THE
Electro-Therapeutic Guide

—OR—

A Thousand Questions Asked and Answered

—BY—

Homer Clark Bennett, M. D., M. E., Ph. G., D. P., M. Ph-Th.

The Electro-Therapeutic Guide

OR

A Thousand Questions Asked and Answered

—BY—

Homer Clark Bennett, M. D., M. E., Ph. G., D. P., M. Ph-Th.

SECRETARY, TREASURER AND PROFESSOR OF ELECTRO-THERAPEUTICS IN THE NATIONAL COLLEGE OF ELECTRO-THERAPEUTICS; EDITOR "THE ELECTRO-THERAPEUTIST"; MEMBER THE NATIONAL SOCIETY OF ELECTRO-THERAPEUTISTS; CHARTER MEMBER ROENTGEN RAY SOCIETY OF AMERICA; MEMBER AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE; EX-VICE PRESIDENT AMERICAN ELECTRO-MEDICAL SOCIETY; EX-PRESIDENT AMERICAN ASSOCIATION OF PROGRESSIVE THERAPEUTISTS; SUPERINTENDENT X-RAY LABORATORY AND SECRETARY ELECTRO-THERAPEUTIC HEALTH HOME AND BATHATORIUM, LIMA, OHIO, U. S. A.

Eighth Edition

Revised and Condensed

Price, $2.00

PUBLISHED BY THE LITERARY DEPARTMENT OF THE

National College of Electro-Therapeutics

Lima, Ohio, U. S. A.

Printed at
FRANKLIN PRINTING HOUSE
THE ART PRESS
Lima, Ohio

TENEO—TENEOR

Fraternally,
H. C. Bennett.

PREFACE TO THE SEVENTH AND EIGHTH EDITIONS

There is no apology or excuse to be offered for the publication of this book, but there is a good reason, as it is but the fulfillment of a demand, which is amply proven by the simple fact that the first six editions were all sold, and the seventh edition was all ordered, sold and paid for in advance of its publication, and a large portion of the eighth edition was urgently needed, to supply the same popular advance demand, so that the seventh and eighth editions are published simultaneously, and are identical, in all respects.

These are the reasons why this book is presented in its present revised, improved and condensed form.

As stated in the previous editions, and as its name indicates, this book is intended simply to act as an aid, and a real "guide," both to the beginner, who is taking up the specialty of electro-therapeutics, and to the more advanced student, and the busy doctor, who needs it to refresh his memory, without having to wait.

In the present age there is a tendency toward proliferation, both in the number and size of books, while this book is different, in that it is the aim and intent of the author and editor, to concentrate ideas, and condense words, in order to save both time and energy, so that the busy operator may get the proper "know how," both quickly and accurately.

It is not expected that this work will take the place of text books, or displace a course of lessons, on the subject of electro-therapeutics.

This work is not written or intended for the well posted and expert specialist, but more for the general practician, with but a limited knowledge of the subject.

There has been, and is, no book like it, and this "guide" is intended primarily as a corollary to, and part of, the mail course of thirty lessons of instruction, issued by the National College of Electro-Therapeutics, which it still is, but it is also in demand by many who are already well informed in electro-therapy, and who do not care for, or may not need, the course of lessons.

A physician who is obliged to cover the entire field of medical and

surgical practice, cannot be expected to keep in mind all the details of technique of electro-therapeutic practice, and the therapeutic index part has been arranged in abbreviated form so that it may be seen at a glance the best or a variety of methods of treatment that may be applied in any particular case, which it is desired to treat by this agency.

The usual stilted form of didactic language, and oscure phraseology, and technical terms have been eliminated as far as possible, and the conversational style of questions and answers has been adopted, as being the most easily understood, and at the same time conveying the ideas of the fundamental principles, so that they will be remembered.

For a full and complete outline of the subject, the reader is referred to, and is strongly advised to consult, the mail course of lessons, but this book is intended to contain the essence of the course of nearly a thousand pages, fully illustrated, without any useless words, and we believe that this guide will save much time, and insure a more scientific and successful use of electrification as a therapeutic agent in the hands of the average physician.

