inoculation. Many forms of germs are

killed more readily by sunlight than by strong germicides.

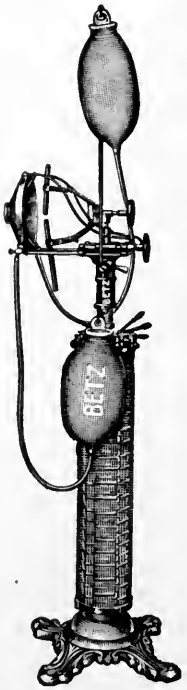
The chemical or so-called actino-therapeutic rays can only be obtained from the sun or the electric arc light. The

Triplet Lamp. Scholtz's Modification of the Finsen.

spectrum of sunlight taken in high altitudes shows it to be rich in the ultra-violet rays, but on account of atmospheric absorption few reach the earth. This is especially true of the sunlight near towns and cities where the chemical rays are strong enough to affect the photographic film, but not strong

enough for bleaching and chemical purposes. The spectrum from an electric arc taken through quartz shows it to be six to eight times as long as the visible spectrum. The incandescent bulb light has little actinic power and penetration. An increase in candle-power or number of lights will not give any practical increase in actinic power, comparable to even the smallest arc.

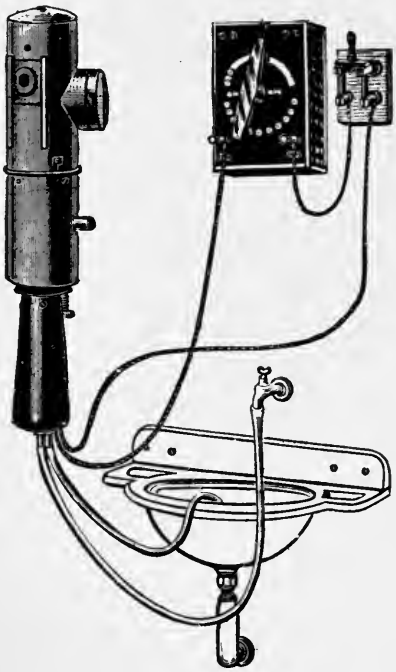
To Finsen the profession owes much for the thorough and



The Finsen Lamp. London Hospital Pattern.

scientific manner in which he has demonstrated the action of the chemical rays alone, and their usefulness in skin affections, especially those of a tubercular nature. His experiments show that the bactericidal effects of sunlight are found in the ultra-violet or chemical rays. He succeeded in sepa-

rating the chemical from the heat rays by filtering sunlight, focused through quartz lenses, through a blue solution of copper sulphate in a dilute ammonia water, varying the strength of the solution to suit the intensity of sun's rays at the different seasons.



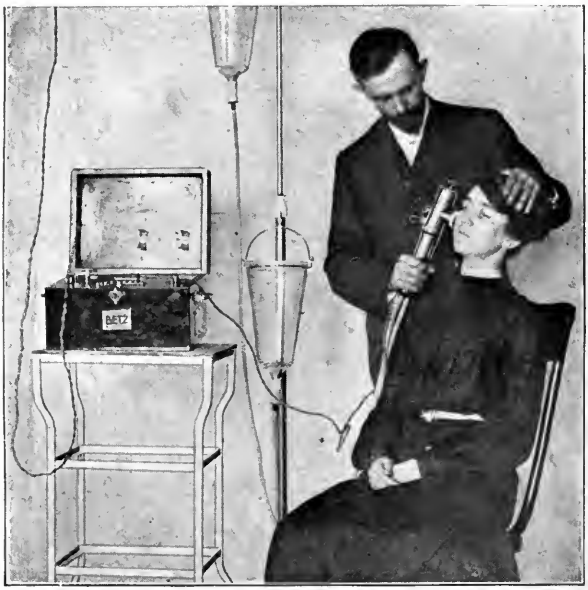
The "Dermo" Finsen Arc Light.

During the summer months Finsen uses glass lenses. As some ultra-violet rays pass through all glass, the deficient permeability of the collecting lens is compensated for by large size, thus making it equal in actinic power to a smaller rock crystal lens.

As sunlight is necessarily limited during the winter months, Finsen uses large arc lights of sixty to eighty amperes, each light having four condenser tubes, dividing the light so as to

treat four patients at once. The tissues outside of the lesion are protected from the rays. A nurse wearing dark glasses presses the compressor on the spot to be treated.

The tissues treated are compressed to empty the blood-vessels, as opacity of tissue is due principally to red blood corpuscles. Compression is accomplished by a hollow crystal disk, which is cooled by a constant stream of cold water passing through it.



Application of Lupus Lamp.

The spectrum of a lightning discharge shows it to have a large number of chemical rays. This being the case, the spark from the static machine or induction coil may be made use of in the treatment of small superficial ulcers, syphilitic or otherwise. The apparatus made for use with the static machine consists of five aluminum balls insulated on hard rubber tips, arranged in the form of a letter S along which the spark flashes from ball to ball. A quartz disc serves

as a cap, and permits it to be brought in contact with tissues treated.

Various modifications of the Finsen lamp are now on the market. One of them is made with hollow iron electrodes, which are kept cool by the constant circulation of water. The beam of white light is cold. It is claimed for the iron electrodes that they are richer in chemical rays than the carbon, though carbon electrodes containing a large amount of iron and manganese also give a markedly violet flame.

The treatment usually lasts from one to one and a half hours, and is repeated until the parts are cicatrized. The area treated is usually one to three square centimeters.

There is no pain during the application; sometimes there is an itching and the surface reddens. A few hours later a vesicle filled with clear serum appears and dries in a few days, leaving a thin crust. Sloughing never occurs. The effect is simply that of an intense sunburn. Cure is not due to the destruction of tissue, but to the destruction of parasitic elements upon which the disease depends, and a quickening of vital activities of tissues, whereby their power of defense is increased.

The action of the light ray is a complicated one; aside from its bactericidal powers it influences the vaso-motor nerves and affects capillary dilatation. If the action of the light is continued for a length of time it causes a distinct endo-vasculitis, followed in time by a low grade of inflammation and consequent permanent atrophy of the vascular tissue.

With an arc light of two to ten amperes only superficial dermatoses can be reached. A fifty to eighty ampere lamp will influence a photographic plate through the thickness of the human body. Investigators have not yet decided as to whether this property can be successfully employed in the treatment of diseases of internal organs. Several experimenters using fifty to eighty ampere lights report cures of various cases of carcinoma of the skin, epithelioma, rodent ulcer and Paget's disease, the result being equal to those obtained by X-rays.

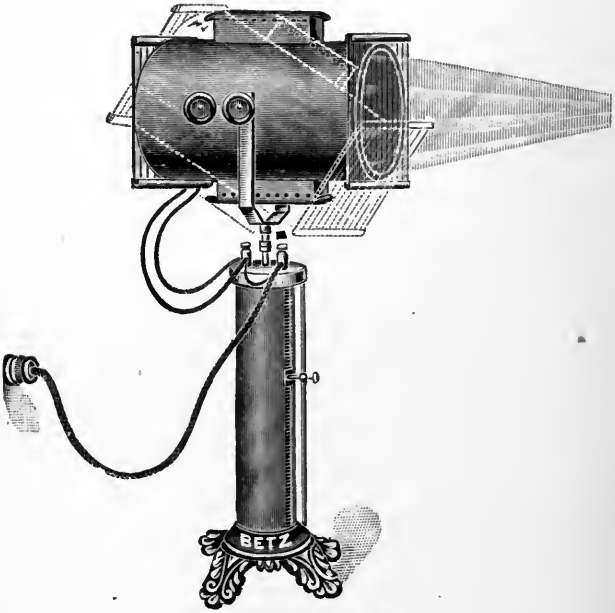
The effects from the light treatment, being immediate, are controllable, which is a decided advantage over the X-rays, where the effect is only visible after a number of days or even a week or more.

In Lupus vulgaris, tubercular verrucosa cutis, tubercular

ulcer, etc., the Finsen light treatment has been found to be the most effective and innocuous treatment. Finsen reports over one thousand cases, mostly cured, and has arrived at the conclusion that lesions which do not react under its use are not tubercular. Lupus erythematosus also responds to this treatment with about thirty-three per cent. of cures.

Alopecia areata, when due to a parasitic disease, has also responded to this form of treatment.

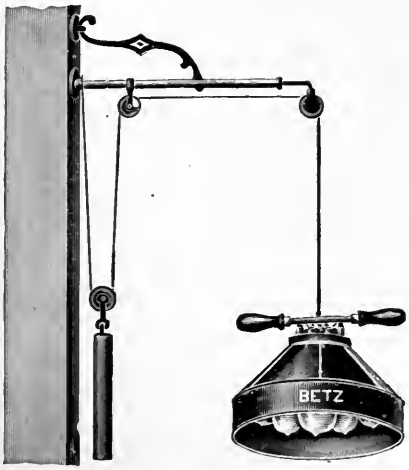
Actino therapy has also been employed in various forms of birthmark, nævus, etc. The endo-vasculitis excited by the light finally leads to cicatricial contractions and obliteration of the redundant vessels.



The Helios Therapeutic Arc Lamp.

BLUE LIGHT TREATMENT.

Professor Minin of St. Petersburg first called attention to the therapeutic uses of the blue incandescent light globe (in place of arc light filtered through a blue solution). These rays have a peculiar effect on the vaso-motor nerves, causing a constriction of the blood vessels in the tissues exposed. A marked anemia is thus produced which frequently has a surprising pain-calming influence. Thus the pains of



Multiple Minin Lamp.

pleurisy, cutaneous inflammations and contusions promptly disappear, permitting a more thorough examination. Professor Minin even reports making painless incisions and stitches without the use of cocaine.

The constriction of the superficial blood-vessels rapidly causes the absorption of infiltration about the edges of ulcers, and gives the impression that the ulcer is leveling itself and becoming smaller during each exposure. The ulceration

is covered with a very thin membrane and becomes smaller. The edges of the ulcer are soon covered with skin of normal color and elasticity, and as these edges come nearer and nearer to each other, complete restitution of tissue soon takes place. Cicatrization does not pass through those phases ordinarily observed, because there is no development of connective tissue.

It goes without saying that in specific ulcerations the microbes which occasion them perish in the first place, and then only does the restitution of the ulcerated tissues commence.

Stand and Reflector for Minin's Ultra-Violet Light.

The author has seen a severely infiltrated foot denuded of skin from the ankle down, following a severe infection, become covered with the fine membrane above spoken of during the first exposure, which marked the beginning of a cure that took place in about six weeks. The condition had lasted over eight months, during which period the patient was in a hospital, from which he was discharged because he was unwilling to undergo an operation, or a number of operations,

for skin grafting, which the hospital staff had decided were necessary to bring about a cure.

The infiltrated, bleeding edges and surfaces of malignant growths are rendered anemic, which frequently prevents the recurrent hemorrhages and relieves the pain in surrounding tissues. It thus accelerates the cure of such cases as are being treated by the X-ray. The secretions so fetid and plentiful in malignant growths are checked to a marked degree by a long daily exposure. The parts surrounding the sore may be protected against prolonged action of the light. The effect of this light is to deplete the granulating surface of its blood, thus preventing tissue activity.

Bearing in mind the physical properties of this light, we find a wide field of usefulness for its absorptive, antiseptic and anesthetic powers, and its portability permits its use even by bedridden patients.

In phymosis due to chancre of recent origin the foreskin can frequently be retracted after five to ten minutes' exposure.

In orchitis the pain and swelling are greatly diminished after ten to twenty minutes' exposure. The swelling about an infected area usually diminishes in about fifteen to thirty minutes, to disappear entirely or to reappear in a milder form.

Excellent results have been reported from the use of the blue light in hematomas, sprains, housemaid's knee, articular rheumatism and weeping eczema.

The cure of a case of lupus by means of this light is reported by Professor Minin. The patient had resisted a thorough treatment by means of the Finsen method. Others fail to confirm his claims.

In neuralgias the action of the blue light is to increase the pain, because it increases the already anemic condition of the nerves. In these cases, massage of the painful nerve tract with a ground glass incandescent light frequently gives great relief, for the action of white light is directly opposite to that of the blue light and increases the flow of blood to the parts.

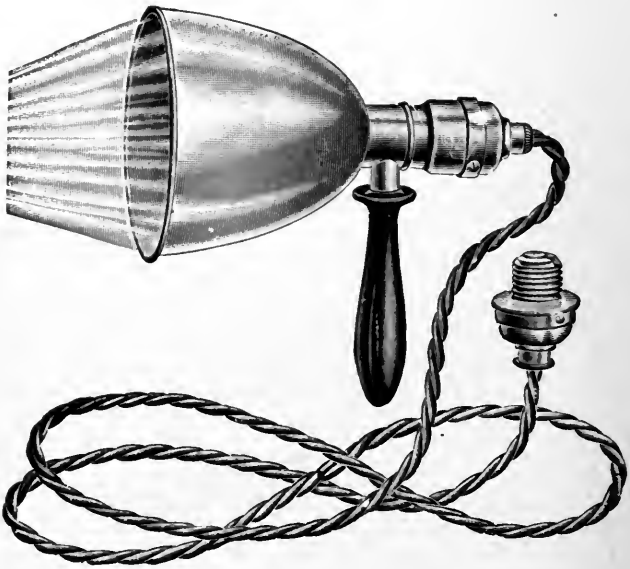
The lamp is placed just near enough to the affected part to permit the feeling of slight heat, care being taken not to raise a blister. Treatment may be given every other day

for fifteen to thirty minutes, or oftener as conditions may indicate.

Parts surrounding the sore spot may be gently massaged to improve local blood circulation.

This lamp is placed on the market under the name of Minin's Ultra-Violet Ray outfit, and has the four globes of different sizes as suggested by Professor Minin.

The Multiple Minin Lamp has seven globes of 50 C. P. each, any number of which may be used at one time, and was first put on the market by Betz & Co. of Chicago.



The Giant Therapeutic Lamp.

RED LIGHT TREATMENT.

At the present time there is a difference of opinion as to whether any therapeutic benefits may be derived from the red rays themselves, or whether their sole value lies in excluding the chemical frequencies, especially the ultra-violet.

Finsen by a series of experiments proved that if the chemical frequencies were interrupted, the remaining rays were innocuous to smallpox patients, and that pustulation due to stimulation of the secondary streptococci infection was thus avoided.

The exclusion of the chemical rays must be absolute, the inflamed skin being as sensitive to the actinic rays as a photographic film. The treatment must be continued without interruption until the vesicles have become dry. The shortest exposure to the chemical rays or daylight is apt to produce suppuration with its sequelæ. Measles, scarlet fever and erysipelas patients also receive marked benefits from the exclusion of the actinic rays, the temperature being lower and the symptoms in general are less severe than when exposed to the full effects of the daylight. Winternitz is authority for the statement that red light acts favorably in various skin diseases. By covering up with red material the parts of the body exposed to the sun he diminished hyperemia and cured eczema. The action obtained being undoubtedly due to the absence of the chemical activities. He also claims a distinct improvement in cases of chronic rheumatic affections of the joints, hands and feet in the same manner.

ELECTRIC ARC BATHS.

The use of electric arc lights has an action very similar to the use of strong sunlight; in very susceptible patients a marked erythema frequently occurs in from fifteen to twenty minutes, while in others it may take hours to bring about

Incandescent and Arc Light Bath.

similar results. The temperature in these baths is very low, it being necessary to warm the rooms to make them comfortable for the patient.

As a rule the rays from two arc lamps of ten amperes and fifty volts are used, each lamp giving light equal to two thousand normal candle-power. The duration of one treatment varies from fifteen minutes to forty-five minutes. The chemical frequencies in which the electric arc is very rich

are not bactericidal in themselves, but they tend to promote active oxygenation of the blood, improving metabolism and consequent nutrition, which in turn means increased resistance.

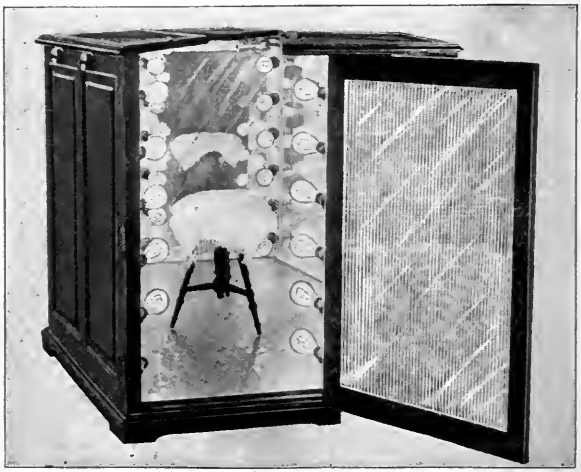
No claim is made that the intense chemical rays penetrate into the deeper structures, as do the X-rays. The absorption of the chemical frequencies of the electric arc by the oxygen-carrying corpuscle in the superficial blood stream compels its influence to be felt in every part of the body.

These electric arc baths are very effective in the treatment of tuberculosis (first stages), bronchitis, muscular rheumatism or neuritis. In exposing the patient, care should be taken to change him about to permit every part of his body to receive the direct influence of the light.

ELECTRIC LIGHT BATHS.

Sunlight is one of the most powerful tonics at our disposal, the various rays being present in the highest degree.

Next to a sun bath the incandescent electric light bath is the most useful and sensible. The heat in this bath is not derived from the air surrounding the patient, as in a hot air



Electric Light Bath.

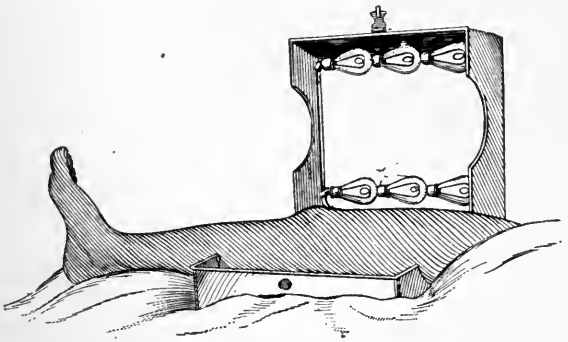
bath, but from radiant energy from the incandescent films. These rays pass through air surrounding the patient, without heating it to any considerable degree. As the rays enter the body they come in contact with various opaque structures, the resistance afforded by which converts radiant energy into heat.

Rheumatic individuals have noted the fact that when exposed to the direct rays of an arc lamp their condition seems to be improved. There are more heat rays present in an incandescent lamp than in an arc lamp, which is very

rich in actinic rays, which are a direct stimulant for animal and vegetable life.

Light rays raise the body temperature the same as hot water, air or vapor. This rise of body temperature stimulates the metabolic activity of all the organs of the body, as is indicated by an increased production of carbonic acid. Animals eliminate more carbon dioxide under the influence of light than when confined in the dark.

Exhaustive experiments show that frogs throw off from one twelfth to one fourth more carbonic acid gas in the light than in the dark. Experiments on dogs and rabbits give similar results.



Local Light Bath.