In following the suggestions as to the treatments outlined in this work, any intelligent physician will of course take into consideration the general physical condition, age, sex, and individual idiosyncracies of the patient.

Thousands of physicians, who would not have devoted their time to a thorough study of electro-therapeutics, from large text books, or who could not have taken post-graduate courses of personal instruction in the subject, have by the aid of the mail course of lessons, and the "Guide," been enabled to apply electrification, in a thoroughly scientific and successful manner, and to have secured results, which would have been impossible without the knowledge derived therefrom.

No originality is claimed by the author in the methods of treatments advised, but the ideas are derived from twenty years of close study of nearly every publication on the subject, and the results, observations and conclusions, from practical applications of the agency, during that time, and the general rules laid down, and the technique suggested, accord with the teaching of the ablest specislists in electro-therapeutics.

If this little work will assist the busy practician, and guide him to proper methods of application of electrification in therapy of diseased conditions, thus securing good results which would otherwise have been failures; and if it will interest him in the subject of scientific electro-therapeutics; and stimulate his desire for accurate knowledge along this line; and cause him to give more careful attention to this important branch of practice, then the author will be satisfied. H. C. B.

INTRODUCTORY

ELECTRO-THERAPEUTICS AS A SPECIALTY FOR THE GENERAL PRACTICIAN

Specialism is the order of the day. The time is past when one man can do it all. In this era, the doctor to succeed must excel in something. He must know something about everything, and must endeavor to know everything about some one thing. That branch to which he is most attracted will be one to which he will devote the most time and study, and it will be naturally followed up, and if he masters the details and technique of that branch, then he will have the best success with it, and this will eventually become his specialty. Some specialties are forced upon physicians against their will by circumstances, but the most of them are at liberty to select the special line of study most congenial to their tastes, and best adapted to their ability and field work. The physician should first, however, have the invaluable schooling only acquired in general practice, without which the specialist is handicapped, so that specialists are not made all at once. Electro-Therapeutics is now becoming firmly established as a branch of medicine. Electrification has its uses and limitations as a medicine. It is not a cure-all, but when scientifically applied in selected cases it will do things that nothing else will. The chief danger in the use of electro-therapeutics is not the agent itself, but in the person using it. If ignorantly or carelessly applied, it may, and often does do harm, and brings disappointment, whereas, if rightly and intelligently used, it gives uniform satisfaction and brings success. It is an axiom that a power for good when rightly used, is as great a power for harm when wrongly used, in proportion to its potential, and this applies strongly to electro-therapeutics. Electrification must not be applied by guess. The laws of its operation must be understood, therefore a preliminary education in electro-therapeutics is an absolute essential to success. Correct technique is everything. There are many doctors who have the idea that all

that is required is a battery and a few directions.

There is just as much sense in this belief as there is to say that all that is required to make a doctor is a stock of drugs and a few instruments. It is just as necessary to understand the physics, chemism and physiological effects of electrification as it is to understand the same of any other medicine.

Doctors are awakening rapidly to the fact that they must have something besides a battery, and must have at least a working knowledge of it and its uses. This knowledge can be obtained by experience, study and experiment, but at what a cost of time, money and disappointment! There are many books published on the subject for sale now of more or less value to the operator, but of more value to the specialist as a reference. The majority of physicians are too busy to leave their homes and practice to take a special course, yet they feel the vital need of more knowledge in electro-therapeutics. They are busy and have little or no time to devote to experiment, and the knowledge to be gained from the average text-book on the subject is to say the least unsatisfactory, therefore, there is an absolute need for a simple, practical mail course of instruction in electro-therapeutics, which the busy doctor can take at home, and which at the same time will give him just the information he needs concerning the apparatus to be used, the nature and effects of the different currents, and the simple facts plainly stated to guard him against mistakes, and guide him in the right direction in medical electrification.