Metabolism is unquestionably stimulated by the reflex action set up by light rays upon the nerve endings of the skin and retina. Oxidation is increased by action of light and less carbon dioxide is eliminated at night than during equal hours of the day, even if an equal degree of rest be observed.

The stimulating effect of light, or rather heat rays, on the nerve endings in the skin brings about a relaxation of the cutaneous blood-vessels.

The dilated cutaneous vessels, when filled, may contain from one half to two thirds of the total quantity of the blood in the body, thus relieving the congested visceral organs, as the liver, kidney, stomach, spleen and brain. Owing to cerebral anemia thus brought on, the patient often falls into a profound slumber. The heating of the blood thus brought

to the surface stimulates the sweat glands to active perspiration, and may increase this excretion from one and a half ounces to two or three pounds per hour.

The temperature of the blood in these widely distended vessels is frequently raised from four to five degrees Fahrenheit in fifteen minutes. This increase in body temperature is probably the cause of the increased production of carbon dioxide, with its remarkable reconstructive effect on the animal metabolism.

General perspiration is produced faster than by any other known procedure. It frequently begins in three to five minutes after entering the bath, the temperature of which may be as low as eighty-five degrees. In a Turkish bath with a temperature of one hundred and seventy degrees Fahrenheit it takes much longer. The cutaneous activity is greater than under any other sweating procedure.

Fig. C.

The respiration also shows an increased elimination of carbon dioxide, amounting at times to forty-four per cent.

The electric light baths are fast superseding all other kinds of sudatory baths, as they contain, in addition to decided benefits of their own, all the benefits of the Turkish or Russian bath, which are withheld from many sufferers from heart troubles. The user of a light bath is in reality enjoying a pleasant sensation, just as if the body were exposed to a mild sunlight, whereas the long-continued use of the Turkish or Russian bath necessarily causes weakness. Light baths, on the contrary, strengthen and give tone to the system, and may be used on account of their strengthening and invigorating qualities.

Locally applied, the light baths are most effective in promoting absorption of exudates from joints and the pleural and peritoneal cavities. Even absorptions of exudates from the cornea and vitreous opacities have been reported.

The arc electric light bath possesses properties identical with those of the sun's rays; in the arc light the luminous and the chemical rays predominate; in the incandescent light the heat rays predominate. The results obtained by the employment of this bath are essentially those obtained by a sun bath. Patients, however, begin to perspire more quickly than when exposed to an ordinary sun bath. This may perhaps be due to the greater number of actinic rays in the arc light, which exercise a powerful stimulating effect upon the sweat glands, the duration of bath being from five to twenty minutes.

For practical purposes the incandescent light bath surpasses the arc light bath.

TECHNIQUE.

No light bath should be given without due regard to the time since the last meal; one hour and a half after a light, and two hours after a hearty meal.

The duration of a bath may be continued from three to ten minutes for a tonic effect, and from ten to thirty minutes for eliminative effects.

Urge patient to drink water copiously to encourage diaphoresis.

Moisten the face and scalp with cloths wrung out of water at a temperature of sixty to sixty-five degrees F. See that the feet are warm. It may be necessary to place them in a basin of warm water.

To make permanent the effects obtained by the light bath they must be followed by a short cold application. The application of cold has the opposite effects to heat and is a powerful stimulant to all the organs of the body and a power for great good. It improves the tone of the organism by the reactionary excitation produced.

In feeble individuals, especially those suffering from neuralgic pains, a cold douche is frequently not advisable. Here alcohol may be applied to a small area at a time, and friction applied until it evaporates. The entire body should be gone over in this manner to bring about universal contraction of the cutaneous vessels.

It is the author's custom to give his patients the benefit of a static breeze for about ten minutes after each bath, to make the benefits thus obtained more permanent.

Light affects the great majority of diseased conditions in the most favorable manner, especially all those forms of disease accompanied by defective metabolism, characterized by defective oxidation, such as obesity, diabetes, uric acid diathesis, gout, Bright's disease, cirrhosis of the liver, rheumatism, etc.

Acne, eczema and even psoriasis have yielded surprising results on exposure to sunlight. Spasm of the cutaneous vessels is relieved, permitting the blood from the congested visceral organs to come to the surface. Neurasthenia in all forms is materially influenced as the blood improves.

The light cabinet is especially beneficial in toxic insanity due to spirits or drugs, melancholias, nervous insomnia and the various symptoms that may accompany a sclerotic condition of the blood-vessels, kidneys and liver, various degrees of vaso-motor paralysis, tachycardia and arrhythmia, due to toxines, are notably diminished in irregularity during the bath. Strength and tone frequently continue for hours afterward.

Albumen and casts from the kidneys grow less and frequently disappear entirely without the use of drugs. The

author has treated a number of cases of chronic nephritis where the apex of the heart was outside the nipple line. After three months' daily treatment it was found to have returned to almost its normal position.

Research has demonstrated that there is a relationship between every portion of the cutaneous surface with some internal area. In general, it is the skin overlying the internal organ that is reflexly associated with it. Understanding this relationship, it is readily understood that the volume of blood

Local Light Bath.

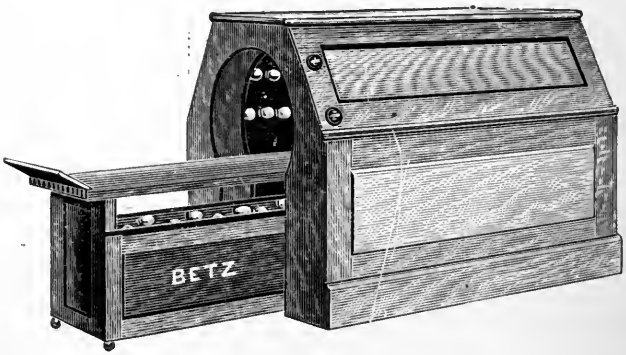
in any internal organ, no matter how remote from the surface, may be controlled to a certain extent by applications to the associated cutaneous area of a thermic or other agent capable of producing vascular change.

Thus congestions of a reflex nature interfering with the perfect action of an organ may be relieved by applications of light to the spine from the base of cranium down, or over the reflex cutaneous surface.

Prolonged applications of light and heat lessen the excitability and energy of the voluntary muscles (this is how heat relieves muscular spasm) and greatly increase the excitability of the smooth involuntary muscles.

A local light bath, applied to the hyperemic tissues, causes the distended capillaries to relax, permitting these vessels to fill with fresh blood, and secures a more rapid and complete oxidation of the effete materials, which are clogging the metabolic processes, into normal excretory products, in which form they are easily disposed of.

A three hundred candle-power incandescent lamp (not brought to a focal point) is very efficacious in the treatment of many skin diseases, especially so in the various eczemas. Carbuncles may be aborted if the light is applied in an early period of development. Pain or soreness may be entirely relieved or greatly modified.



The Carlsbad Electric Light Bath Cabinet.

PART II.

NERVOUS SYSTEM.

ELECTRO-DIAGNOSIS.

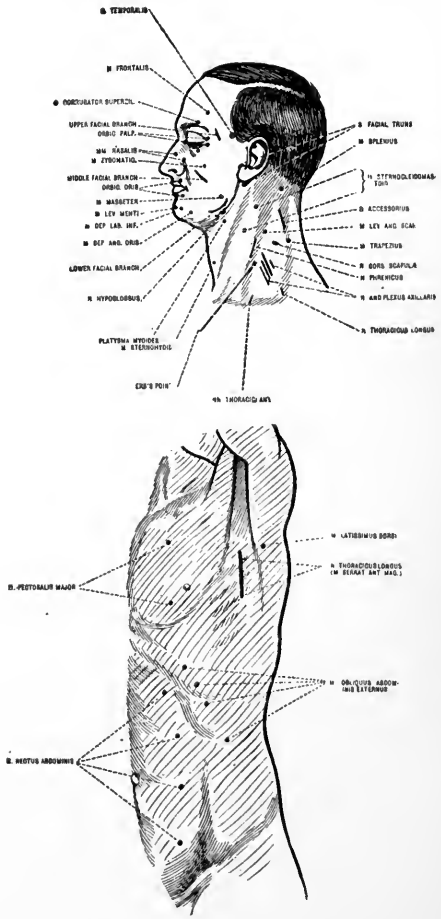
This includes examinations of the electrical reactions of diseased nerves and muscles. It presupposes on the part of the investigator a thorough knowledge of the human anatomy, physiology and pathology, as well as a familiarity of technique with electrical appliances. In making this examination the indifferent or positive pole is placed at a distance, and the negative pole, which gives the strongest response, is used as the active electrode. When the minimum response is compared with the corresponding healthy nerve or muscle on the opposite side of the body, it will be noted that similar positions of the coils will give similar results.

Normally, the first contraction in the series is always on closing the circuit with the cathode (negative pole), and the last on opening with the cathode (negative pole), anodic (positive), opening and closing contractions appearing with intermediate current strength. The current strength necessary to elicit cathodic (negative) opening contractions is usually painful. Stimulating a motor nerve stimulates the muscle to which it is supplied. Muscular tissue is a much better conductor of electricity than nerve tissue, with the result that the current takes the path of least resistance. Directly on entering the nerve it leaves and passes along the surrounding better conductors.

A *reaction of degeneration* exists whenever a muscular response presents either of the qualitative changes. The modal alteration from the quick jerk of health to the slow wave-like movement is an important accompaniment of degenerative reaction, and points infallibly to its existence. The phenomenon is readily detected by the eye.

A diminution or total extinction of faradic irritability is strong presumptive evidence of degenerative reaction, and a quantitative change in the galvanic irritability are the qualitative changes which usually occur.

Its occurrence indicates positively certain pathological



Motor Points of Body and Face.

changes in the nerves and muscles, resulting from their more or less complete separation from their trophic centers in the ganglion cells of the anterior cornea. If a motor nerve be divided, crushed or mutilated, the peripheral portion will degenerate. In two or three days the medullary sheath coagulates at the point of injury and a process of degenera-

tion spreads rapidly toward the periphery into the finest ramification of the nerves, resulting in a cirrhosis of the nerves.

Histological changes not only occur in the injured nerve, but in the muscles as well, finally undergoing waxy or fatty degeneration until the muscle mass is converted into a tough band of connective tissue.

In favorable cases regeneration occurs, but only after the trophic conductivity of the nerve has been restored. All forms of degeneration do not follow the typical course, for where the motor conductivity is only partially interfered with a large variety of phases are presented. For instance, we may have complete degeneration in one part of a large muscle supplied by several nerves and partial degenerative reaction in another part. Here we are apt to have a double contraction on direct stimulation of the muscle, the healthy portion contracting quickly and the degenerated portion contracting much slower. The same nerve trunk may present complete nerve degeneration in one part of its course and the partial form in another portion.

Diseases in which reaction of degeneration is present in certain muscles are neuritis of motor nerves (traumatic or idiopathic), multiple neuritis, poliomyelitis, bulbar paralysis, lead paralysis, atrophic lateral sclerosis (early stages), certain cases of diphtheritic paralysis, cases of myelitis caused by injury, toxic agents or pressure of intra-spinal hemorrhages, tumors, syphilitic deposits in which there is a partial degenerative reaction as shown above.

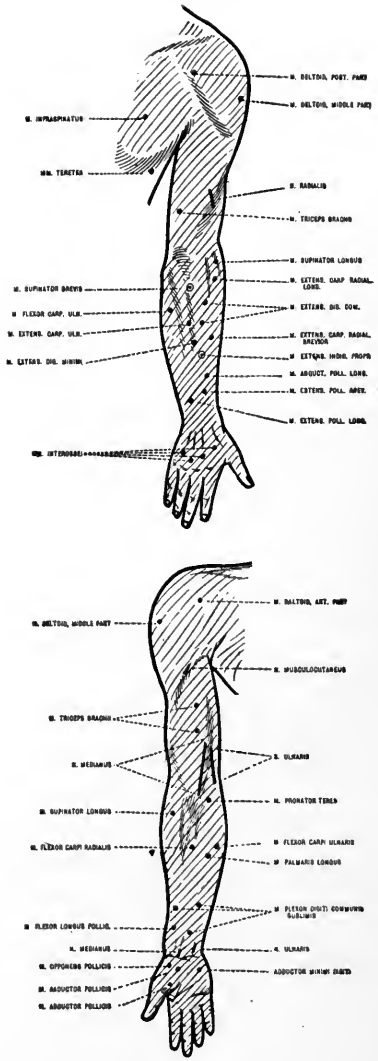
The examination of sensory nerves is not so important as that of motor nerves, though it is more accurate than other means employed.

The reaction of degeneration gives a definite result and enables the physician to form a prognosis and to institute rational treatment.

Reaction of degeneration at once excludes the brain, the white matter of the cord, hysterical paralysis, idiopathic muscular atrophy and shamming.

All peripheral diseases in which the integrity of the nerves has been seriously compromised, as the result of injuries, pressure or morbid growths or rheumatic influences, show the usefulness of electrical examinations.

In a case of lessened mobility of a limb or muscle it will



Motor Points of Arm.

clear up the question between a cerebral and a peripheral seat, the presence of a full faradic response or of degenerative reaction being conclusive.

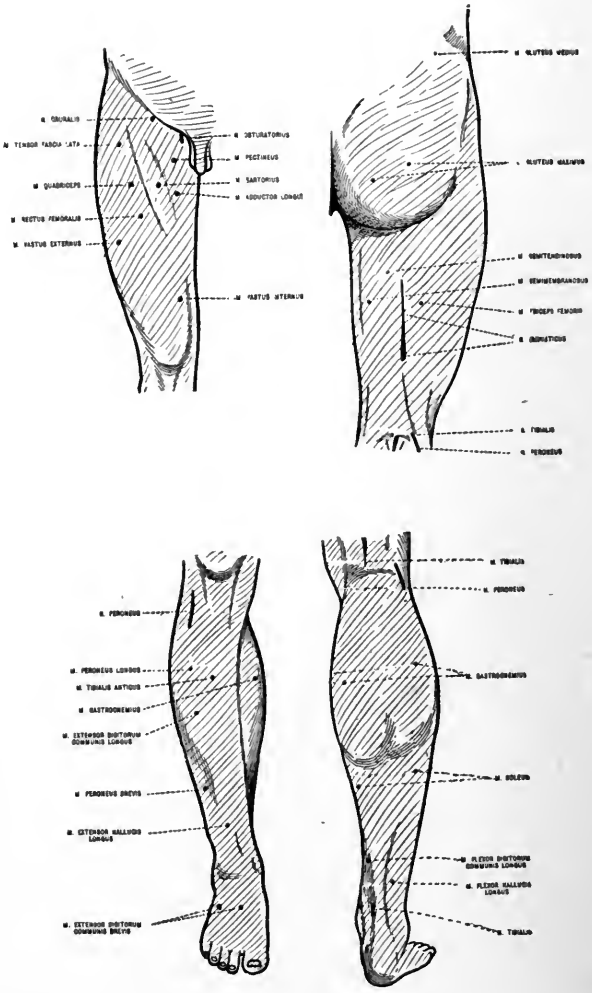
An examination will differentiate between cerebral, peripheral and lead palsy, and in unsuspected cases of the latter will enable a diagnosis to be made in the absence of other conclusive signs.

Anodal Electrolysis in Neuritis.

From the above list it will be seen that the usefulness of electrical examinations is by no means extensive, yet its indication may be of great value.

Nerves of special sense respond to electrical stimulation with a sensation corresponding to their particular function. The cathode (negative pole) is more irritating than the anode (positive pole). The supra-orbital nerve is usually chosen as a test for the sensory nerves, and response is usually most marked on opening and closing the circuit.

The galvanic current is used in making this examination.



Motor Points of Lower Extremity.

In locomotor ataxia it is of especial value. The sensibility of the whole body is often found very much decreased. Sensibility to pain is generally affected in proportion to the general sensibility. In certain cases there is complete analgesia. When the affection is unilateral the difference of the farado-cutaneous sensibility on the two sides can often be clearly brought out.

MODE OF PROCEDURE.

Place the patient in an easy position on a couch or chair opposite the examiner. Place the indifferent electrode at some distant part of the body, the sternum for instance, and maintain a steady contact. This electrode should be large and well moistened, so that local action will be kept at a minimum. Start with the negative as the active electrode. There must be no variations in the conditions under which the tests are made other than the change of polarity. The sponges should be well moistened in bicarbonate of soda. The muscles of the parts to be examined should be relaxed. The active electrode should be small, say four fifths of an inch in diameter.

It is not always easy to find the motor points at once, notwithstanding the operator's knowledge of where they should be, as the overlapping of muscles and adipose tissue and the natural variations of distribution give considerable range for variety of situation.

We begin our examination with the faradic current, as it has a diagnostic value peculiar to itself. If there is much degenerative change in the motor nerve or muscle structure they fail entirely to respond to the brief and sudden impulse of the induced current. If a muscle or nerve is found, therefore, to respond to the induced current, this in itself is evidence that the muscle is not undergoing degeneration.

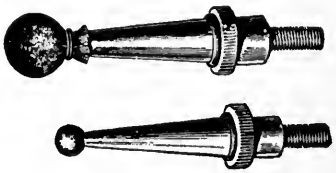
In making a diagnosis of diseases of children, such as infantile paralysis, where it is necessary to know the exact condition of motor nerves and muscles as a guide to treatment, it may be necessary to chloroform the child, as the currents used are at times quite uncomfortable and even painful.

Note the weakest current that induces the first visible muscular contraction. After having examined the nerve trunk to test its irritability, we go over the motor points.

Repeat this with the galvanic current and note the number of milliamperes needed to produce the first visible muscular contraction.

It is very important to know whether the positive or negative pole is over the nerve, and whether the contraction occurs at the opening or closing of the circuit. The polarity of the electrode may be changed and the same fact determined for the minimal contractions.

In the more delicate shades of degenerative reaction this mode can alone be depended upon to give exact facts. Produce vigorous contractions at cathode closure and note carefully the extent; note number of milliamperes used. Reverse the pole by the commutator. Increase or diminish the current until the same number of milliamperes are in the



Erb's Electrodes.

circuit and then note the extent of the contractions at the anode closure.

Complete the examination by similar observation at anode opening and cathode opening, the original number of milliamperes being carefully maintained.

The irritability of a nerve is increased when first visible contraction is caused by a current of less strength than normal, and diminished when a stronger current than normal is required to excite muscular contractions. Increased muscular irritability is present in the early stages of locomotor ataxia, chorea, etc.

Having found the spot where the weakest current produces the greatest individual action on the part examined, it is marked with an indelible pencil for further ease in identification, and the current is then alternately decreased and interrupted until a mere trace of contraction is visible.

Atrophy from disuse and from inflammatory joint diseases is characterized by diminished irritability. To determine with

certainty increased nerve irritability the resistance of the skin over the parts treated must be accurately measured.

Muscles react to the faradic current in the same manner as they do to the motor nerve. The faradic current contracts muscles by stimulating the intramuscular nerve fibers and increases the irritability of motor nerves. There is little electrolytic action caused by this current.

A slowly interrupted current causes contractions of the muscles at each break in the current, while the rapidly interrupted current causes tetanic contractions, the muscle having no time to relax between each electrical stimulus to the nerve.

When the disease is unilateral, the opposite healthy side is used for comparison. If the disease is bilateral, the electrical reaction should be compared with some other nerve or muscle whose reactions are known to have nearly the same value. Any of these nerves may be taken as a standard of comparison when same nerve on both sides is involved. We may get response from a muscle through stimulation of the nerve when response from the muscle direct gives a marked degenerative reaction.

Examinations of corresponding sound parts are used as comparisons; the electrodes in size and current interruptions must be the same. Equal pressure should be brought to bear on the electrode, for where the degenerative changes are slight, carelessness in this regard may leave an error in diagnosis. It is not always easy to determine the exact amount of current, as the overlapping muscles and adipose tissues and other natural variations give considerable range in variety of situation.

The disappearance of electro-nervous excitability coincides with the degeneration of the nerve structure.

Farado-muscular excitability disappears with established degeneration of intramuscular nerve fibers and motor end plates. The last contraction to disappear is anodic closure.

If regeneration takes place in the nerve, voluntary impulses are the first to be transmitted. This is shortly followed by conduction for electrical stimuli. The muscle begins to respond more sharply, the sluggish contractions gradually disappear and the negative takes its normal position in the polar series.

When we propose to apply electrical stimulus to a single muscle the active electrode must be applied accurately to

the motor point of the muscle or the motor nerve filaments supplying the muscle. Care must be taken to prevent the current from reaching muscles that should not be stimulated, lest our object in giving treatment may be defeated, as in the correction of deformities. A muscle must always be stimulated in a relaxed condition, and a disregard of this important rule makes the treatment harmful rather than beneficial, as overstretching of the fibrils and tendons may take place.

Repeated practice in locating motor points on oneself as well as on patients is necessary to acquire proficiency in electrical diagnosis.

SPINAL DISORDERS.

From the incurable nature of most spinal cord diseases, too sanguine predictions must not be made.

In some instances the diseases are cured, in others their course is arrested and alleviated, while in still others not even the symptoms are relieved. As a rule, diseases of the spine are well advanced before they are recognized. Could an early stage of the process be detected, we might be able to arrest it.

For the special anatomy, physiology and pathology of the spinal cord the reader is referred to the standard authorities. The essential point in the treatment relates to the localization of the part of the cord affected. The most invariable effect due to electrical stimulation of the peripheral nerves and their end organs is the improved nutrition of the patient, the patient frequently gaining in weight irrespective of the improvement which may or may not ensue in the disease. Just how much stimulation will do harm or how much do good will depend upon clinical observation, each case being a law unto itself.

The morbid processes of the spinal cord are divided into a number of classes:

1. Functional.
2. Nutritional.
3. Anemic and hyperemic.
4. Hemorrhagic.
5. Neoplastic.
6. Inflammatory.
7. Degenerative.

If we exclude the hemorrhagic and neoplastic, which are of rare occurrence, the remaining pathological states are more or less interwoven, their nature being that of a chronic fibroid condition. The sclerotic process is an active one and not one of decay, nutrition being very active.

Toxic agents, as alcohol, lead, etc., and the poisons of infectious diseases, fatigue, overexertion, imperfect metabolism, auto-intoxication, due to uric acid, etc., produce a neuro-paralytic condition. What is more natural than that the nerve cell, bathed in a fluid toxic to its nutrition and life, should die?

Toxic paralyses are peculiar in that they begin their recovery the moment the poison is eliminated. Oxygenation of the tissues effected by electricity at once becomes a question of prime importance. Weak galvanic currents should be passed through the paralyzed limb or limbs. Static electricity may be used as a general nerve tonic.

If it is desired to produce excitation, the interrupted galvanic current is used, while if sedative effects are desired, apply the anode (positive electrode) of the galvanic current. If we wish to excite generally, we place the anode (positive electrode) at the feet and move the cathode (negative electrode) up and down gradually over the whole body surface, and frequently interrupt or change the current direction. If we wish to excite cutaneous anesthesia or muscular atony, the whole surface of the body may be gone over by the faradic brush or wet sponges. When there is increased excitability, faradism is contraindicated. The venous engorgement of the extremities found in paretic stupor improves when treated by the interrupted or labial galvanic current.

In making a spinal application the patient may sit sideways on a chair with clothing loosened at the back. Two spinal electrodes are used, about two and a half by five inches, the positive being placed immovable on the lumbar region and the negative held in contact with the cervical and various parts of the median and dorsal region, and in turn giving a stabile or stationary current in each region for one minute. A current of ten to seventy milliamperes may be used, according to the patient's tolerance. The faradic current is not employed in this manner, as it would doubtless fail to act on the cord or deep-seated nerve roots. A more effective application than this is the abdomino-dorsal application,

placing a large pad upon the abdomen and sliding the thoroughly soaped electrode up and down the back, using about forty milliamperes, more or less, according to the patient's tolerance.

Long percussive sparks to the vertebral column, small sparks, such as are easily borne, to the muscles, friction or rubbing the electrode over the entire skin surface, and a Leyden jar current, are especially useful in spinal cord dis-

Using Faradic Brush for Cutaneous Stimulation.

eases. No chemical decomposition attends its flow, but in place of this great molecular disturbance takes place. The resistance of the human body is practically nil to this current, it being especially adapted to reaching and influencing the spinal marrow.

Infantile paralysis offers frequent indications for the use of electricity. The muscles, whose faradic contractility is only partially lost, may be expected to recover completely, either spontaneously or under treatment.

The injury of an organism or any part of it during its epoch of growth produces a much more profound effect than

if received after growth has been completed, when it is only necessary to maintain the status of nutrition.

We are not justified in waiting for spontaneous recovery. The aim should be to allay the hyperemia of the spinal cord, which is one of the elements of the initial myelitis when this really exists, and when the paralysis is not due to peripheral neuritis.

The arrest of the circulation which occurs at the beginning of inflammation can be dissipated, provided the blood-vessels have not yet become agglutinated, hence its value in creeping inflammations of the nerve centers. Electric currents promote circulation in the blood-vessels and lymphatics.

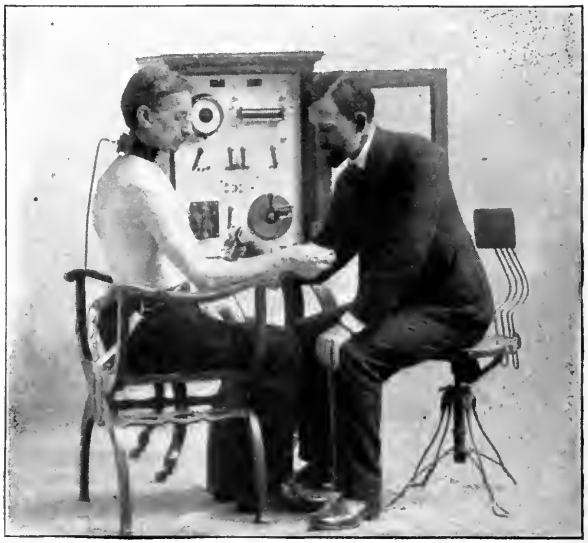
The conductivity of the axis cylinder of nerves should be maintained by the passage of constant electrical currents, as a substitute for the nervous currents which have ceased to pass, and to maintain the nutrition of the muscles by means of electrical stimulation in place of volition. The constant current contributes to the nutritive regeneration of ganglion cells, nerve fibers, muscle fibers, by its catalytic influence, and promotes the development of adjacent neuro-vascular elements to assume the functions of those hopelessly destroyed.

In an exposed nerve traversed by a constant current the excitability of the segment at the positive pole is diminished. At the negative pole it is increased. This is one of the fundamental laws of electric physiology. By the prolonged passage of the current a nerve may be completely paralyzed, so that for a while it ceases to respond to faradic stimulation. This experiment shows why the positive pole of the galvanic current acts as a sedative agent to nervous irritation.

As these cases frequently recover spontaneously, it is difficult to prove the nutritive value due to faradic contractions. The distinguishing characteristic of the faradic current is that it elicits and promotes functional activity, and this is only indirectly and under favorable circumstances a stimulant to nutrition. Since the functional activity implies and depends on the processes of disassimilation, it would seem at first as if such activity should be sedulously avoided in cases of paralysis, and only rest sought. The muscular atrophy occurring in many cases of paralysis is due largely to inaction; hence artificial stimulation must be resorted to to a limited degree.

Infantile paralysis may require treatment for a long time before recovery. A period of two years may frequently be assigned in advance.

In *acute poliomyelitis* the treatment may begin as soon as the signs of the acute inflammatory stage are over. This is often as early as the second week. Employ the galvanic current upon the cervical or lumbar enlargements. The site of the disease is covered with a large electrode, while the



Faradic Stimulation.

other electrode is applied to the anterior part of the body. By the aid of a pole changer first the positive and then the negative poles may be employed for one or two minutes each. The negative electrode may also be placed stabile over the site of the disease and labile or stabile to the nerve trunks or muscles, the anode (positive pole) being placed at an indifferent point, as in the hand or on the sternum.

In paralysis of the milder forms the reactions are all normal, paralysis being only a symptom, the nerve trunk being incapacitated by disease for carrying motor impulses.

Where a single group of muscles is involved, the disease is generally confined to the nerve trunk supplying this group.

The study of the reaction of degeneration locates the seat of the lesion and separates in a broad way diseases of spinal and cerebral origin, and excludes hysteria and shamming. Nevertheless, we must remember that grave spinal and cerebral lesions may be present and nearly normal electrical reactions take place.

It may be stated as a general rule that the more complete the reactions of degeneration, and the longer they have been manifest, the more unfavorable the prognosis.

If the electrical reaction is normal, the disease may disappear in a few weeks.

If partial reaction of degeneration is present, the disease usually lasts a few months, and when reaction of degeneration is complete, the disease usually lasts from six to nine months or even longer.

In making a prognosis, the etiology of the disease must, however, always be taken into consideration.

In *diphtheritic paralysis* the cord is only exceptionally affected. The paralysis usually is peripheral in character and tends to spontaneous recovery, but the rapidity of the progress depends on the functional nutrition. If this is imperfect the paralyzed condition may drag on for months. In case nerve degeneration and muscular atrophy supervene, the paralysis may become permanent. Hence it is important to aid nutrition by means of drugs. General faradization is indicated, although local applications may be made directly to the pharynx. The faradic current is preferable to the galvanic. If the galvanic is employed, it must be without interruptions, which tend to exhaust the affected muscles.

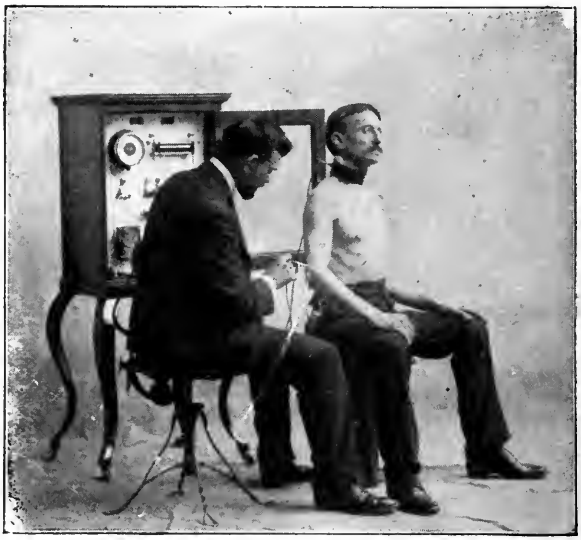
Study the nerve distribution from the spine to the affected region. A contractured muscle after an injury may bring direct pressure on a nerve fiber, or a plexus, cutting off its function and causing paralysis in its area of distribution. In such cases the result is seen directly upon the parts supplied by the combined nerves; it is uncomplicated in other parts of the body and is manifested in a circumscribed area; namely, in muscle groups supplied by the nerve or nerves in question.

If the trouble is due to an auto-intoxication, such as we find in anterior poliomyelitis, where the source of trouble

lies in the bowels, we frequently find that flushing of bowels and the hot air bath to eliminate the poison from the system, as well as stimulation of liver and kidneys, are of great aid.

It may not be amiss here to acknowledge the value of lymph hypodermatically administered, in cases of paralysis due to auto-intoxication or auto-infection. Early administration is advised.

A child suffering from a severe gastro-enteric infection



Anodal Electrolysis for Neuritis.

developed marked cerebral symptoms. Paralysis of the optic nerves and absence of reflex to light were present. The child had slept with its eyes wide open, even when under the influence of an opiate, which had to be administered to prevent shrieking and restless tossing about. This condition had been going on for about a week when the patient was seen in consultation by two specialists, who made an unfavorable prognosis—they had never seen a child with such severe involvement recover the use of its faculties. It occurred to the author that as the use of lymph had been followed by

favorable results in case of adults, it might be employed in this case, while the active cause was still in progress. Two injections were made four hours apart, and were followed by a normal sleep with closed eyes. A marked improvement was noticeable after eight hours. Three injections a day were made for the next four days. At the end of this time, the child had recovered the use of all its faculties and was able to recognize everything that was going on, even calling for his playmates.

If the action of the trophic centers in the cord which control the nutritive processes is impaired, thereby complicating the paralysis, the parts affected rapidly become soft and atrophy. In brain lesions, the trophic centers not becoming involved, the motor mechanism suffers only from disuse, and thereby secondarily affects general nutrition. In peripheral paralysis, if exercise of other parts of the body is not impaired, only the part paralyzed suffers.

Stimulation tends to preserve the balance of nutrition, which is restored and degeneration thereby retarded. If it is due to a blood clot on the brain or congestion of the brain or cord, or embolism, stimulate the cervical centers of circulation to assist in its absorption. This can be accomplished where the clot has not had time to become organized or encysted.

In paralysis the wave current should be applied over the organ itself and the trophic centers in the spine, increasing nutrition and relieving arterial tension. Activity in the organs is quickened and absorption hastened, removing the pathological condition and establishing collateral circulation in the parts previously cut off.

Contractions as a rule do not take place in the paralyzed limb during treatment. A treatment should last at least twenty minutes, with about a four-inch spark-gap. The high frequency current is also a great aid in these cases and relief is sometimes very speedy, especially if the trouble be of central origin. One electrode is placed over the sensitive spot of the brain (which is easily localized by means of the electrode), while the other is placed over the nerves supplying the parts.

In chronic cases, soften the contracture, build up the circulation, increase the nutrition to the tissues and tone up the local nerve mechanism.

In treating the muscles of the face an electrode handle should be used which permits the opening and closing of the circuit without removing the electrode from the surface of the skin. Treatments should be every other day.

In *facial paralysis* the muscles can be stimulated by the induced faradic current from static machine with much less pain to the person than either galvanic or faradic. This is especially valuable in treating children.

Faradic Current in Facial Paralysis.

In *atrophic paralysis* the galvanic current is superior to the faradic current. It excites a movement of the liquids in the plasma of tissues favorable to nutrition, while it arouses no function in either muscle or nerve. There is no danger of fatiguing either from premature activity. The reason why the faradic current may be beneficial is that it does not reach the wasted ganglion cells, and if limited to the skin by a dry brush, does not penetrate to the paralyzed muscles or motor nerve.

With static electricity success is obtained only in cases of recent paralysis, and in cases where the disease advances

slowly. There is, of course, no remedy that will resurrect a dead cell. In many cases the vitality of the neuro-muscular elements is so profoundly smitten that recovery is impossible, for the injury may have been so widely distributed that no element remains intact.

In diseases of the brain electricity is considered useless by many, while some claim that it permanently injures the nervous system of children.

There is no form of nervous trouble or disorder where the various forms of electricity are more serviceable in effecting a restoration to normal conditions than in neuritis. It assists nature in clearing up the debris resulting from the invasion of inflammatory exudates, thus removing the vulnerable condition of the nerve trunk, which makes it prone to a recurrence on slight provocation.

The operator possessing a good working knowledge of the physical and physiological effects of the various electrical modalities, and having made out the pathological state of his patient, has, as a rule, no difficulty in choosing that form of electrical action best adapted to meet and counteract the abnormal states.

In *trauma*, over-stimulation will retard rather than promote the nutrition and restoration of nerve function. The treatment should be the application for five to ten minutes daily of the galvanic current, followed or preceded by vibratory massage and Swedish movement, and will be quite sufficient. The length and vigor of treatment should be increased as the nerve begins to respond more actively. When the function has been restored the induction coil current, with slow interruptions, can be substituted for the direct current. Gentle contraction of the muscle supplied by nerve may be thus effected, and in order to arouse the sensory nerves the faradic brush should be passed over the area of sensitive distribution with a current strength quite perceptible to the patient.

Lesions of the olfactory and optic nerves are not amenable to electrical treatment by galvanic current. The application of the electrode to the optic conjunctiva is exceedingly painful. Indeed, it is possible to injure the refractive media of the organ with too strong a current.

In *perverted functioning of the brain,* arising from either nutritive or circulatory disturbances, the indications for

its use are generally empirical. In many cases the nature of the trouble forbids more than a hope of amelioration, while in others unexpected results have followed its use. The first point to be considered is the form of electricity to be used.

A galvanic current of great amperage affects the brain, the spinal cord and the sympathetic system more powerfully than currents of even the highest tension. The amperage

Galvanic Stimulation of Trophic Centers in Spine and Solar Plexus.

also gives it a more potent electrolytic, and thermic action and also greater influence on the secretions.

A current of from three to thirty milliamperes may be applied for a minute or more, according to the susceptibility of the patient. Begin with a weak current and increase until the metallic taste is perceived in the mouth. The cranial center, the summit between the ears, is especially important in central galvanization. A current traversing from this point to the solar plexus is sure to affect an intensely vital area. Avoid sudden interruptions in giving applications to the head.

The current should not be strong enough to produce cutaneous irritation. The vaso-motor action of the current is the one chiefly desired in brain diseases, hence the galvanic current is largely used, though either current may be used. Where there is a congested disk there is contraindication to the use of faradic. The current should be two to five milliamperes, one electrode on the forehead and the other on the nape of the neck or over solar plexus, the treatment lasting from three to five minutes.

In applying electricity to the brain a large, well-moistened flexible electrode should be used, the hair also should be moist at point of application, and great care should be exercised in turning the current on and off.

In the use of the poles the best results are obtained by using both poles successively at each point of application. If we wish to increase the flow of blood to the brain the negative pole is placed over the forehead, and if we wish to diminish the flow of blood to the brain the positive electrode is used.