Such a course has been prepared by The National College of Electro-Therapeutics, Lima, Ohio, which is the oldest school of its kind in the world, having been chartered in 1896, and which course is now in its fifth edition, and consists of thirty, thirty-two page lessons, covering fully the entire field of electro- and photo-therapy, and to which course this "guide" is a corollary. The lessons are profusely illustrated and plainly and concisely written and teach electro-therapeutics in a practical manner, and all should take them.

The question is often asked by general practicians whether the ends will justify the means, for them to equip themselves with proper batteries, and use the same in their general practice. To such we reply that if they once become posted and apply electrification as they would any other medicine, the ends will ALWAYS justify the means, and a GOOD battery is one of the best assistants the busy doctor can have, and when they once begin to look for places to apply it they will never cease finding openings where it will be of great assistance to them, both professionally and financially. The general practician can make a specialty of electro-therapeutics without necessarily confining himself to it as a specialty. The great ma-

jority of the alumni of the National College of Electro-Therapeutics are busy doctors in general practice, many of them in country practice. We have one doctor in mind, over sixty years of age, doing general practice, and in a village of 700, who has an office equipment of electro-therapeutic apparatus costing over one thousand dollars, which he has made pay for itself many times over in the last few years, and with which he is now busy all the time in his office, having relegated the outside work to his son. We know of other doctors equally well equipped in locations ranging from small villages to large cities, all of whom are succeeding in electro-therapeutics. The field of application is so large and the indications for the use of electrification as a medicine so plentiful and the results following its use so satisfactory that when once in the field, they invariably stay with it. One of our students became so enthusiastic recently that he wrote that he had decided to abandon practice of medicine entirely, and devote himself exclusively to electro-therapeutics, as he had found a remedy that would meet all his needs. We were sorry to do it, but we had to throw a cold blanket over his enthusiasm because electrification is not a cure all, and will not take the place of all other remedies, but should be used in conjunction with other means and methods of treatment wherever and whenever indicated, only applying electrification when it seems most indicated just as you would any other form of treatment. Enthusiasts are all right, but sometimes they overdo it, and make promises they cannot fulfill, and often disappoint themselves and patient. A wise discrimination is necessary to successful therapeutics. The day is coming when the true physician will not be hampered by a limitation of schools, pathies, isms or narrow dogmas, but will be like the bee—gather honey from all the flowers, appropriating and using only the best from each; in other words, the coming doctor will be treating his patients with whatever he thinks will relieve or cure most safely, quickly and pleasantly, whether it be drugs of large or small doses, or no dose at all, baths, massage, electrification, light, heat, vibration, diet, hygiene, exercise, rest, suggestion, sunshine or moonshine. The doctor who is not posted in electro-therapeutics will seldom see any indications for its use, while the doctor who is well acquainted with its properties and power will be always finding cases in which it can be applied with great advantage, as there is scarcely any limitation to its usefulness in some way or other. In this rapid age where most of us are nervous dyspeptics, electro-therapeutics has a great field for usefulness. The combination of nervous unbalance, termed Americanitis, especially calls for the soothing application of electrification to restore the normal equilibrium.

What is Electricity?

This question is often asked by the unthinking and thinking alike, and has never yet been answered definitely. Many theories have been offered, all with some points in favor, but they are none of any practical value to us.

Occasionally we are amused by some one making a "discovery," (save the mark,) claiming to have found out what electricity is, and he either guards his secret (?) closely, or gives a very old and confusing job lot of meaningless words, as a definition.

So do not be afraid to show your ignorance as to what electricity is, for you are in very good company, as the wisest do not know, and in that respect we are all wise.

While we do not know *what* it is, we do know what it is *not*. It is not a tangible entity. It is not an energy, as many claim. Electricity is a *condition*. Electrification is an energy, or manifestation of the electric condition, and we know some of the laws governing electrification, and can, by following these laws, bring about certain manifestations of electrification, and get certain results.