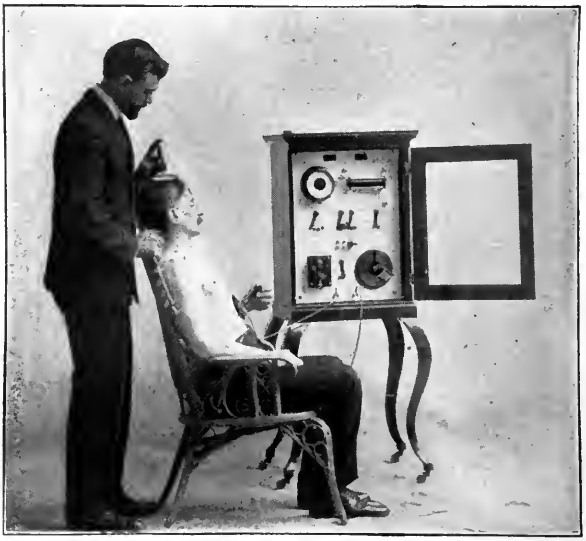
If the galvanic current is passed from the forehead to the occiput, or from the summit of the head to the stomach, little vertigo follows. If, however, the current be passed from temple to temple or from mastoid to mastoid, a very decided dizziness at once appears and becomes more decided the moment the circuit is broken.

Whenever the expected results do not follow the theoretically indicated pole, the contrary pole should be tried. The galvano-faradic current is sometimes very effective as a tonic when everything else fails.

In *mental diseases,* which are usually indications of deep-seated organic changes in the cerebrum, the symptoms are frequently successfully combated. Many cases of mental derangements, insomnia, extra and intra-cephalic changes, congestions of the face, epigastric oppression, false perceptions of sense, such as taste and hearing, may be successfully treated. The galvanic current controls these factors by re-establishing the deranged circulatory conditions and controlling the factors which cause the mental trouble. Turgescence of the veins of the brain really constitutes a withdrawal of so much blood from the efficient circulation.

Electricity, if used carefully and perseveringly, may be a valuable remedy. Weak currents excite and stimulate the

circulation, a medium current promotes, strong ones hinder it and very strong extinguish it. Hence it follows that strong currents should never be used. Where it is desired to produce a change in nutrition the constant current should be used, the anode (positive electrode) being placed at the back of the head and the cathode (negative electrode) placed at the extremities in the form of a foot plate, metal plate or sponges.



Central Galvanization.

Hallucinations and fixed ideas are disorders which are frequently amenable to electrical treatment. The positive pole may be applied to the superior cervical ganglion of the great sympathetic on each side, and negative pole moved slowly on the same side from the region over the eyebrow to the occiput. The periods of treatment may vary from a week to a year. Developmental insanities and morbid mental irritabilities, due to rapid growth, have been effectively treated with electricity. Insanity of the climacteric, which usually takes the form of mania or melancholia and in lac-

tational insanity excellent results have been reported from its use. In general paralysis of the insane alleviation may be looked for. The insane condition frequently found in aged people usually arises from nutritive enfeebleness and is most amenable to treatment, and next to careful alimentation, electricity is the most valuable therapeutic remedy for this trouble.

Psychic disorders having their sources in exhaustion and overwork frequently respond to the static current. Electricity is of little use in attacks of mania, though many cases of improvement under its use are reported.

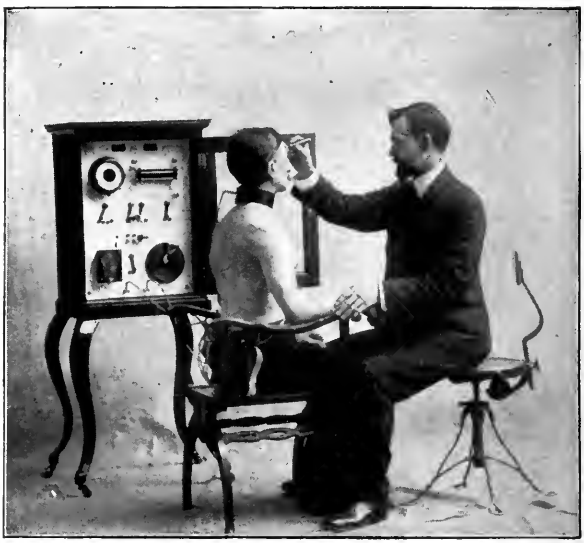
The results obtained by electricity in *cerebral hemorrhages* have been variable, but owing to the lack of other remedies its use is almost always justifiable. The applications should, of course, be deferred until the danger from cerebral fever has subsided. The treatment consists in galvanization of the injured portion of the brain, as well as of the injured muscles. Faradism of the brain is always contraindicated, weak currents doing no good and strong currents liable to do harm. By the peripheral treatment of the muscles, etc., the brain is also reflexly stimulated to assist in the restoration of conduction to the motor nerve tract.

In *hemiplegia* the large electrode of the positive pole is applied to the nape of the neck and the other is placed on the diseased side, so as to include the lesion between the two. The hair should be well moistened. The treatment is much the same for all cerebral paralysis, varying only with the seat of the lesion and the affected muscles. Should there be paresis or paralysis of the diaphragm faradization of the phrenic nerve is indicated.

Headaches.—The treatment of this trouble should be preceded by a careful investigation into the cause and the treatment directed to the starting point.

In practically all forms of headaches there are contractions of the cervical spinal muscle. These contractions are, as a rule, easily relaxed by means of the static spray or high frequency application. As the vaso-motor system, controlling the circulation of the body, has its location here, relaxation of these muscles and ligaments has a marked influence in relieving headaches; at least, temporarily. Manipulation or manual pressure over the vaso-motor nerve centers about the head, face and neck will frequently relieve a headache.

Congestive headaches are frequently relieved by application of the high frequency current; the operator, holding the glass electrode in one hand, applies the current to the patient's head with the other. To begin with, the spark-gap must be very small, and the current should be hardly perceptible to the operator's hands. A half-inch spark-gap may cause the patient to faint. In making application to the patient's head a number of intensely sore spots are usually found, which



Central Galvanization.

will disappear after a few moments' application, when the spark-gap may be widened.

It has been suggested that this means might be utilized in making diagnoses and in locating brain tumors.

Chronic headaches at the base of the occiput are frequently relieved by placing the positive electrode over this region, with the indifferent electrode in the hands or on some other part of the patient's body. The current strength to be applied must be governed by the patient's sensitiveness.

The pain of neuralgia is usually due to pressure on the nerve

filaments by spasm of its nutrient vessels, as well as by compression of the nerve trunks by the overfilling of the blood-vessels in the contiguous area. Consequently the pain is often relieved by simple relaxation of the nutrient vessels in the nerve trunks, drawing away the stagnant stream of nutrient material.

In neuralgia of the fifth nerve, cervico-occipital neuralgia, cervico-brachial neuralgia, it is absolutely necessary to bring about a relaxation of the muscular fibers of the neck. Manipulation of the muscles of the neck, with moderate pressure and vibration over the painful locality, frequently brings relief in two to three minutes.

Prompt relief from pain is frequently obtained from galvanism in neuralgia and it certainly exercises a curative influence. Spinal tenderness is often completely cured by electrization. Electricity may relieve the pain and not affect the pathological process, which may be uninfluenced and run the regular course.

In applying electricity the rule is to use the weakest current which will produce perceptible action, but no violent contractions. The anode (positive pole) should be placed over the seat of pain, successively, at the points of emergence of the several nerves, the cathode (negative pole) being firmly fixed over the upper surface of the vertebra. Avoid interruptions of the circuit. Apply daily for ten minutes.

In *sciatica* release the tissues along the entire course of the nerve. This is accomplished by stimulation of the spinal centers from the first dorsal down, and vibration along the entire course of the nerve.

Relaxation of the tissues about the sciatic notch is absolutely necessary. In chronic cases of sciatica the wave current, localized over the nerve exit and over the sciatic notch, is very effective. Long sparks applied over the nerve track frequently give great relief. Although cases are often cured in a short time, many cases call for patient continuance of treatment. Deep vibratory pressure by hand just above the thigh in the iliac fossa is frequently followed by instant relief, when all other methods fail.

In acute cases of neuralgia a hot static spray over the origin of the nerve, static brush discharge, and the high frequency current over the course of the nerve for twenty to thirty minutes, as well as applications of Leyden jar currents,

are very effective, though it must be remembered that almost any kind of electricity may aggravate the symptoms at first treatment.

Exposure of the painful parts to the X-rays will frequently be followed by immediate and wonderful relief in otherwise stubborn cases of neuralgia. If the neuralgia is of a toxic nature, electric light baths are indicated.

Intercostal neuralgia is frequently relieved by counterirritants. It is on this account that the static spray is very effective. The faradic brush frequently acts very favorably.

Applying High Frequency Current by Means of Hand.

and galvanism will often relieve promptly and permanently. The positive pole is usually placed over the vertebræ, and the cathode, or negative pole, near the sternum, or vice versa. The pain is usually relieved by the first galvanization.

Coccygodinia is due in most cases to either an arthritis or a neuritis. Static modalities seem to be successful in almost every case where the treatment is continued. The prognosis is generally good unless inflammatory products deposited restrict motion. The wave current or sparks are indicated to promote the reabsorption of the products of inflammation.

Exophthalmic Goiter.—This form of neurosis is undoubt-

edly greatly benefited by means of the galvanic current. That it is entirely cured by electricity alone is very improbable. The positive pole is placed at the nape of the neck, the center of its lower border corresponding with the seventh cervical spinous process. The negative electrode should be moved up and down the side of the neck from the mastoid process along the course of the great occipital nerve. Several applications a day of a weak current (two milliamperes) for five minutes to ten minutes give marked relief to the patient. Treatment may be applied by patient, as it is inconvenient for a physician to treat a patient that many times a day.

Chorea.—This disease does not seem to be favorably influenced by any form of electricity, while vibratory stimulation over the entire spine and over the sides of the neck seems to have a very soothing influence upon the patient. Flushing the lower bowels and dilating the sphincter have been most effective in the author's practice in connection with medicinal treatment.

Epilepsy.—Unless due to heredity or brain lesion, a fair percentage of cases get well under proper treatment. In these cases the cause is usually found in some lesion which interferes with the nutrition of the cord or brain, or irri tation of the motor nerve-strands running to the peripheral motor structures, exciting the connected nerves, or an auto-intoxication due to the obstruction of lymph and venous circulation. The exciting cause may be in the intestines, and diet must be carefully regulated.

Treatment—Stimulate the spinal centers in the cervical region as well as those from the middle dorsal to the last lumbar region, by means of vibration, and give the wave current to the upper spine, and the spray over the solar plexus daily. If due to auto-infection a hot air or electric light bath will be a great aid.

Static electricity may be applied for its tonic effect and for relief of nervous irritability.

Hysteria, being a functional disease of the nervous system, is frequently found to depend on some lesion which disturbs the nervous equilibrium. There is usually some actual derangement responsible for the altered conditions in those of neurotic temperament.

Treatment—Stimulation of the entire spine, especially the

dorsal and sacral regions; friction sparks to entire body; sedative spray over pelvic organs; wave current with electrode applied to lower spine to correct circulation in the colon, intestines and genitals. Stretching of the sphincter muscle was followed by relief in a number of the author's cases.

All the numerous *occupation neuroses*, such as those of musicians, telegraphers, seamstresses, barbers, drivers, milkers, cigarmakers, penmen, etc., are in reality starvation neuroses and manifestations of a more or less severe obstruction of nerve supply. The occupation which brings about these conditions usually requires the elevation of the right shoulder, resulting in drawing the upper ribs together and approximating the clavicle and first rib in such a manner as to bring pressure to bear upon the brachial plexus.

Treatment consists in stimulating the vaso-motor secretory and trophic centers involved by means of mechanical vibrations, and making a liberal application of short sparks to the ball of the thumb, muscles of the forearm, neck and cervical spine, followed by friction sparks. Always relieve the obstruction or the pressure on the nerve. In stubborn cases the arm may be placed in a water bath and treated in this way by means of the wave current.

Counterirritation by means of the static spray or high frequency application over the clothes will remove the weary, tired feeling.

Locomotor Ataxia.—In this trouble the electrical examination of common sensation is of special interest and value. The sensibility of the whole surface of the body will often be found to be very much decreased. The sensibility is usually affected in proportion to the general sensibility, but in certain cases there will be absolute and complete analgesia to the strongest current. In unilateral affections the difference in farado-cutaneous sensibility can often be clearly brought out.

Aconite applied by means of cataphoresis frequently gives relief for the dorsal neuralgic pains in locomotor ataxia.

Application must be made for five or ten minutes, and eight to ten drops may be applied at one treatment, with a current strength of five or six milliamperes.

The absorption of toxines from the bowels usually aggravates the dorsal pains, hence colonic flushings must not be neglected while receiving electric treatments.

Bladder pains of locomotor ataxia may be greatly relieved by systematic application once a day of the fine wire faradic current through the parts affected, the negative pole being applied over the sacrum and the positive pole over the symphysis, and the gradual increase of strength with the fine interruptions until the limit of pleasant toleration is reached. Application should be from ten to twenty minutes.

There can be no doubt as to the beneficial effect of electricity in this affection. The important symptoms may be caused to disappear and the patient made comparatively comfortable during the initial and ataxic stages of this disease. As a chronic disease it demands chronic treatment. Treatment should be galvanization with a moderate current strength of two milliamperes to a square inch for ten to twenty minutes daily, with the electrodes over the nerve extremities, one at the nape of the neck and the other one on the lumbar region, or one electrode may be placed on the sternum, while the other one is applied to the spine.

It is important not to neglect the treatment of the nerve roots and the peripheral nerves, since they, as well as the posterior column of the cord, are in many instances the seat of pathological change.

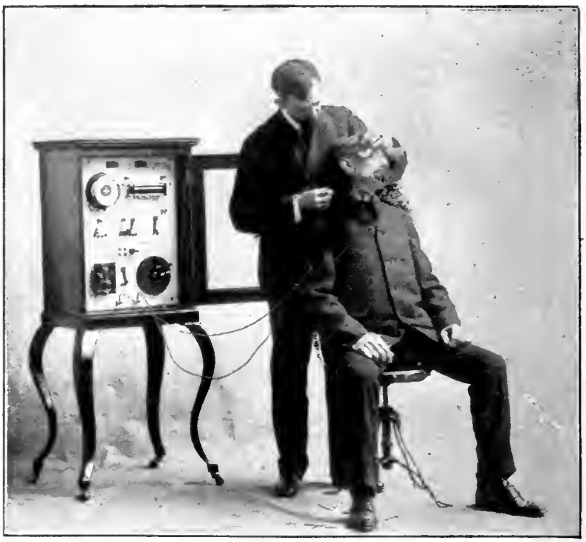
When patients under galvanic and faradic treatment fail to show improvement, recourse should be had to static electricity, as under this treatment improvement frequently results almost immediately when other currents have failed. Thick percussive sparks, from four to eight inches in length, should be administered over the spine to the nerve roots and trunks, to peristethic areas and to all points from which ingoing impressions may be caused to impinge upon the spinal gray matter, or to affect the spinal circulatory mechanism. The density of the charge from a static machine is likewise sufficient to afford a powerful rubefacient effect to the cutaneous nerve distribution.

The wave current from the static machine with the electrode on the spine (treatment thirty minutes daily) has in the author's experience been most effective in relieving pains of ataxia.

Insomnia is only a symptom of some underlying pathological condition, and whether this condition be due to infection or auto-intoxication, it must be remembered that there are always a number of cerebral cells in an unusual state of

vigilance while they should be in repose. This perverted cerebral circulation must be corrected before the cells can perform their normal functions.

While receiving the static breeze, patients suffering from insomnia often fall into a refreshing physiological sleep, due to lowered arterial tension, which in turn is followed by lowered frequency of the heart's action and increased volume of pulse. Internal congestion and strain upon the heart



Galvanic Current in Megrim.

muscle are relieved by dilatation of the integumental blood-vessels. This lowered tension in the blood-vessels also has the effect of aiding respiration, which becomes less labored, less frequent and deeper. As a sedative to the nervous system static electricity surpasses the hypnotic and sedative drugs by inducing a return to normal sleep, and assures it popularity wherever its uses are known.

Vibration over both sides of the neck, as well as stimulation of centers in spine from seventh dorsal up; hot static spray over the spine, liver and solar plexus; wave current

over the liver, and electric light or hot air baths, are all agents that tend to correct or combat the underlying pathological condition.

When static methods fail, try central galvanization; it may prove itself more efficacious.

After applying the current for one to two minutes over the vertex, move it over the sterno-cleido-mastoid muscle, the object being to influence the pneumogastric nerves. Make application on both sides of the neck. Then apply the current to the entire length of the spine.

Avoid interruptions most studiously. Observe the effect on pulse and respiration. If more than two milliamperes are used move the negative electrode about in order to prevent electrolytic action. The positive pole is usually the active one, because the indications for general galvanization usually call for tonic sedative effects.

In the treatment of this chronic and obstinate symptom, general faradization should never be forgotten. It increases the nutrition of brain and spinal cord, sends richer blood to a fatigued and exhausted stomach, increases peristalsis of the intestines and relieves constipation.

The liver and spleen acted on by the alternating currents applied locally may be made to exercise their specific action on the intrapelvic organs without use of the internal electrode. The effect is dependent on electromotive force and on the smoothness and the number of interruptions.

In paralysis of the diaphragm the galvanic current should be used, the positive pole against the outer border of sterno-cleido-mastoid muscle, the negative pole upon the epigastrium. In a case of laudanum poisoning the galvanic current may have to be applied for hours, until the respiration has risen to about twenty per minute and the contracted pupils have become dilated.

In chloroform narcosis the galvanic current, passed through the phrenic nerve, has been successful in some cases.

We are told, however, that there is danger of stimulating the vagus at the same time that we stimulate the phrenic nerve. This stimulation of the vagus would readily arrest the action of an already failing heart. Therefore, to avoid reaching the vagus, electrolization of the phrenic nerve must be reserved as a last resort. In ether, opium or aconite

poisoning it is safe to try to stimulate the phrenic nerve, because in the first case the heart is not depressed, and in the second case the heart's action is rapid and feeble, and it is desired, if possible, to exercise some inhibitory action. In the third case, the pneumogastric nerve is paralyzed and would not respond to electricity.

Faradization of the thorax is frequently followed by increased respiratory efforts, and is frequently used in the same conditions in which inhalations of oxygen are now generally employed with advantage. The stimulation must be addressed to the nervous mechanism, which controls the respiratory act.

Lead Paralysis.—The distribution of the paralytic effects of chronic lead poison varies greatly. Static sparks to the spine and muscular surface of the trunk and extremities are a great aid in assisting other methods of elimination. When atrophy has taken place local applications of the faradic and Leyden jar currents are indicated. Painters having slight attacks respond to treatment much faster when with it are associated various static modalities.

In *spasmodic stricture* of the esophagus, which is usually associated with the neurasthenic state, hysteria, etc., electricity may be applied for the purpose of reducing reflex excitability. The galvanic current is to be preferred. The negative pole may be placed on the back of the neck over the cilio-spinal center, while the positive is held just over the sternum or over the border of the sterno-cleido-mastoid muscle. If this fails an insulated esophageal electrode, with a metal tip, should be introduced in the esophagus to the point of spasm. Great caution must be exercised, on account of the proximity of the pneumogastric nerve. The faradic current may also be used, applied to the constrictor muscles of the pharynx, and is sometimes very effective.