Upon this hypothesis, which to us seems the most plausible, that electricity is a condition, and that electrification, in the various modalities which will be taken up and studied in detail later, is the manifestation of this condition, let us proceed to study the different phenomena of electrification, and learn the laws governing the production or causation of these phenomena. The electric condition is universal and pervades everything, and as such, differs from matter, the existence of which we recognize by one or more of our special senses. This condition is not an entity, is imponderable, and while pervading everything, has no dimensions. It is through the manifestation of certain phenomena, only, that we realize the realty of this condition, and it is these phenomena we appreciate by our senses. Electrification is the energy operating to produce these phenomena, and this electrification acts according to certain fixed laws. It is the study of these laws of electrification, which it is our pleasure to place be-

fore you in this "guide". These laws are simple and the principles of their operation are easy of comprehension, and these laws being fixed, knowing them, we can by bringing about certain conditions, invariably cause certain effects.

It is upon the laws govering the production of these phenomena that is based the science of electro-therapeutics, and these laws must be known and followed in order to achieve success.

When electrification is in perfect equilibrium, no phenomena are manifest, but when this equilibrium is disturbed we note the operation of the fixed law of physics, which says that: "For every action there is an opposite and equal reaction."

There is ever present the tendency toward an equalization of balance, the same as water seeking its level. It is upon this that we base our belief of a difference of potential between the two poles. We do not know whether there is a transference of energy in the form of a current, like water flowing down hill, or if it is on the form of a wave, or if it is merely a transmitted impulse. For the sake of convenience in our work we speak of it as if it were a current of energy flowing through media, known as conductors, or held in check by other media known as insulators. These are enumerated in detail elsewhere in this book. Again for convenience we say that the side having the higher potential, is plus or positive, and the opposite side having the lower potential, is minus or negative. Again for the sake of simplicity we will speak of electricity, the generally accepted word, as the same as electrification, so that when we say electricity, please know that we refer not to the electric condition, but to the manifestation of it.

Electrification

Electrification may be divided into four classes, according to the various phenomena of manifestation, as follows:

1st. —Electrification in motion, or dynamic.

2nd.—Electrification at rest, or static.

3rd. —Electrification in vibration, or radiant.

4th. —Electrification in rotation, or magnetic.

This classification indicates the relative importance to us as electro-therapeutists, in the order named.

We will consider the most important first, the dynamic, which is generally spoken of in two forms or currents, viz. galvanic and faradic, which are proper adjectives, in honor of Galvani, and Faraday. The proper terms to use would be constant, and induced.

The constant current is unidirectional, with a fixed polarity, while the induced current is an interrupted and alternated current with no fixed polarity.

Under the head of the constant, may be placed the cautery current, and under the induced we class the sinusoidal, and the so-called high-frequency currents or modalities.

The franklinic, after Franklin, or static as commonly named, when in effect, is also unidirectional, with a fixed polarity, and it has a modification in the static induced, which while being an interrupted current, differs from the faradic, in having a fixed polarity, which is always the reverse of the primary or inducing current. We also get a high frequency or oscillatory modality from the static.

Commercial incandescent light and power currents can be utilized for purposes of therapeutics, but they differ in no way from the other modes, except in the method of generation.

The constant or galvanic mode is spoken of as galvanizm, and the application, as galvanization.

The induced, or faradic mode is spoken of as faradism, and the application, as faradization.

The static mode is spoken of as franklinism, and the application as franklinization, on insulation.

The vibratory or radiant mode is known as photo-therapy, or light treatment, and is applied to any form of light, but the term is most often given to the use of the Roentgen or X-ray, which is known as the X-ray treatment, or roentgenism, and the application is called roentgenization, or X-raying or radiation.

The rotating or magnetic mode is known as magnetism, and the application is called magnetization.

$$C = \frac{E}{R}$$

OHM'S LAW

In the erection of our system of practical electro-therapeutics, we wish to have a bridge to carry us over the hard places. The key-stone of this bridge is most important to fully know and understand, and is the law of Ohm, which enters into the consideration of every therapeutic application. The foundation of our bridge is based on three things or units, which we use as measures of pressure, strength and resistance. These are named in honor of the labor and study of three eminent physicists, Volta, Ampere, Ohm.

VOLTAGE is the push, pressure, head or electro-motive force which drives.

AMPERAGE is the rate of flow, or current strength.

OHMS represent the opposition encountered, or the resistance offered to the flow of current.

For the sake of convenience we say that the

Volt is the unit of electro-motive force or drive;

Ampere is the unit of current strength;

Ohm is the unit of resistance.

Dr. George Ohm formulated a definite statement based upon experiments, measurements and observation, concerning these units, and this is known as Ohm's law.

He demonstrated that the strength of a current flowing through a conductor was entirely dependent upon the pressure behind it, and the resistance in front of it, being directly proportional to the drive, and inversely proportional to the drag.

He formulated a proposition that says, that it requires one volt of pressure or electro-motive force to drive one ampere of current strength through

one ohm of resistance, in one second of time, but as time element is not important to us we may omit it from our considerations of the subject.

In simple language the law of Ohm is this: "The current strength (amperes), is equal to the electro-motive force (voltage), divided by the resistance (ohms), thus:

$$\text{Amperes} = \frac{\text{volts}}{\text{ohms}}, \text{ or current strength} = \frac{\text{Electro-motive force}}{\text{Resistance}},$$

or to make the formula still more simple, $C = \frac{E}{R}$.

HOW ELECTRIFICATION ACTS

The effects of electrification on the body tissues are accomplished through three ways or processes, as follows:

1st. By phoresis, which is mechanical.

2nd. By electrolysis, which is chemical.

3rd. By catalysis, which is physiological.

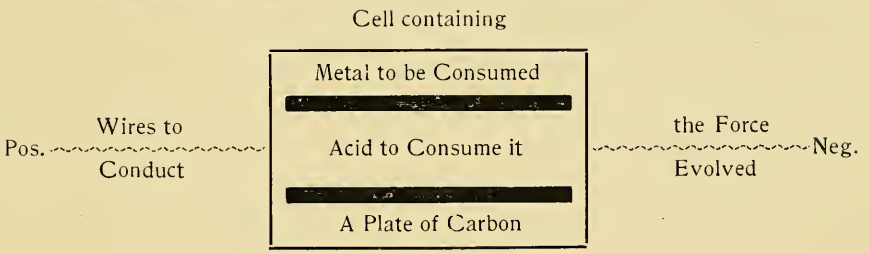
Electrolysis is a chemical effect which is produced by the galvanic current only.

Phoresis is a mechanical effect which is produced by the galvanic, and static currents only.

Catalysis is a physiological effect, which is produced by all of the different modalities, galvanic, faradic, static, magnetic, and radiant, and on account of its wide spread distribution is the most important effect of electrification.

A Thousand Questions and Answers

Of what does a cell consist?



A cell consists of a jar, or container, holding a solution called the electrolyte, in which are immersed two dissimilar substances called elements.

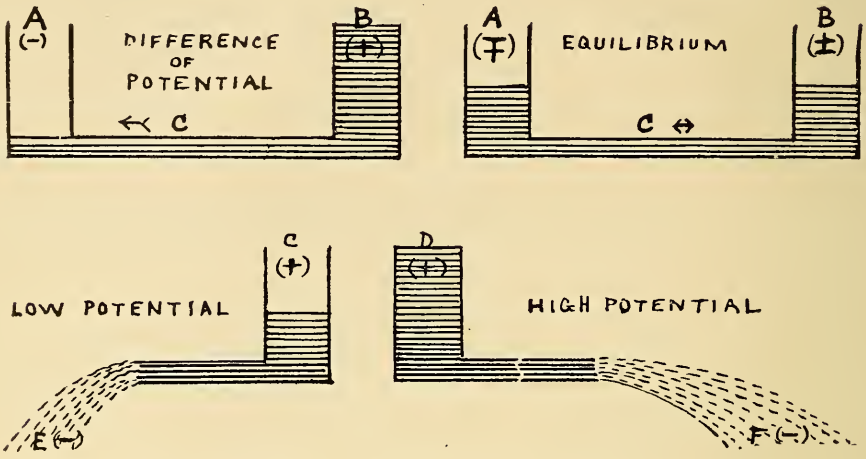
In which direction does electrification flow?

The current of electrification flows from the place where chemical action in the cell is greatest to the place where it is least, that is, from positive to negative, or from the point of the higher potential to the lower.