In stricture of the esophagus cathodal electrolysis with a current of ten or fifteen milliamperes may be used, treatment lasting from three to twenty minutes. The electrode must be more flexible than the ordinary esophageal bougie made for gradual dilatation.

Hiccoughs are undoubtedly of a reflex origin. Galvanization and faradization of the phrenic nerve have been resorted to with marked success. The treatment is the same as that for paralysis of the diaphragm.

Vibratory stimulation to the spine has been successful, following one treatment, where the various other forms of electricity and drugs were unsuccessful.

Firm pressure on the phrenic nerves for a few minutes will sometimes relieve an obstinate case of hiccough in a few minutes.

Hyperesthesia of the Stomach and Vomiting.—These symptoms are frequently an expression of a neurotic condition, rather than of a gastric disease. If of a purely neurotic origin, there is usually no nausea present. Electricity, as a rule, greatly benefits these cases and general faradization and galvanism are frequently very effective.

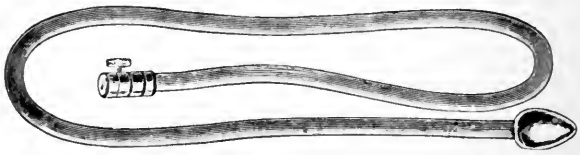
In *atony of the stomach* the integrity of the digestive powers depends on the tone of the muscular tissues of the stomach, as well as upon the healthy action of the nerves and

nerve centers. Indigestion in many cases depends upon deficient gastric secretions rather than on lack of muscular tone. Lack of muscular tone develops gradually. Indigestion due to atony causes no pain, while epigastric tenderness is almost invariably associated with an inflamed condition of the mucous membrane. Many cases improve rapidly under electricity when used in connection with other proper hygienic measures. The tendency of electricity is to increase secretory processes and modify their quality.

The appetite is sharpened, digestion is quickened, constipation relieved.

Patients in whom hydrochloric acid was absent after a test meal frequently showed hydrochloric acid after internal faradization.

An excellent means of studying the variation of nutrition through electricity is found in the examination of urine. This is believed to be a result of oxidation, taking place



Œsophageal Electrode.

either in the kidneys, in the tissues, or in both. There is no single chemical change which explains growth and sustenance of the body. Electricity passing through the body modifies many of these processes. Animal nutrition is a process of enormous complication. In applying the faradic current the electrode should be sufficiently large to prevent any undue concentration of current, and the electrode over the region of the stomach should be kept in almost constant motion. The rapidly interrupted galvanic current is also of value in these cases, though inferior to the other currents. The peristaltic movements of the stomach depend upon the integrity of the vagus nerve, and anything that interferes with its accelerating influence interferes with peristalsis.

In the author's hands the high frequency current applied to the region of the solar plexus by means of the glass electrode has been a most effective measure in these cases,

improvement being noticeable in a very short time. This is especially true in infants where, due to the distended condition of the intestines, we practically find an immovable diaphragm. This effect on the respiratory organs produces a condition of insufficient oxidation and when we realize that every chemical change in the body is one of oxygen we see why this current with its abundance of oxygen applied directly to the parts is so effective. Gastro-enteric infections also show a marked improvement under this treatment, and make a much more rapid recovery than ordinarily.

High-Frequency Current in Atonic Dilatation of the Stomach.

In treating *gastric dilatation* Einhorn's electrode is used, and can be swallowed by the patient the same as a stomach tube.

All kinds of electricity affect gastralgia favorably, varying with the individual.

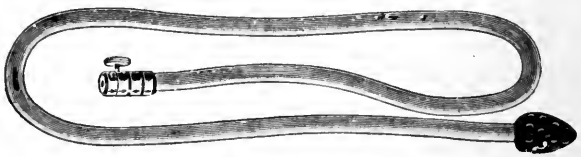
Spasm of the stomach also yields to electrical treatment.

In paralysis of the intestines and consequent constipation, the nervous system may be at fault, the muscles losing their contractile power, due to enervation. Thus, disease of the spinal cord itself may produce intestinal paralysis. Constant dilatation due to retained feces may also cause it. When

there is any depreciation in the tone of the muscular and nervous systems both the galvanic and faradic currents may be used. If the galvanic current is employed the cathode (negative pole) should be placed in the rectum, the current hardly exceeding more than two or three milliamperes. If used with an interrupted current one to two milliamperes are sufficient. The strength of the faradic current is safely left to the sense of the patient. Whatever can be borne without great discomfiture can be safely used. The internal electrode should invariably be the negative.

Constipation treated by electricity most often yields rapidly. To be successful we must take into consideration all the causes which have led up to the condition, as neglecting to attend to nature's calls, sedentary habits, faulty dress, insufficient drinking of water, etc.

There is no doubt about chronic constipation being largely due to loss of sensibility in the nerves of the bowels and



Stomach Electrode.

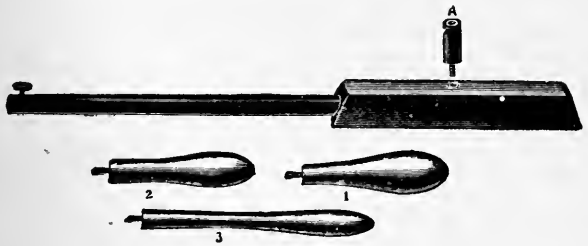
rectum, brought about by the absorption of toxic materials from the bowels. The treatment consequently resolves itself into removing the stasis in the blood stream of the bowels. A sufficient blood supply in the vessels of the bowels will revive the poisoned nerves and bring about normal secretions in the bowels. The static wave current applied by means of a rectal electrode (the metal tip being inserted well above the sphincter muscle) exercises the intestinal muscles and brings about peristaltic movements obtained in no other way.

In the application of galvanic electricity the positive pole is placed over the liver, while the negative pole is moved slowly in a rocking motion from the right inguinal region upwards and downwards on the left side over the descending colon, and repeated several times in the same way, the treatment lasting about twelve minutes with a current strength of from twenty to twenty-five milliamperes.

Three applications a week should be made. When a strong effect is desired, a rectal electrode covered with chamois skin may be inserted in the rectum, using a current strength of about ten milliamperes. The treatment should be continued for about ten minutes.

Chronic diarrhea is favorably influenced by general faradization. Combined with frequent and prolonged applications to the abdomen and back, general faradization seems to have not only a direct local effect upon the affected parts themselves, but a most invigorating influence upon the system at large.

In *prolapsus ani* apply faradic current, high tension, with the positive pole at the prolapsed part and the negative pole over the abdomen, the current adjusted to the tolerance of the patient. Treatment should be made three times a week.



Rectal Electrodes for Static Wave Current.

Hemorrhoids are usually caused by an impediment to the return of venous blood from the hemorrhoidal veins, and are as a rule accompanied by constipation. The cause of this interference may be found in any of the areas of the spine that regulate the circulation and muscular tone of the abdominal and pelvic viscera, and obstruct portal circulation.

Many severe cases have been treated by vibration of the lower spinal centers and the solar plexus. The high frequency current, applied to the rectum by means of a glass electrode, usually relieves a good deal of local congestion at the first treatment. The active cause of the trouble (constipation) can frequently be reached by means of the static wave current applied by means of a rectal electrode. A spark-gap of at least four inches should be employed.

This produces a powerful massage which affects the entire alimentary canal. The swelling method with variations may also be used with success.

The positive pole of the galvanic current applied by means of a chamois-covered copper electrode, is very effective in the treatment of recent cases. On account of its vaso-constrictor qualities the turgescence of the lower bowel rapidly subsides. It not only relieves the inflammation but the pain as well. The electrode may be lubricated with a ten per cent. solution of ichthyol in glycerine. A current of ten to fifteen milliamperes applied for ten minutes every third day is usually sufficient to secure the desired result.

Old and hard external hemorrhoids may be removed by negative electrolysis.

Fissures.—High frequency currents affect some cases favorably. When this form of treatment is effective, improvement will be noticed after two or three treatments.

Fissures are also readily treated with a silver probe used on the cathode (negative) pole to lightly cauterize the raw surfaces with a current of three to ten milliamperes. When a copper wire is used as the anode (positive pole), the treatment should continue until the tissues are stained green with the dissolved copper. The current is then reversed for a few seconds until the wire is free.

In stricture of the rectum electrolysis will frequently keep the intestines patent as long as the malignant disease allows the patient to live. A treatment lasting from one to twenty minutes, with a current of five to twenty milliamperes, according to seat and nature of the trouble, and repeated in one or two weeks, is recommended.

RESPIRATORY TRACT.

In *hypertrophic rhinitis* rapid and surprising results may be obtained by the use of the galvanic current. A copper wire applicator, covered with gauze saturated with adrenalin chloroform, allows us to obtain not only the vaso-constrictor effect of the positive pole, but the effect of the adrenalin and copper cataphoresis as well. A current of from three to five milliamperes may be used for five minutes. Treatments may be repeated three times a week.

In *atrophic rhinitis*, aside from constitutional treatment and attention to hygienic measures, local applications of the galvanic current by means of the negative electrode with one milliampere current, repeated three times a week, have given favorable results in cases in which the atrophy had not advanced too far.

In *fetid atrophic rhinitis* cupric electrolysis has brought about cures where all other methods failed. After thoroughly cleansing the parts they should be anesthetized with a cocaine solution. A copper electrode attached to the positive pole is inserted well into the tissues of either middle turbinal. A current of from five to ten milliamperes is applied and continued from three to ten minutes. A new needle must be used at each treatment, as electrolysis roughens the surface of the needle. Should the needle adhere, reverse its polarity by means of a pole changer and apply a current of two milliamperes for about two minutes. The results of this treatment favor the theory of the bacterial origin of this disease.

Diseases of the Ear.—Tinnitus aurium is frequently amenable to electrical treatment. If either the anode or the cathode modifies or arrests the sound during application of the current, the prognosis is favorable and treatment should be continued.

The ear electrode covered with moist cotton is placed over the external canal of the ear; the resistance between the electrode and the skin should be reduced as much as possible. The non-active electrode may be placed on any spot not in transverse direction from the ear undergoing treatment.

Begin the current at zero and creep up at a snail's pace. At the first report of faintness or nausea stop. An increase of one milliampere per minute and a decrease at the same rate is not too slow for correct technique. Don't break contact during the application of the current.

In *tonsillitis* of a chronic nature a compressed loop of platinum, heated to redness, may be plunged into the mouths of distended crypts. Pierce the surface at three or four points at each sitting. The operation should be repeated once or twice a week.

Obstructions of the anterior nasal passages may be successfully removed or relieved by the galvano-caustic loop. Pain is usually relieved by the application of cocaine.

In *trachcotomy* the galvano-caustic method has been employed by passing a curved needle, carrying a double platinum thread, into the trachea, directly through the skin and other superjacent structures, and then emerging about

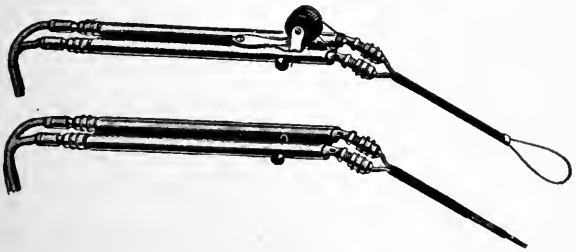
Ear Electrode.

two centimeters above the point of entrance. The two ends were then connected to the two ends of a galvanic pile and the intermediate loop heated by a current and drawn through the entire mass of intervening tissue. The entire operation, as a rule, does not cost a drop of blood, thus showing its advantages over a cutting operation in edema of the glottis, neoplasmus, etc., where hemorrhage is liable to be an alarming feature. The platinum loop may be used for the removal of hypertrophied tonsils, but had best be reserved for exceptional cases, where hemorrhage is threatened on account of vascular anomalies or hemorrhagic diathesis.

Tubercular Laryngitis.—In this trouble cupric electrolysis applied by means of a laryngeal electrode to which a small bulb of chemically pure copper is attached has been recommended. The bulb is applied directly to the diseased area under full illumination from the laryngeal mirror. The larynx should first be anesthetized with a cocaine solution. The copper electrode is connected with the positive pole,

the dispersing electrode being applied to the neck. From one to three milliamperes should be used for five minutes at each sitting. The application may be repeated every second day. There is no real destruction of tissue under this treatment and no lacerations of any surface which might form a point of entrance for new germs, as is the case with curettement and cautery. The cure is effected by the healthy reaction of the tissues, in the same manner in which we often see specific lesions heal when the system is under the influence of mercuries.

Asthma.—The exciting causes of asthma are numerous, and the disease varies with the source of irritation. Both faradic and static electric currents have been used in various ways, and while successful in some cases, in many more they have failed. The electrodes should be placed on opposite



Cautery Snare and Cautery Electrode Handles.

sides of the neck at points from the angle of the jaw to near the sternum. The current should be a strong one and used for one-quarter to one-half an hour. It may be passed from the nape of the neck through the cardiac region. When the faradic current fails the galvanic should be tried. Galvanization of the pneumogastric has been successful. Sometimes the positive pole and sometimes the negative is placed over the nerve; that is, about the middle of the outer edge of the sterno-cleido-mastoid muscle. Weak currents should be used at first. Another mode of treatment has been to place the negative electrode over the sacrum and the positive over the spine for ten to twenty minutes at a time, or the electrodes may be placed on opposite sides of the thyroid cartilage. The various points should be tried until it is learned which treatment is followed by relaxation.

Angina Pectoris.—In this condition galvanism promises more than medicine and frequently gives prompt relief, while persistent use of electricity frequently appears to produce a permanent cure. The current may be applied in several ways. The positive pole, placed with the broad surface over the heart and sternum, and the negative to the lower cervical vertebra, or the positive electrode may be placed in the supra-sterno fossa and the negative upon the cervical sympathetical ganglion, first on one side and then on the other. The positive pole may then be moved to the lower cervical ganglion and the negative pole applied to the sensitive spots at the angles on both shoulder blades.

Asphyxia has been treated by electricity with a few brilliant results, but with more failures.

The faradic current should be used and applied by means of a large sponge electrode to the phrenic nerve along the insertion of the diaphragm into the thorax wall. The current first used should be strong enough to contract the muscles of the thumb vigorously. The current should be interrupted as often as three times a minute, and its strength can gradually be increased. If the faradic current fails, try the galvanic, though it is less frequently successful in reestablishing respiration. Place the positive pole over the epigastrium or along the attachment of the diaphragm with the ribs, and the negative on the phrenic nerve, that is, along the outer edge of the sterno-cleido-mastoid muscle just below its middle. Or, instead of this, the current may be passed transversely through the body at the horizon of the diaphragm. The current should be moderately strong. It can be conceived that a strong current might stop the heart when feebly beating.

Coughing can be provoked by passing a galvanic current from a negative electrode at the nape of the neck to the positive electrode on the dorsal vertebra by breaking or reversing the current. By this procedure tickling in the throat and coughing are excited.

The pneumogastric nerve can be galvanized by applying one electrode along the external border of the sterno-cleido-mastoid muscle a little below its middle and the other over the heart. In this way a rapid heart can be slowed to much uniformity.

The faradic current may be applied to the same point on

the neck and over the cartilage of the seventh rib, or to other points where the diaphragm is inserted into the thorax, in order to stimulate a paralyzed diaphragm.

This treatment is also applicable to chloroform, opium and other drug narcosis and to drowning.

The author suggests that patients suffering from opium narcosis when brought to hospital be placed on the platform of a static machine, as sparks repeatedly applied are a stimulant that reach the vital centers as no other measure at our disposal.

PELVIC ORGANS.

Suppression of menses, dysmenorrhea, leucorrhea, prolapse of the uterus, etc., are all due more or less to faulty nutrition and circulation in the pelvis and can be relieved and improved only by removing the cause, which is frequently found in the obstructed and enlarged lymph vessels and venous circulation.

Electrical treatment as well as vibratory stimulation have both scored a decided success in the treatment of pelvic disorders, and in no place in the whole art of healing do patience and care accomplish as much as in the treatment of chronic pelvic disorders.

The more we know of electricity the more we hesitate in hurrying our patients to the operating room, as electricity lacks the horror of an operation as well as the dangers of an anesthetic. Both faradic and galvanic currents are used.

The faradic current is a valuable stimulant to contractions and physiological exercise of the uterus. It restores tone to the impaired muscle structure in the pelvis, as found in the relaxed uterus of subinvolution and weakened states of certain muscular and fibro-muscular structures of the uterus, vagina and uterine supports.

In making pelvic applications of electricity have the patient assume the recumbent position, loosen the clothing and see that both the bladder and colon are empty. The electrode should always be warmed, and then anointed with glycerine or soap so as to facilitate its insertion. It must be introduced with the greatest gentleness, avoiding contact with or pressure on tender spots.

The vaginal galvanic applications are necessarily monopolar. The active electrode can be pressed behind the exudation or enlarged organs, the indifferent pad being on the abdomen or back, and the electrode being so disposed as to include the diseased portion within the tract of the densest current line. The conducting surface of the electrode should always be covered, to prevent the cauterizing action on the tissues, the most convenient covering being absorbent cotton wound about the conducting surface, thoroughly soaped and lubri-

cated with non-irritating soap, the cotton being detached after each application.

When it is desired to produce a determination of blood to the pelvis or uterus, the negative pole is made the internal or active electrode. When the contrary effect is desired the positive pole is used.

In the conditions in which intrauterine treatments are applicable, the amount of current strength depends upon the idiosyncrasy of the patient as to pain. It must be remembered that the same effect can be obtained from fifty milliamperes applied for twenty minutes that is obtained from two hundred milliamperes applied for five minutes. The powerful action within the intrapolar region would, however, be lacking, the weaker current strength merely effecting the cauterization. Again, the caustic effect of slowly liberated chemicals does not compare with that delivered en masse.

The thickened endometrium may be disorganized and

Vaginal Electrode.

broken up by the caustic action of the negative pole, so that it easily comes away in shreds. The softening action of the current relaxes the internal os, so that large pieces of membrane may escape. Fatty degeneration is hastened, with consequent softening. Electricity performs slowly without an anesthetic what rapid dilatation and curetting accomplishes in a short time with an anesthetic.

If the electrode is bare and the current sufficient to cauterize when concentrated, the electrode should be covered with cotton, to somewhat modify the effect. If simple positive cauterization is required the electrode should be either platinum or carbon, as cataphoresis will surely follow if a decomposable metal electrode is used. If it is desired to insulate the electrode, gum shellac heated over an alcohol burner will give a smooth, highly insulated covering. The covering should be sufficiently thick.

Intrauterine applications should never be made for neuralgias or general conditions of any character, they

being reserved strictly for conditions involving organic changes of the organ itself.