What is potential?

Potential is the accumulation of energy at some point in the circuit in excess of that present at all other points, and it is this condition which

causes the current to flow when the circuit is closed, that equilibrium may be restored.



What is a volt, ampere, ohm?

A volt is the unit of pressure, or electro-motive force. An ampere is the unit of quality, or current strength. An ohm is the unit of resistance, or opposition to be overcome.

What is a milliampere?

In our work as electro-therapeutists the ampere is too large a dose to give, so we divide it into 1,000 parts, and call each one a *milliampere*, which is the unit of current strength in electro-therapeutic dosage.

What is Ohm's law?

Ohm's law is that the electromotive force, or voltage, is equivalent to the amperage, or current strength, multiplied by the resistance, or vice versa, that the current is equal to the voltage divided by the resistance.

Ohm's law is the keystone of the arch of the entire system of electro-therapeutics and is therefore very important. The law enters into every treatment given, and upon its perfect understanding depends in a large measure our success in this field.

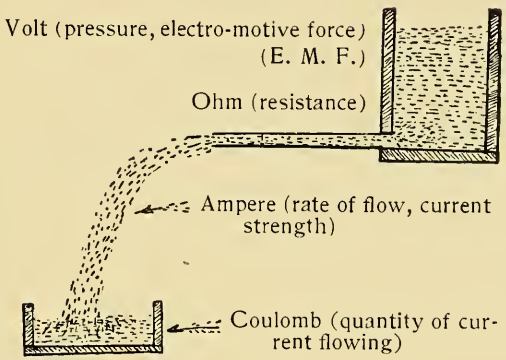
What is the symbol or formula of Ohm's law?

In simple language the law of Ohm is this: "The current strength (amperes), is equal to the electro-motive force (voltage), divided by the resistance (ohms), thus:

$$\text{Amperes} = \frac{\text{volts}}{\text{ohms}}, \text{ or current strength} = \frac{\text{Electro-motive force}}{\text{Resistence}},$$

or to make the formula still more simple, $C = \frac{E}{R}$.

Is there any analagous illustration?



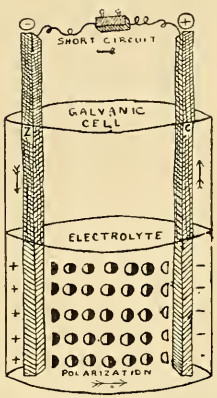
The above sketch graphically illustrates the hydraulic analogue. Remember, however, that the quantity (coulomb), does not accumulate as does the water in the lower basin, but keeps on flowing, in a stream back to the source from whence it came, no matter where it may be. Therefore we do not reckon the coulomb or quantity. The amperage does the work while it is moving.

This current strength is the same in all parts of the circuit. The majority of students do not realize the immense importance of getting this formula clearly understood before attempting to make further advances in the study of electrification, for on this depends all.

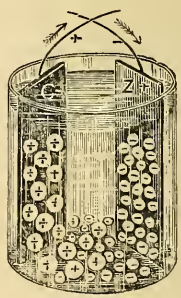
What is polarization?

By polarization is meant the condition into which a cell gets, whereby

the elements become temporarily similar, and no current flows for the reason that one element is just as positive as the other in its chemical relationship to the electrolyte. It is caused by the deposit of hydrogen bubbles upon the surface of the negative element, which bubbles of hydrogen are a product of electrolysis of the water of the electrolyte, in consequence of the passage of the current of electrification before polarization occurs. The accompanying cut shows the theory of this separation of the atoms of water into the polar gases. The black half of the atom being the (—) oxygen going to the positive (+) element zinc and the white half of the atom being hydrogen, (+) going to the negative (—) element carbon. The arrows showing the direction of the current of electrification flowing to the right in the cell, up the carbon, to the left, through the short circuit, then down through the zinc to complete the circuit, in its endeavor to find equilibrium of potential.



The accompanying cut shows the process of polarization. In this illustration the atoms of hydrogen are marked (+) and spread over the carbon plate which is the negative (—) element, and the atoms of oxygen marked (—) spread over the positive zinc element, attacking it. The hydrogen does not corrode the carbon plate, but forms a thin film of hydrogen upon the surface of the element, insulating it and causing a condition of inaction or polarization. The arrows show the direction of the outside current above, before the polarization occurs.



How can polarization be prevented?

There are several ways of preventing polarization. It may be done by pumping air into the electrolyte, or by brushing or scraping the film of hydrogen gas off the carbon, or by shaking the cell. This brings oxygen into contact with the excess of hydrogen, causing a reuniting and formation of water (H_2O.)

This however requires frequent handling of the cell, and if you have many, it is laborious. Polarization may be best prevented by supplying a chemical which is rich in oxygen and at the same time parts with it easily. For this reason, we add to the acid solution bichromate of potash, and in

the alkali cells we mix with the carbon, when it is moulded, powdered bin-oxide of maganese. By these means the excess of (H) hydrogen is taken care of as fast as it is liberated and the cell will not become polarized.

AMALGAMATION

What is amalgamation?

In order to prevent the too rapid rise of potential, due to a too active corrosion of the zinc, we coat the surface of the zinc with a film of metallic mercury. The mercury unites with the hard zinc to form a soft amalgam, which allows only a part of the zinc to be attacked by the acid. This is known as "*amalgamation*," and not only prolongs the life of the zinc by permitting it to be corroded more evenly and slowly, but also of the electrolyte and causes a more regular rise of potential, and more uniform current. To amalgamate the zincs, they are first washed free from dirt and grease in a dilute acid, then the mercury is rubbed over the clean zinc till the metal has a bright mirror like surface. The mercury in the amalgam is also corroded by the acid, and in order to keep the zinc plate amalgamated, soluble bi-sulphate of mercury, is added to the electrolyte. This mercury, held in suspension, unites with the zinc as the amalgam is destroyed, thus keeping it amalgamated. The acid cell batteries are usually constructed so that the zincs may be taken out of the electrolyte when not in use, otherwise they would be corroded and used up when not in use. In the alkali cells the chemical action is less and the zincs are left in the cell all the time.

THE ELECTRO-POION FLUID

What is the electro-poion fluid formula?

The electrolyte used in the acid batteries is called the electro-poion, or battery fluid, or the red-acid solution, on account of the color given to the electrolyte by the bichromate of potash, which is added, as stated before, only to prevent polarization.

TO MAKE THE ELECTRO-POION OR BATTERY FLUID

Take commercial sulphuric acid, 3 fluid ounces. Powdered bichromate of potash, 2 ounces. Rain water, 16 fluid ounces. Bi-sulphate of mercury, 2 drams. Dissolve the bi-sulphate of mercury in the water, then add the bi-chromate of potash. When dissolved pour in the sulphuric acid, *slowly*, stirring with a stick or glass rod, and allow the mixture to cool, as the mingling of the acid and water generates great heat, and if the mixture is

warm it injures the battery. Store in a glass or earthen vessel or jug, in a cool place.

NOTE—If you can obtain bichromate of soda, it will be advantageous to use 3 oz. of bichromate of soda instead of 2 oz. of bichromate of potash, as the bichromate of soda makes a stronger and better fluid; and by the use of this formula, your cells will be kept free from the annoying deposits of chrome alum crystals.

The above formula is best for the following reasons: Decomposition of the bichromate of potash sets free oxygen which unites with the free hydrogen, which would otherwise, by accumulation upon the negative element, polorize the cell. Decomposition of the mercurial salt sets free metallic mercury, which being deposited upon the zinc by virtue of its affinity therefor, amalgamates it, which is desirable for reasons set forth in answer the preceding question.

CONDUCTORS

What are conductors? Name the best ones.

Conductors are those substances over or through which electrification will spread or pass from one pole to another in order to seek its level or normal balance of potential. There is no such thing as an absolute conductor, as all conductors offer more or less resistance. The following list shows the various conductors in the order of their quality of conduction and lack of resistance. No. 1 being the best and No. 21 being the poorest of the so-called conductors.