There is no clear relative indication governing the choice between monopolar and bipolar faradic applications. Bipolar methods are usually most effective in the control of pain, for which the finest wire coil is usually preferable, even if the patient affirms that she feels nothing. Both poles should be wholly within the cavity. The outer pole must not be in contact with the sensitive vulvar orifice, and pressure on painful spots should be avoided. The current from the secondary coils should be employed first, as it is the most sedative and its chief effects are to relieve pain and congestion. The application must always be grateful to the patient and never uncomfortable, hence vibration must be smooth. Continue treatment until relief and sedation are produced. In many cases it produces effects like opium. Repeat the treatment daily if parts are very painful. Because the positive is the

Vaginal Bipolar Faradic Electrode.

more sedative, it is nearly always made the internal electrode of the bipolar, and is placed against the most sensitive point in the pelvis.

A large, relaxed and discharging uterus soon regains tone and diminishes in size, while the endometrium returns to its normal condition. Slow interruptions should be used with the coarse wire coil.

The fine wire coil can not be employed in these conditions, as a larger volume of current is necessary than can be obtained from their use.

When the current is turned on the electrode should be held strictly immovable, as movement during application will bring about a disturbance of the effect. Application should be from four to ten minutes daily, if practicable.

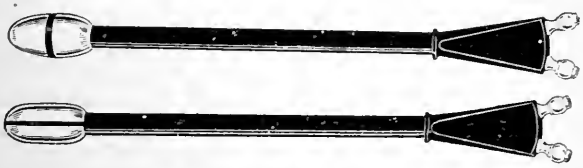
Direct applications in the uterus are sometimes necessary. This application is made by means of the bipolar electrode inserted into the cavity of the uterus. Both pole terminals must be wholly within the cavity, as contact with the canal or internal os is unnecessarily painful and would

be unbearable or unendurable. The bipolar electrodes are only employed with the faradic or alternating current under strict asepsis. The static induced current may at times be thus employed.

Aside from the bipolar vaginal method, there are various methods of applying electrodes, as the utero-cervical, vagino-abdominal, vagino-sacral and lumbar, utero-abdominal and utero-sacral lumbar, lumbar hypogastric, recto-abdominal and recto-vaginal applications.

A much stronger current can be given with a bipolar electrode than with a monopolar.

In electricity, as in medicine, dosage is of primary importance. The dose, of course, is variable to a variety of circumstances. When the interval is too long between treatments the benefit of the treatment is lost, hence it is necessary that they reinforce each other at proper uniform intervals. The long-continued use of the positive pole causes contractions



Vaginal Bipolar Electrodes.

of the uterine cavity as well as of the cervical canal. If this contraction is too great a few treatments of the negative pole will relieve this condition.

The vagina and uterus are comparatively insensitive to electric currents, and much stronger currents can be used than on skin.

It may be well to have the patient rest a while before going home, and neglect of this precaution may cause serious congestion. The electricity should not be used during acute inflammation of the uterus or adnexa.

Infantile Uterus.—Non-development of the uterus is frequently the result of overwork, either mental or physical, at the time of puberty, leaving but little of the vital principle for such organs as those of reproduction. The painful results following are practically a starvation neurosis.

The faradic or sinusoidal current with slow interruptions, applied by means of the dipolar intrauterine electrode,

should be employed, the whole influence of the current being concentrated in the uterus. The frequency of application varies from every day to once a week. To establish a cure it should be employed until the uterus develops to a normal size and condition.

Scanty and irregular menstruation will usually respond to stimulating local applications to the cavity of the uterus, if made for a few days during the week immediately preceding the expected period.

During the intervals local applications are not necessary. If this condition is the result or is associated with uterine atrophy, whatever its cause, results are as a rule prompt when stimulating treatment is continued twice weekly during the intervals between the menstrual periods.

Dysmenorrhea.—Painful menstruation, when due to anemia, seldom requires local treatment. A tonic course of electricity by static insulation, short sparks or spray to

Carbon Ball Electrodes.

the spine, lumbar region and sacrum, is often a very efficient remedy in these cases.

If the dysmenorrhea is caused by an obstruction of the cervical canal, negative electrolysis applied by means of a dilating electrode may be employed. The smallest sized electrode should be used in the beginning and increased in size at successive treatments, which may take place every three to five days. A current of ten milliamperes may be used for about five minutes. Sufficient dilation to overcome the obstructions and promote free drainage is required.

The most important use of the galvanic current in gynecology is to produce dilatation or a patulous condition of the canal of the cervix and secure drainage from the uterine cavity. An equally important effect, that is obtained at the same time, is a freeing or expansion of the orifices and ducts of the submucous glands and a thinning of their secretions, which permits them to empty more freely. It is a much more rational treatment than the older method of

cauterization and astringents, the results being prompt and gratifying. The strength of the current should never be more than ten to fifteen milliamperes, used for from three to five minutes, not oftener than every second day, better still, every third or fourth day. Drainage from the tubes is promoted when the obstruction is due to infiltration of the endometrium at the mouth of the tube and of the mucous membrane and muscular wall at its uterine end. The point of electrode is directed against the opening of the tube into the cornu of the side affected, or both sides if involved, but no effort is made to introduce it into the tube. These manipulations must be conducted under the strictest asepsis.

Vaginal Bipolar Faradic Application.

An inhibition of the excretions when due to muscular spasm is almost invariably due to a vaso-motor disturbance, consequent to abdominal torpidity and habitual constipation. Positive intrauterine applications may be necessary. Ten to twenty-five milliamperes are, as a rule, sufficient to bring about results.

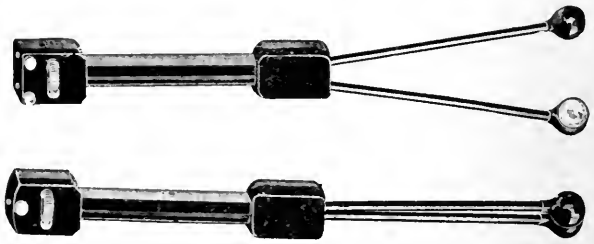
Ovarian Congestion.—Abdominal dorsal applications of both currents with general galvanic stimulation and massage usually relieve this trouble.

Relaxed abdominal walls may be frequently corrected by means of the faradic as well as galvanic currents, one pad being applied on the abdomen and another on the back. The pad on the abdomen should follow the direction of the colon and pass down the flanks on each side. The current con-

tracts the dilated intestines gradually, adding tone to the muscular walls.

Electricity at the bedside not only frequently replaces opium and other sedatives, but materially reduces the extent and duration of the inflammation. The electrode should always be warmed before insertion. The current from the long, fine secondary wire is used for fifteen to twenty minutes, and if great relief is experienced it may be repeated twice daily if necessary. Its use is not only followed by lessened pain, but by relieving the hypertrophied condition.

Drainage of the uterus by means of the negative galvanic pole may cure a considerable proportion of all cases, but if the progress is not as rapid as desirable intrauterine applications may be made. Twenty milliamperes will be ample during the beginning of the treatment, and applications may



Ovarian Electrode.

be made every four or five days. The vagino-abdominal treatment may, however, be continued as usual. Care must be taken not to aggravate the trouble, which would certainly occur in the presence of purulent inflammation.

Chronic Ovaritis.—The normal function of the ovaries when inflamed may frequently be restored and adhesions loosened by the absorption of the bands of exudates by means of the bipolar fine wire faradic applications for five minutes daily, or by the galvanic current applied by means of zinc or carbon covered electrodes with a current of thirty to sixty milliamperes.

Ovarian Neuralgia.—Marked relief is usually brought about by the rubefacient effect produced by static spray or by means of the glass electrode of high frequency applied over the clothing about the lower abdominal and sacral

regions. The static wave current with large spark-gap may also be applied over the painful area.

Amenorrhea, when the result of a chronic metritis, requires energetic treatment. Strong currents must be used to stimulate the impaired muscular structure of the uterus. When a metal electrode is introduced into the uterus and a strong current used the metal part of the electrode must not come in contact with the cervical canal, as the resultant cauterization is likely to result in a stenosis.

The bipolar faradic electrode must also pass wholly into the uterus, as the external os is extremely sensitive. The stimulation should be made as strong as can be comfortably borne. Some can bear only the fine wire coil, while others bear the coarse wire coil without apparent discomfort. Continue treatment four to five minutes twice a week or more.

Bipolar Uterine Electrodes.

Metrorrhagia.—Endometrial hemorrhage is, as a rule, due to a diseased condition of the endometrium. When not contraindicated by accumulation of pus or septic exudates in the pelvis, tubes or ovaries, electricity may be used to combat this trouble, though it must by no means constitute the only remedy. It should usually be preceded by curettage. When the canal is not patulous it should be first dilated either by a steel dilator or by means of negative electrolysis to permit free drainage. The uterine canal must be thoroughly irrigated to remove shreds of blood before each treatment, to permit the electrode to come in contact with the parts.

When positive electrolysis is used to control uterine hemorrhage, fifty to one hundred milliamperes will be required and must be continued for some time.

Metallic electrolysis is very energetic and penetrates to a greater depth, which is a decided advantage over dry cauterization by means of positive electrolysis. Copper or zinc

electrodes may be used, copper being the most astringent as well as the most irritating. Zinc is followed by little irritation, but not by a profuse discharge, as is copper electrolysis. The cervical canal must be excluded from its action.

The electrode should fill the cavity as completely as possible, but if the cavity is longer than normal it will be necessary to act on each section separately. A current of fifteen to thirty milliamperes may be used for five to ten minutes, and if the electrode sticks the current should be reversed.

Irrigate the canal at least every twenty-four hours until application is repeated, which may be on third or fourth day, especially if bleeding is active and interferes with effective cauterization.

If the hemorrhage is due to hyperemia of the endometrium, caused by engorgement of uterine vessels from pressure of tumor, etc., a vagino-lumbar or vagino-abdominal application will often prove effective in controlling bleeding.

Subinvolution may be more successfully and quickly treated by means of electricity than by any other means at our disposal. Flagging muscular tissue rapidly shrinks after a few stimulating applications from a primary or secondary coarse wire coil. Discharges continuing after the normal period following parturition may frequently be controlled by one or two applications. If there is a morbid condition of the endometrium present the positive covered elastic uterine electrode is best suited, as its introduction causes least pain.

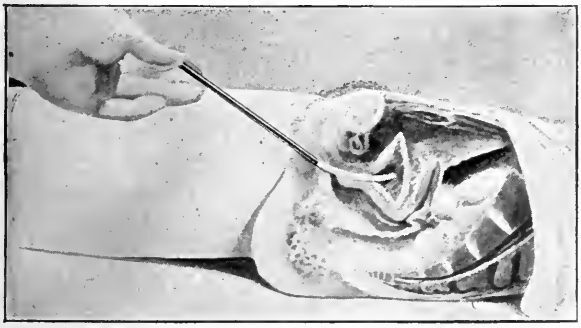
If a septic condition is present the positive mercuric pole may be used, on account of its bactericidal power.

The bipolar vaginal method is first used, because its action is more diffuse than when applied to the interior of the uterus. Application is of short duration to avoid tiring the muscles, and interruption should be sufficiently slow to permit physiological contractions and relaxations. This is borne without discomfort if the nervous apprehension has been previously overcome. Treatment should be every day in the beginning, and after two weeks every third or fourth day. If the impaired muscle structure responds poorly to the faradic current, an interrupted galvanic current should be used, as its amperage or volume can be increased until response is elicited.

The bipolar vaginal electrode is also used to remove the obstruction in the tube and to stimulate the absorption of the infiltration of its walls and lining membrane. Great care must be exercised in acute cases. Being a stimulant, it may provoke undesirable and even harmful irritation by improper administration.

Uterine Displacement.—The treatment must be directed against the conditions operating to produce it, subinvolution, endometritis, metritis, etc. The possibility of a cure without an operation will depend upon whether the tonicity of the sustaining ligaments can be restored and whether the uterus is movable or not.

Where the uterus is movable, but is restrained by the

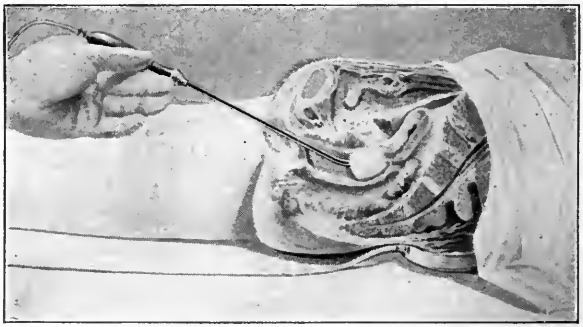


Applying Negative Electrolysis to Female Urethra.

thickened utero-sacral ligaments, the treatment is directed towards the absorption of the inflammatory deposits in the surrounding cellular tissue. The negative electrode, with a current of from twenty-five to forty milliamperes, will have the effect of softening the parts, after which the bipolar faradic electrode applied for about ten minutes will by its stimulating properties cause rapid absorption.

Erosions of the Os.—Removal of the exciting cause is always necessary for a permanent cure. Local applications to the excoriated surfaces, of a normal salt solution, applied by means of wet cotton attached to the positive pole with a current flow of about twenty milliamperes will greatly aid in promoting the healing process. Treatments may be repeated every two to three days.

Cervical Endometritis.—This disease is almost invariably an obstinate affection and of a penetrating microbic origin, and being almost always associated with corporeal endometritis. This being the case, zinc, mercuric cataphoresis or mercury on copper or silver is usually very effective if applied through the cervical canal with thirty to fifty milliamperes for a period of five minutes. On removal, the positive electrode will be found to have adhering to it a mass of albuminous material, coagulated by the acid action of the positive pole. Examination of the cervical canal will show it to be denuded of mucus clear down to the nebothian glands. A number of applications of this kind are as a rule necessary, though the secretions have a tendency to become



Electrodes in Position for Vagino-Lumbar Application.

less at each seance. The plain, positive current with a platinum electrode is frequently effective.

Endometritis.—The simple catarrhal condition is usually due to a hyperemic condition of the uterus consequent to constipation, torpid liver, exposure to cold, etc. Removal of the cause is the first indication. Applications of the static spray or spark or high frequency current by means of glass electrodes over the sacral and lumbar regions as a rule make local applications unnecessary. When local measures are indicated the faradic bipolar applications are as a rule sufficient and produce effects not otherwise obtainable.

In chronic endometritis the secreting cavity of the uterus which is normally open becomes closed and normal secretions

confined become a source of irritation. Negative electrolysis may here become necessary. Applications by means of a uterine electrode with a current of about ten milliamperes, continuing for five minutes, may be repeated every two to five days. Bipolar stimulation may also be used two to three times a week, as the case may demand, until free drainage has been fully established.

Septic Endometritis.—Cupric cataphoresis on account of its germicidal action is very efficient in this class of cases, and causes the patient less pain and inconvenience than a curettement, which of necessity must always be done under an anesthetic with the accompanying risk. The application should be made by means of an intrauterine electrode, selected to well fill the uterine cavity. Attached to the positive pole a current of thirty to fifty milliamperes is gradually turned on and allowed to flow for ten minutes. Treatments may be repeated every other day. Gently rotate the electrode during treatment to prevent it from sticking.

Metritis.—This condition may persist after the inflammatory condition of the endometrium has disappeared and is sometimes most intractable.

Irrigation with a negative galvanic pole and a current of forty to fifty milliamperes sometimes gives great relief, if applied thrice weekly. In applying cauterization to the uterus it must be done in such a way as not to cauterize the uterine canal, which would defeat the purpose by subsequent cicatricial contractions.

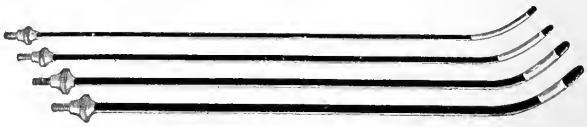
If we desire to avoid deep cauterization it is absolutely necessary to keep the electrode in motion over the surface. If bleeding should supervene, the treatment must be suspended until it ceases. Never turn on more current than an inflamed organ can bear. The first treatments should continue for only five minutes.

Senile Endometritis.—This condition of atrophic degeneration is coincident with the menopause. The uterine cavity is filled with irritating, excoriating secretions. The absorption of this material provokes general sepsis, owing to the constriction of the canal by bands of cicatricial tissue. As this cicatricial tissue will not stretch without tearing, negative galvanism with its dilating effect is the only proper remedy to employ. As the condition is a progressive one, it can not be cured in a short time, though marked improvement often occurs.

The irrigator may be used as an electrode when the canal is sufficiently dilated to admit it. Application may be made every second day for three to four weeks, and once a week for the succeeding weeks.

Catarrhal Salpingitis.—In acute cases of catarrhal salpingitis bipolar faradization carefully applied will relieve pain, lessen congestion and remove the tumefaction by stimulating the absorption of infiltration. This will promote drainage of the retained tubal secretions into the uterus, both by lessening pelvic hyperemia upon which it depends and by removing the obstruction in the tubes. Care must be exercised in acute stages, for we are dealing with a stimulant and even harmful results may follow its improper administration.

The current from the fine wire coil should be employed first. The application must always be grateful to the patient, never uncomfortable. Each application must continue until relief is experienced and sedation is produced. The



Intrauterine Electrodes.

application must be repeated sufficiently often to maintain quiescence, which may mean several times a day. Employed in this manner electricity may be made to take the place of opium. The patient must, of course, be confined to bed, in the recumbent posture, until the acute symptom subsides.

When the acute sensitiveness has subsided recovery will be hastened by means of the cotton-covered carbon ball electrode in the vagina, the indifferent electrode being over the lumbar region. The galvanic current may be used for five minutes before using the faradic stimulation. If the infiltration is soft, make the vaginal electrode positive; if hard, make it negative; but, as a rule, the negative is more appropriate. Twenty to fifty milliamperes may be used, according to the susceptibility of the patient.

If the current produces an aching sensation the current strength must be reduced at once. Electricity is especially serviceable when the case is one of long standing. Daily applications should be made during the first week, and later every second.

Pyosalpinx.—In purulent infiltration of the ovaries and tubes, electricity is of no avail except possibly as it may promote drainage. It is usually contraindicated, as the positive pole may cause absorption of pus. Cure by electricity seems to be out of the question.

Hematosalpinx.—Absorption may be promoted by means of the negative galvanic current, thirty to fifty milliamperes.

Hydrosalpinx.—Following aspiration, application of the positive electrode through the cavity will prevent the recurrence of the trouble.

Pelvic peritonitis.—The bipolar fine wire faradic current occasionally gives good results.

Vomiting of pregnancy.—The sedative action of the positive pole of the galvanic current, when applied to the pneumogastric nerve, frequently is followed by marked relief. A current strength of ten to fifteen milliamperes maintained for ten minutes is usually sufficient to bring about the desired result.

The high frequency and faradic currents applied to the epigastrium are also highly spoken of by various operators.

Postpartum hemorrhage is treated by placing one electrode on the abdomen and the other on the back, using the faradic current.

After-pains.—The secondary faradic current from the fine wire coil, applied for about five minutes by means of sponge electrodes to lumbar spine and abdomen, is usually very efficient.

In ectopic gestation the interrupted galvanic or faradic current will destroy the life of the fetus, thus arresting the development of gestation and promoting the ultimate disappearance of the product by absorption. It is justifiable and feasible. After a rupture nothing is gained except by an operation. Electricity can be employed with safety while in doubt, waiting to establish a positive diagnosis, and if complete absorption fail it can be removed with safety later on.

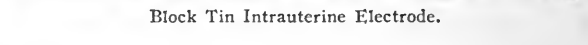
It is best to insert one electrode in the vagina and the other in the rectum beyond the tumor mass. The electrodes should be covered. The treatment may continue five minutes with a current strength according to the susceptibility of the patient.

Sterility is frequently due to an inflammation of the cervix

and endometrium. An actual cure of these conditions would undoubtedly cure many cases.

In the treatment of sterility it is necessary to correct the conditions of chlorosis and anemia. The uterus and ovaries should be stimulated by means of galvanism and faradism in order to hasten development. The negative galvanic application to canal of the cervix twice a week for several months will alter the diseased secretions which frequently interfere with conception. If the secretions are acid these applications to uterus will correct this condition. After three months' treatment suspend treatment and watch for results. If the secretions are alkaline, use the positive pole, with platinum or carbon electrode in the vagina, with twenty to thirty milliamperes for about five minutes every two or four days.

Menopause.—Galvanic and faradic currents have both proven successful. The faradic is most used, the current being as strong as the patient can bear it. Use on alter-



Block Tin Intrauterine Electrode.

nate days. The negative galvanic current may be used to promote absorption. The positive electrode when used should be made of either platinum or carbon.

The hot flashes, headaches and other nervous disturbances are best treated by means of static electricity. Small spark applied all over the body, as well as static insulation, acts as a sedative to the nerves.

Fibroids.—The actual disappearance of a fibroid tumor seldom occurs under the use of electricity, though frequently a considerable reduction in the size of the growth may be caused, as well as a cessation of the symptoms. Operations, being comparatively safe, should always be resorted to, unless contraindications exist. Electricity may often be employed to advantage preparatory to operative procedure to clear up exudates. Absorption of serous infiltration, fibrinous exudations, blood extravasations of pelvis, are promoted by the positive pole of the constant current, and if carried far enough has a marked effect upon the nutrition, in consequence of which a retrograde action must ensue. The posi-

tive pole is used by means of the cotton-covered carbon electrode, well moistened or soaked in glycerine.

Intrauterine applications cut off the nourishment from the parts much more rapidly than the vaginal applications.

Applications of solutions of supra-renal capsule may be made by using a hard rubber electrode, hollowed throughout and having small holes at the lower end through which the fluid flows and thus permits electrical connection between the tissues and the twisted wire applicator around which is placed a loose winding of gauze saturated with the medicament.

The excessive hemorrhages that frequently accompany growths of the fibroma of the uterus are usually due to a fungoid change in the endometrium, that becomes very vascular, owing to the obstruction. This condition can generally be relieved by application of the positive electrode in the uterus. After treatment the uterus may be considerably reduced in weight.

Galvanism has no beneficial effects on fibroids that have undergone cystic degeneration, but, on the contrary, may do harm. Myomata and interstitial growths seem to be more amenable to treatment than fibroma.

In treating a fibroid growth the electrodes must be so placed as to include the mass between them, the negative or positive pole being selected as the active electrode, according to the effects desired. The negative electrode is used in the tumor when hard and no hemorrhage is present, and a current strength of from twenty-five to one hundred and fifty milliamperes may be used. A large pole should be used on the abdomen, or it will be painful. A wet towel is a good electrode, but should be so placed as not to touch the thighs or pubes, and any wound should be covered with collodion to prevent an eschar.

For pain the fine wire faradic current may be used. The positive pole, with the constant current and a current strength of from twenty-five to fifty milliamperes for two minutes, may also relieve the pain.

Galvano-puncture involves the risks of injuring the uterus and blood-vessels, and experience shows that growths are rarely situated conveniently for puncture through the vagina. Galvano-puncture is followed by more rapid symptom amelioration and may be absolutely indicated in some cases.

Electrolytic destruction is not wanted, but rather a regressive metamorphosis of the growth.

Strictest asepsis is necessary to prevent infection, which, in spite of all care is frequently followed by peritonitis. In treatment of exudates into the broad ligament, the puncture must be made near the uterine wall, and should not penetrate more than one fourth of an inch. Treatment should be given once a week, and not repeated if no impression is made.

GENITO-URINARY TRACT.

STRICTURES.

Clinical experience has demonstrated that after a few minutes' application of the cathode or negative pole to a stricture the resisting bands become less dense and less obstruction is offered to the dilating instrument. After a succession of such applications the bands are softened and rendered more yielding, and are absorbed, in part at least. Notwithstanding the time required, it is less dangerous than forcible urethrotomy and equally satisfactory in results.

Cathodal electrolysis meets the conditions necessary for relief, and has been practiced upon urethral stricture more than on any other on account of its predominance in number of cases. In urethral strictures rapid cathodal electrolysis with a strong current (twenty to thirty milliamperes) has been abandoned, and *the slow method of five milliamperes or less for a period of five minutes is now employed. This method has been much criticized and failures have almost always resulted where a stronger current was used.*

In cathodal electrolysis we use only mild currents with batteries from small cells containing weak fluids. A battery presenting a large surface and big cells is unsuitable, as it will cauterize more rapidly and more intensely than a caustic, and by the destruction of tissue and consequent suppuration aggravate the trouble.

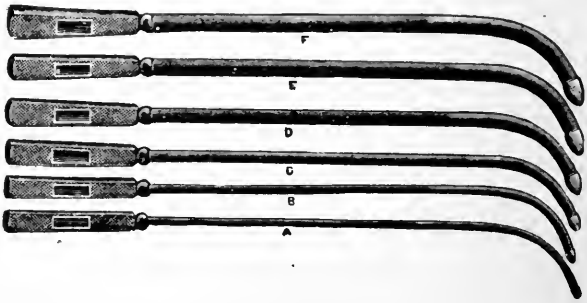
Before using a sound or electrode it is well to inject an antiseptic solution into the canal. The electrode must be insulated except at the point where action is desired, and it should be coated with a lubricant which offers little resistance to the current. Vaseline is dangerous as a lubricant, as it may enter the bladder, cake and become the nucleus for a vesical calculus. The olive-tipped electrode for treating stricture should be made of one piece, as the screw thread frequently wears out and the tip can not be firmly attached.

If the canal is very irritable inject a two to four per cent. solution of cocaine or introduce a suppository containing—

℞ Extract Belladonnæ ....gr. ¼ to ½.
Aquæ Ext. Opii .....gr. 1.
Cocoa Butter.....Q. S.

Anesthetics are not used. Don't operate during the acute or subacute inflammatory condition. Only one instrument should be introduced into the urethra at each operation. For an ordinary stricture use an electrode three sizes larger than the stricture.

The olive-tipped electrode is passed into the canal until it becomes partially engaged in the strictured area. The positive pole of large surface is well moistened and kept well in



Urethral Electrodes.

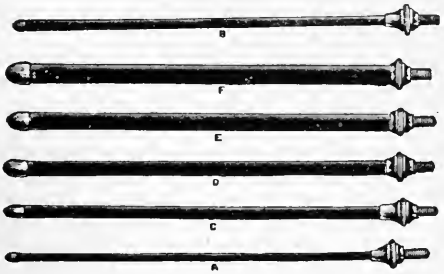
place on the breast, back or hand, and the current of from three to five milliamperes is gradually let into the circuit. The tip is kept gently in contact with the stricture until the tip of the instrument slowly moves onward past the point of obstruction. This may require from two to twenty minutes, but a longer treatment is not advisable. If the electrode passes through the stricture in a few seconds bring it back and hold it in place for a few minutes to prolong the effect of electrolysis at one sitting. It is sometimes necessary to use the same electrode for several successive treatments, as determined by the nature of the stricture. Too much should not be attempted at one sitting.

Its action is slow, gradual, dissolving or disintegrating, and should be repeated at intervals of five days to two or three weeks until the size of the normal urethra is reached.

Gleet.—The faradic current may be used, with a preference for the positive pole in the urethra, the negative pole being placed over the lumbar plexus. The benefit arises from a stimulation of the mucous membrane and the glands. A sound may be used, but an electrode with two to three inches free and uninsulated will answer the purpose better.

The galvanic current may also be used; the pole must be selected according to the effect desired. A current stronger than five milliamperes is apt to overstimulate and even cause inflammation and bring on a consequent discharge. Hydro-galvanism is useful when the parts are painful, but do not displace the solid metal electrode.

Chancroids.—Saturate the parts thoroughly with oxychloride of copper. After moistening the parts with a normal



Urethral Electrodes.

salt solution, apply the copper electrode attached to the positive pole until the parts have a deep green stain.

Vesical spasm is usually a symptom of some other disorder. Both galvanic and faradic currents have been successfully used, and either is beneficial. The positive pole is used in the urethra and the negative pole over lumbar spine. The current is slowly increased until the sound or electrode passes into the bladder. The induced current from a long coil of fine wire is preferable in the beginning.

If the cause of spasm is general or central paralysis, use the galvanic current with two pad electrodes over the spine, or the anode (positive pole) over the lumbar region and the cathode (negative pole) over the bladder. Eight to twelve milliamperes may be used for ten minutes.

If the muscle of the bladder has lost its contractile power hydro-galvanism is indicated.

Local use of the faradic current to the spine is contra-indicated in nervous patients.

Cystitis with painful tenesmus.

For this disease use a flat electrode under the sacrum and a carbon electrode and pad to the perineum. Through the tissues pass a circuit of twenty low tension cells for ten minutes. It is frequently surprising how quickly the pain vanishes and tenesmus is lessened.

Impotency.—Associated with suggestion, static electricity is undoubtedly more beneficial than any other form of treatment. Sparks to the lumbar spine and perineum, as well as the static wave current to these parts, are indicated. Friction sparks and Leyden jar currents may also be used locally on the penis with effect.

All electrical modalities have been tried, with success in some cases and failures in others. The positive electrode may be placed on lumbar cord, the negative along the seminal

Tunneled Electrode.

canal from the lingual ring downward. The current should produce a distinct burning sensation. Then one minute labile application along the upper and lower surface of the penis as far as the glands. Finally the cathode (negative pole) may be applied to the perineum for two minutes. If the testicles are atrophic, pass the current directly through them.

Enuresis.—The treatment of enuresis consists largely in building up the body generally and locally and in removing the irritating cause. Stretching the rectal sphincter is frequently followed by marked relief. The nerves of the detruso urinæ muscle and the sphincter ani have a common source; this being the case, we are justified in assuming that what will cause a spastic contraction in the one will do so reflexly in the other. Local treatment should consist largely in strengthening the sphincter muscle at the neck of the bladder by causing an increase in muscular cell growth. This is best accomplished by means of an inter-

rupted induced current causing the muscle to contract and relax, exercising every part of the tissue and brings about better nourishment in the parts.

Direct stimulation of the vesical sphincter may be used in females, where the canal is short and the parts can be rendered thoroughly aseptic. The other pole should be placed over the lumbar spine. In boys one pole may be placed over the perineum or up against the prostatic urethra, using a short rectal electrode for this purpose. Many brilliant results have followed this treatment where medication has failed. Care must be taken not to give too long treatments, as the muscles would be worn out and great harm result. Begin treatments with one or two minute seances, gradually increasing.

Regulate the interruption of the battery so that the muscles may contract and come back normally between each interruption. Rapid interruptions merely tetanize and tire

Prostatic Electrode.

out. It is best to use a rheotome in which the number of interruptions may be controlled.

Where incontinence depends on the hyperexcitability of the vesical mucosa, the sedative influence of galvanism should be used. Where the trouble is due to weakness of the vesical centers in the spine, galvanism may be used to increase the activity in this particular center.

In hydrocele the positive needle is inserted into the tumor. This treatment frequently prevents secretions and determines absorption.

Varicocele.—Insert a silver needle into the vein and connect it with the positive pole of the galvanic current. Apply ten to fifteen milliamperes. This procedure will bring about occlusion of the vessel, the same as tying it would. Carried out with antiseptic precautions, it is altogether without danger.

In the treatment of *prostatitis*, acute or chronic, static electricity by means of the wave current is frequently very

effective. The rectal electrode should be about five inches in length, adapted to the conformation of the glands and reaching the seminal vesicles. In patients not suffering from constipation it is well to use the insulated electrode, thereby relieving the sphincter muscle from a painful contraction which would otherwise be induced. The base of the electrode may be set either flat upon the chair or elevated at either extremity, in order to bring a proper pressure or contact with the diseased parts. The spark-gap should be regulated as tolerance permits (from six to twelve inches). The use of a urethral sound of a large size may be conveniently carried to, but not into, the vesical sphincter, where it would produce a disagreeable contraction. The spark-gap here, as in the rectum, must be regulated by the sensation produced.

Galvanic electricity has been used for years by various operators, with varying success. The negative, being made the active electrode, may be applied either by rectum or urethra.

Galvano-puncture of the hypertrophied prostate (per rectum) by means of the negative platinum needle has also met with success in some cases.

Many cases will be more benefited by the electrode in this position than in any other.

The galvano-caustic method introduced by Bottini is performed as follows:

After washing out the bladder the posterior urethra is anesthetized by means of cocaine. The instrument is introduced with the electric current broken. In order to burn a groove the concavity of the instrument is turned towards the desired spot. The instrument is slightly withdrawn, so that its concave surface will hug the prostate. The current is turned on. The surgeon waits fifteen seconds for the blade to heat and then projects the blade to the required extent by means of a screw handle. When a sufficient groove has been produced the cautery is returned to its sheath. A second and third furrow can be burned in this manner. Bottini burns three furrows, a moderately deep one towards the rectum and a deep one into the lateral lobe which is most markedly enlarged. After the furrows have been burned the current is turned off and the instrument withdrawn. The operation requires five minutes to execute.

The patient can urinate at will after the operation and can get out of bed in a few days.

The operation is not entirely free from risk, as sepsis may ensue. The operation is still on trial, as contractures are liable to occur, followed by stenosis, and render a subsequent prostatectomy an extremely difficult procedure.

DISEASES OF THE SKIN.

Electricity in diseases of the skin, as in all other troubles, acts either as a stimulant, a tonic or a sedative. Galvanic electricity is of far more value than either the faradic or static, singly or combined.

As a sedative galvanic electricity is used only with a mild current of about three milliamperes and is usually applied for about five minutes, care must be taken that the current is not broken during the application. Galvanic electricity possesses the power of improving the nutrition of the skin and thus rendering it less hospitable to many forms of organic life, and thereby tends to destroy parasitic diseases.

Acne.—Electric treatment is employed rather as an adjuvant to general and local treatment. As the trouble undoubtedly arises from faulty elimination the organs of elimination must be stimulated. The following prescription, taken internally, has a decided beneficial effect on the trouble:

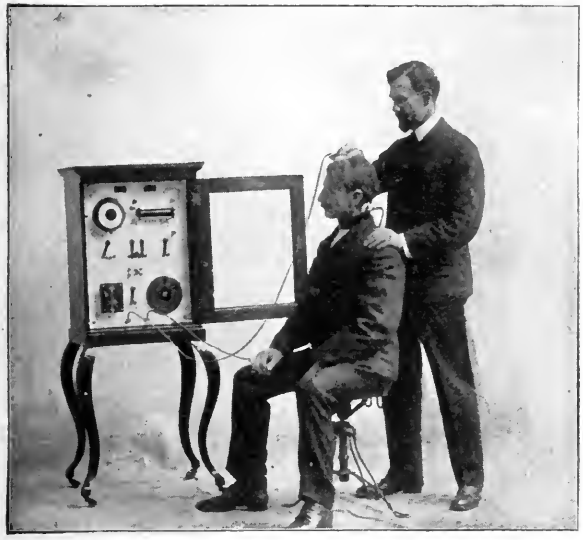
℞ Citrate Potass.....℥i
Liquor Potass. Arsenitis.....℥ii
Glycerine.....℥i
Aqua Menth. pip., q. s. ad, ℥iv
Sig.—One teaspoonful, taken three times a day.

Before beginning electrical treatment it is first of all necessary to empty the comedomes of their inspissated sebum. This is best done by means of a comedome extractor. The pustules should also be emptied of their contents, the entire affected area washed with an antiseptic solution and then thoroughly dried.

The positive pole of the galvanic current attached to a sponge electrode may be applied over the surface with a current strength of about ten milliamperes. The current should be allowed to pass for about five minutes.

The alternate use of the negative and positive poles are sometimes productive of more rapid results than the positive pole used alone.

The use of the X-rays in acne is indicated first, because



Faradic Stimulation to Scalp.

it causes an atrophy of the glands of the skin, the sebaceous glands as well as the hair follicles; and secondly, on account of its bacteria-destroying properties, thus inhibiting the formation of pus.

The X-ray should, however, not be used until all other measures have been tried and failed.

Acne Rosacea.—This disease may be treated by electrolysis of the capillary blood-vessels, with the positive pole at some indifferent place and the negative a thin needle pushed into a dilated blood-vessel. Where this is not possible, transfix the blood-vessel in two or three places. A current from a galvanic battery of four to ten cells, with a strength of one to three milliamperes, is usually sufficient. The electrolysis is continued until the blood-vessels are thoroughly destroyed, and no bleeding should follow. Three or four punctures or electro-punctures are sufficient for one sitting, and the pain on introducing the needle is slight when no current is passing. The treatment may have to be carried on two or three times a week for five or six months, and has proved satisfactory in quite a number of cases.

Alopecia.—There is no doubt of the efficacy of a galvanic current in hastening a recovery from this trouble. A large sponge electrode connected with the negative pole with a current strength of six milliamperes may be applied until the scalp turns red.

The alternate use of faradization by means of a very fine wire brush (bristles as fine as those used in a brush for silk hats) acts as an excellent stimulant.

Thorough massage of the scalp by means of electric vibrator may also help to revive the hairs and improve their nourishment. If the hair roots, however, are absolutely dead, no amount of treatment will revive them.

Callosities of the skin, caused by pressure, etc., may be softened and greatly improved by means of the galvanic negative electricity, and

Carbuncles may be aborted in their incipiency by means of the electrolytic needle or by means of the positive galvanic current, applied for about twenty minutes with a strength of about twenty milliamperes.

Colasma, or the abnormal deposition of pigment in the skin, is frequently benefited by the use of galvanic negative electricity.

Eczema.—In this multiform disease the itching, tingling and burning may be frequently relieved temporarily by means of faradic stimulation. The dry form responds rapidly to an application of the negative electrode to the parts, the current as strong as can be borne without discomfort to the patient. Apply until the parts are thoroughly reddened. Daily sessions are best and frequently bring on a complete cure in chronic cases. The positive pole applied to a weeping eczema may be equally efficacious by removing the infiltrations from the surrounding tissues. In the moist form, exposure to the blue light has in the author's experience been more successful than any form of electricity.

Remarkable results are being claimed for the X-ray therapy.

Erysipelas.—Cataphoric applications of various disinfectants may be tried in suitable cases.

Freckles.—The negative electric needle applied to the superficial layers of the skin is frequently followed by a decided effect in eliminating the discoloration.

Herpes.—In this affection the positive galvanic pole

applied near the periphery of the nerve for ten or fifteen minutes frequently relieves the neuralgic pains.

Hypertrichosis.—For the removal of hair a very fine blunt-pointed needle is used with a current of one-half to two milliamperes, with twenty-five volts or less. For the extraction of hair a low voltage is used. The sensation produced by a current is roughly proportionate to the voltage. A small current with a high voltage is intensely painful, as is seen in static electricity, while a low voltage may be comparatively painless. From four to ten volts will do for small hairs and a larger voltage for large coarse hairs, in the less sensitive part of the skin.

The cells of the batteries are connected in series, the carbon of the one to the zinc of the next. Connect the electrodes and test the current by taking one electrode in moistened fingers and touching the other with the tip of the tongue. Some operators insert a wire from a positive pole in a glass

Needle Holder.

of water, into which the patient puts one or more fingers to complete the circuit. Others use a sponge electrode.

The needle, being fastened in the holder, is inserted gently beside the hair. The needle will glide gently down to the root of the hair and there will meet with slight resistance. Instruct the patient to grasp the electrode firmly. Cease pressure, and in ten to thirty seconds bubbles of hydrogen will appear around the needle. If the hair is destroyed it can be easily removed. The current must not be turned on before the needle is in place, nor is it safe to extract hairs that are close together. The proper method is to go over the ground, leaving three or four millimeters between. Not more than from twenty to forty hairs should be removed at one sitting. Begin with a small amount of current, say two or three cells, and increase if not found sufficient. It may be well to have two different colors of cords, so that there will be no confusion between the positive and negative elec-

trodes. Unless the operator's eyesight is good a magnifying glass should be used.

Hairs that were less noticeable before the treatment are sometimes stimulated to growth by this method of epilation, so that it is sometimes necessary to go over the area several times.

In the treatment of fine, downy hair, treatment by electricity seems to be impracticable.

As shown by the effects of X-rays upon the hair follicles, resulting when treating other pathological conditions, hair will drop out in from four to eight weeks of exposure. The treatment should be suspended until the hair begins to reappear, when the treatment should be resumed and carried on as previously. The X-rays are not advisable except in cases

Portable Battery for Facial Electrolysis.

of hypertrichosis of exaggerated type. The greatest difficulty in connection with this treatment of hypertrichosis is that one must cause sufficient atrophy of the hair follicles to produce alopecia and yet do it without causing an undesirable degree of dermatitis. There is no therapeutic application of the X-rays which requires so much caution and skill as does the removal of hair, and should only be undertaken after one has had considerable experience with his particular apparatus in the treatment of other affections.

Lupus Vulgaris.—May be treated by means of the X-ray and high frequency current locally applied, but responds almost invariably to the Finsen Light treatment.

Pruritis, being a neurosis of the skin, may be either idiopathic, symptomatic or due to some external irritant. It may be greatly relieved in many cases by means of galvanic electricity, the poles being placed to influence the nerve

terminal. Faradic electricity from the fine wire coil may also give marked relief, so also may a few exposures to the X-rays.

Seborrhea.—The negative pole of the galvanic current with a moderately strong current may be used with the sponge electrode over site of the disease.

Sycosis.—Responds favorably to the treatment of X-rays and the high frequency currents. Satisfactory treatments are usually obtained in most cases within a month.

Ringworm.—The germicidal action of copper electrolysis is a specific for this trouble. The copper electrode attached to the positive pole may be applied directly to the lesion, after moistening it with a normal salt solution to insure electrical contact. A current strength of from five to fifteen milliamperes should be applied until the parts take on a greenish appearance. In treating ringworm on the head a very weak current must be used on account of extreme sensibility. Treatment, of necessity, must last longer than when application is made to other parts.

Tattoo-marks of an insoluble pigment may be removed by means of electrolysis. A sharp-pointed needle connected with the negative pole of a galvanic current will excite sufficient inflammation to cause the pigment to be thrown off.

Tinea.—The cataphoric action of electricity may be made use of for the purpose of conveying medicinal substances of an antiseptic nature into the deeper layers of the skin, where these parasites make their habitat.

Chronic ulcers may be stimulated to assume a healthy condition by means of galvanic electricity. A zinc electrode connected to the negative pole should be placed over the ulcer, while the positive may be placed at some indifferent portion of the body. A feeble current is used from fifteen to thirty minutes.

Antiseptics such as copper may also be introduced into the ulcerating tissues, by means of the positive pole, and thus bring about a healthier condition.

Warts.—The galvanic current with the positive sponge electrode with a current of from four to six milliamperes is frequently effective. The faradic current may also be used; it should be weak at first and gradually made as strong as the patient can bear it. The static spark applied to the wart is equally effective. If the wart is very prominent electrolysis as in nævus or the galvanic cautery may be used.

Scars.—A fine needle attached to the negative pole of the galvanic battery is introduced just below the superficial layer of skin, and the current continued long enough to separate it from the underlying tissues. Reinsert needle and continue until the entire surface of the scar has been acted upon.

Wounds.—Needle pricks, cuts and abrasions of the surface may be readily determined by placing one hand in a basin of water in which one of the poles of the galvanic battery is placed. A smarting or burning sensation will manifest itself at the point if there is any solution of continuity. This is of advantage to a physician who is about to perform an operation upon an infected surface, enabling him to thoroughly prepare his hands by protecting the abrasions.

Angioma or nævi, if not too large, may be destroyed by means of electrolysis. The main thing to be obtained is the complete destruction of the vascular tissue and the ultimate shutting off of the blood supply to the part. The galvanic current accomplishes this by using the positive electrode. Use a limited area and repeat at frequent intervals.

Needles set in a brass disk one or two millimeters apart comprise the proper electrode for treating nævi. The needles must be exceedingly fine and have very sharp points. When the skin around the needles begins to blanch and rise in wheals galvanic action is established. In twenty-four to thirty-six hours small crusts will form, and when these fall off small cicatrices will show themselves. The operation may be repeated every two weeks until the color is approximately normal.

In occluding veins care must be taken not to withdraw the needle until the clot is firmly fixed, otherwise the clot may become an embolus and cause any amount of mischief.

When desired needles connected with both poles may be introduced into the growths parallel to each other, one being positive and the other negative. The current is turned on until the tissues are blanched and the froth around the needle indicates a rapid destruction of tissue. Electrolysis must be continued until no hemorrhage takes place on the removal of the needle, and as much of the growth may be destroyed at one sitting as possible. The strength of the current is indicated by the patient's endurance, the pain being very intense at times, but usually ceases on the removal of the needle. The scar following galvano-cautery is much more marked than when electrolysis is used.

MISCELLANEOUS.

NEPHRITIS.

Whatever the cause of this disease, it may be presumed that there is some inherent or acquired weakness of the kidneys present, rendering them the weak link in the visceral chain, and that this is the real cause why they fall victims to the various causes ascribed as the active agents in producing this disease. In many cases lesions of the spine, of such a nature as to interfere with the vital forces distributed to the kidneys, are present. This explains why the poisons of acute infectious diseases frequently produce nephritis in an already weakened urinary mechanism, and why one person suffers from the disease, while similar circumstances fail to cause it in another.

Owing to the serious pathological changes that have taken place before the patient consults a physician, the treatment is directed largely to the alleviation of the manifestations of the disease, such as nausea, vomiting, headache, pain in the back, dropsy, etc. It is necessary for the relief of the symptoms to rid the system of the accumulated poisons. As the visceral organs are usually in a congested condition and frequently fail to respond to diuretics, etc., recourse should always be had to either hot air or electric light baths, which give relief to the kidneys, liver and heart. In many cases where the first sound of the heart at the base can not even be heard, ten to fifteen minutes in the electric light bath will make it almost as plainly distinguishable as the second sound, whose ringing character is also greatly modified. The effect frequently lasts for hours, and where treatment is persisted in daily, for a long time, the apex beat, which is outside of the nipple line, may be brought back almost to its normal position.

Vibratory stimulation of the entire spine is indicated, as the vicious circle, once established, involves all the organs.

The high frequency current, on account of the large amount of ozone developed, is a great aid in treating this disease. Treatment should be given to the entire body for an hour, several times a day if necessary, in severe cases.

The wave current with the electrode over the liver, kidneys and spine, with a spark-gap of five to six inches, for one-half hour daily, as well as the static bath, may be given with a great deal of benefit.

DIABETES.

The influence of the general nervous system in diabetes is well known, but not understood. Lesions in the medulla, cord and sympathetic system have caused diabetes. In the floor of the fourth ventricle lies the so-called diabetes center. It is a point puncture of which results in diabetes. The effect is doubtless gotten through the vagi nerves which originate from this point. The vagi also participate in liver function.

Treatment.—Stimulate the cervical spinal centers, solar plexus, splanchnic and lumbar region, restoring the function of the pancreas, liver and small intestines. Apply the wave current with the electrode over liver. The pain in the hepatic region is usually relieved almost instantly by application of the negative spray to this region. The head breeze usually relieves the headache and dizziness. Electric light baths will hasten elimination and oxidation of waste. The high frequency current is also a great aid in hastening oxidation of tissue waste.

AUTO-INTOXICATION.

In the course of all diseases we find nature trying to dispose of the deleterious or poisonous products by means of elimination, and anything that will assist in the removal and oxidation of this waste material will help to relieve the diseased condition.

The elimination of waste is most easily accomplished by means of the hot air bath, which causes elimination of waste through the skin, causes ingestion of water in abundant amount and at the same time permits absorption through the mucous surfaces, subjecting the tissues to a veritable water bath.

Anything that will assist in the oxidation of the waste material present in the body will hasten a cure in the diseased condition. Hence the wave current with the electrode over the liver or organ involved, and positive insulations

Wave Current in Diabetes, Electrode Over Liver and Interrupted Breeze to Forehead.

will be most effective. Friction sparks over the entire body will also be a great aid by stimulating the integumental tissues to empty their waste into the general circulation.

When the heart is involved, positive insulation, with the active pole over the heart, is frequently very effective.

The entire lymphatic system needs stimulation, and this may be secured by stimulation of the trophic nerves which supply the glands draining the infected areas.

HEPATITIS.

Repeated attacks of congestion, if not relieved, will cause atrophy or cirrhosis of the liver. After exhausting fevers there frequently remains an impaired condition of the general system. The weak and irritable heart usually present in these disorders frequently keeps up a chronic state of engorgement of the liver.

Faradic stimulation and static electricity act in some

degree as a substitute for active exercise, and frequently bring speedy relief and even complete recovery where other methods have failed.

A powerful effect may frequently be had on the sympathetic system by these currents, affecting the heart itself as well as the arterial ramifications in the liver. In using the faradic current apply one pole at the cilio-spinal center and the other at the feet or the buttocks or the solar plexus. Electricity is of little value as long as disregard for hygienic methods of living exists.

Enlargement of the liver may follow as the result of an enlarged spleen, frequently depending on a loss of its contractility, followed by a subsequent retention of its contents. Where faradization and static electricity have failed the galvanic current is frequently of benefit.

In cirrhosis of the liver the pains are frequently temporarily relieved by electricity, which also keeps in subjection the ascites and edematous condition of the legs.

Jaundice, being merely a symptom, frequently yields to electricity if not due to obstruction of gall-duct.

It is frequently difficult to determine the exact measure of benefit derived from any special method of treatment when it is only one of a number of others that are simultaneously in use.

RHEUMATISM.

In rheumatism of special groups of muscles, the source of the discomfort is frequently found in the origin of the nerve supplying them. This is also true in chronic articular rheumatism, and the nerve supply of the limbs is almost always obstructed. The obstruction may be at the exact locality of the pain, or in the course, or at the origin of the nerve supplying the part.

In lumbago there is almost invariably some irritation of the nerve fibers supplying the muscle bundles of the erector spinæ. The causative agent of rheumatism acts by deranging the blood and nerve supply locally or generally. In inflammatory rheumatism the effect is possibly an infection, acting on the system through causes which derange the functions of the liver and kidney and also of the central nervous system.

The treatment consists principally in treating the primary

cause, looking particularly to the excretion of the poisons from the system. The circulation to the part affected must be kept free.

This is accomplished by vibratory stimulation along the entire spine, and especially the tender spots, if any are present. Stimulation must also be employed along the vessels and lymphatics of the part affected. Remove the muscular contractures wherever present.

Muscular rheumatism is usually obedient, in a very marked degree, to some form of electricity. Static electricity is found the most efficacious in muscular rheumatism. It is by no means a pleasant method of procedure, but if continued for from twenty minutes to a half hour, sufferings of weeks from attacks of lumbago, etc., have been completely cured after a single treatment.

Where the pain is of a neuralgic type, with great tenderness on pressure, galvanic and faradic electricity are preferable, and one treatment will almost immediately lessen the tenderness and relieve the pain.

Acute Rheumatism.—The static brush discharge or high frequency current for twenty to forty minutes over the seat of inflammation frequently relieves the swelling and improves metabolism in acute rheumatism.

Local applications of methyl salicylate, the affected part being afterward covered with flannel, are made very effective by static friction sparks which hasten absorption and improve the circulation.

There are some persons who are born not to be treated by electricity, while there are others who are more susceptible and respond more kindly to any form of judicious electric application. General faradization is frequently followed by a marked alleviation of pain and the shortening of an attack.

In *articular rheumatism* the wave current over the liver and kidney will stimulate these organs to activity. This current may be applied over the affected joint with a spark-gap of from six to ten inches, or as long as it can be borne without causing painful contractions, about fifteen or twenty minutes.

Hot air or electric light baths (local or general as indicated) are important aids in eliminating the poison. If cold is applied after the bath it must not be too prolonged or too intense, as cold water flowing directly on the joints may increase the pain.

As it is of importance to increase the nutrition of the parts, the trophic centers in the spine must be actively stimulated.

RHEUMATOID ARTHRITIS.

Electricity has been found to be a palliative to a marked degree in many cases, relieving pain and increasing mobility. The static-induced current, with the high tension, is often very serviceable, as well as the high tension faradic current, and a vigorous current sufficient to produce intense redness of the skin is sometimes followed by great relief.

When we wish to give the entire body the effect of galvanic or faradic stimulation or sedation there is no mode of treatment so well adapted to do so as the electric bath.

SCOLIOSIS.

Spinal curvatures are rarely painful, but when pain is present, the first step in the treatment is to carefully relax all spinal tissues, deep and superficial; to increase or correct the circulation in them.

Treatment—Vibration—Treat with moderately deep pressure on the side toward the deviation to relax the contracted muscles, thereby removing the irritation to the nerves consequent on contracture. Next, treat the opposite side of the spinal column to increase the blood supply to the nerves of nutrition. This will materially aid in developing tone and strength in partially inhibited muscles.

It is a good rule in spinal curvature to direct attention to replacement of the parts affected. Begin at the lowest vertebra involved and make an attempt at each treatment to replace it. A considerable degree of force is sometimes necessary to put the parts back into place, but violence must be avoided. Wave current to the spine is a great aid in improving the circulation and tone of the muscles.

CONTRACTURES, TORTICOLLIS, ETC.

Whenever an inflammatory process continues for a length of time in the structures of a movable joint in any part of the body, the group of muscles which control the action of that joint become contracted and the limb becomes fixed in extension or flexion, because long-continued irritation of the

nerves induces contraction of the muscular fibers. Sparks liberally applied along the course of the contracted muscles serve better than any other means to overcome muscular contractions. Contracture may be prevented in paralyzed limb, if treatment is instituted while the muscles may still be extended by gentle manipulation and muscular shortening is not yet established. The wave current from the static machine, as strong as can be given without causing painful muscular contractions, is also useful, though not so effective as sparks.

SPRAINS AND BRUISES.

If the incandescent blue light be used shortly after the injury, sprains or muscular ruptures are greatly modified, as swelling is prevented and pain averted.

Massage and vibration of the affected parts is also very effective, as it removes the stagnant condition in blood and lymph systems. Look well to the glands draining this area.

Local light baths will aid the disappearance of the swelling in a comparatively short time. The static wave current, short sparks and Leyden jar currents are also great aids in improving the nutrition in the parts.

In the treatment of fractures the static spray or brush discharge will allay the suffering of the patient and hasten the complete recovery of the case. Sparks are not indicated, as the active contraction of the muscles before the bones are united would be apt to throw the parts out of position.

The danger of anchylosis is greatly lessened, due to the diminished congestion and more rapid repair of the injured parts.

SYNOVITIS

when not characterized by pus may be treated by means of the static wave current, spark or spray. Long percussion sparks are imperative in many cases to bring about a cure. Exposure to the blue light alone for thirty to fifty minutes has been followed by success in several of the author's cases.

GOITER.

The positive sponge electrode with galvanic current may be applied to the surface. A large electrode should be used to permit a considerable current strength (five to ten milli-

amperes). Treatments should be repeated every second day. The dispersing electrode may be held on the back. Cataphoresis may also be used, a solution of iodide of potassium being applied by means of a large electrode, the negative pole being used over the gland.

Hypodermic injections of dilute Lugol's solution may be diffused throughout the tissues by leaving the needle in place and using it as the negative electrode.

In the cystic form of goiter, electrolysis should be given the preference. The cyst, being emptied, is filled with a normal salt solution and the negative needle introduced, a current strength of twenty milliamperes being passed for twenty minutes.

ANEURISMS

of large blood-vessels offer, as a rule, a hopeless prognosis, and until anodal or positive electrolysis was employed, little hope of even amelioration could be held out for any. Skilled operators have succeeded by inserting a spiral coiled fine gold wire into the aneurismal sac through an aspirating needle. This wire is then made the anode, or positive pole, of a direct current of from ten to one hundred milliamperes. The cathode, or negative pole, being placed on some convenient part of the body, the current is continued until pulsation ceases and evidence is given that coagulation and solidification have taken place, which may require from ten minutes to an hour or more.

In some instances several coils of fine wire have been inserted at different points of the dilated vessel at the same sitting. Considering the inevitably fatal ending of these cases, if not interfered with, the operation is justified in suitable cases, as a sufficiently large proportion find marked relief and life is prolonged.

TUBERCULAR GLANDS.

Zinc cataphoresis may be used when the infected area is limited.

After anesthetizing the parts to be treated (which may be done by means of an ethyl chloride spray), a puncture is made by means of a Hagedorn needle. To permit the introduction of the needle electrode a drop of cocaine placed about the

end of the needle will make the anesthetic effect more permanent.

The negative electrode may be placed over the back or abdomen and a current of from one-half to four milliamperes passed through the parts for about fifteen minutes. As a rule only one gland is treated at a time, applications being made every few days. The treatment may require months, but when cured no ugly scars will be found, as in cases where the glands have been removed.

INDEX.

WB495
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1908
Gottschalk, Franklin B
Practical electro-therapeutics

Un