1. Silver, (annealed),
2. Copper (annealed),
3. Silver (hard),
4. Copper (hard),
5. Aluminum,
6. Zinc,
7. Platinum,
8. Iron,
9. Lead,
10. German silver,
11. Mercury,
12. Charcoal,
13. Acid,
14. Salt solution,
15. Ores,
16. Sea water,
17. Spring water,
18. Rain water,
19. Snow (wet),
20. Animals (living),
21. Damp earth.

INSULATORS

What are insulators? Name the best ones.

Insulators are substances which by reason of the great resistance they possess, oppose the spread and passage of electrification. There are no ab-

solute insulators or non conductors, because of the moisture in the air, which condenses on the surface of the insulator, forming a film of water, which acts as a conductor. However this is so slight as to be of no consequence, and we speak of insulators as being more or less non conductors, according to their composition and resistance.

The following is a list of insulators classified. No 1 being the best and No. 18 being the poorest.

1. Dry air, (dielectric)
2. Sulphur,
3. Mica,
4. Glass,
5. Paraffine,
6. Fiber,
7. Vulcanite,
8. Shellac,
9. India rubber,
10. Resins,
11. Silk (uncolored),
12. Dry wood,
13. Porcelain,
14. Earthenware,
15. Oils (clean)
16. Paper,
17. Marble,
18. Slate.

LOCAL EFFECTS ON ELEMENTS.

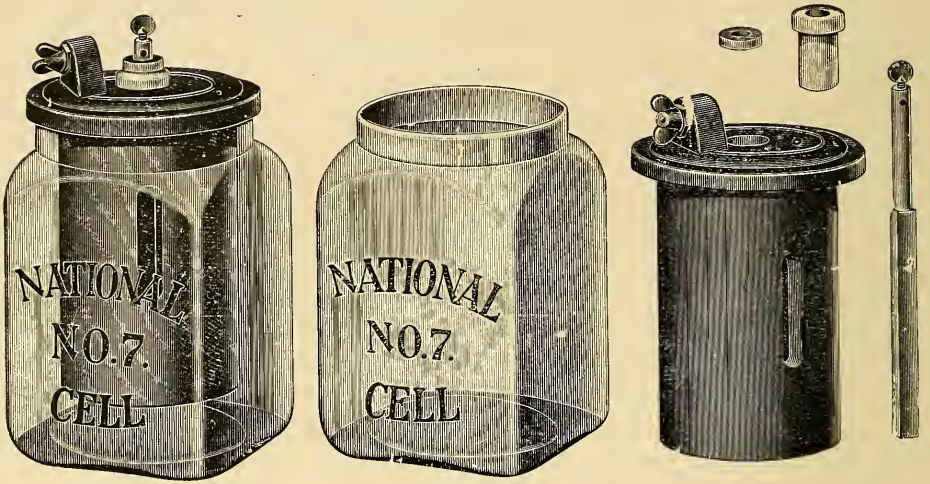
How are the cell elements affected?

We have shown the effects of the electrolyte on the surface of the cell elements, leading to increase of chemical action and polarization. There is also a local action on the zinc itself. Pure zinc is not easily corroded by the acid, but the ordinary cheap commercial article of zinc, is full of impurities, such as iron, arsenic, lead, carbon, etc. These being dissimilar to the zinc, when both are in the acid, we have a closed circuit between the zinc, the impurities, and the electrolyte, in fact many small cells or a battery of cells, acting on the surface of the zinc. This causes the zinc to corrode faster and weakens the main current. If the zinc is too impure, a hissing noise is heard at the zinc end of the cell, and violent chemical action occurs, heating the cell and weakening it.

How many types of primary cells? Name them.

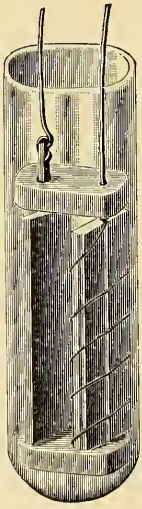
There are five types of primary cells, which are in common use among physicians for generating galvanic currents.

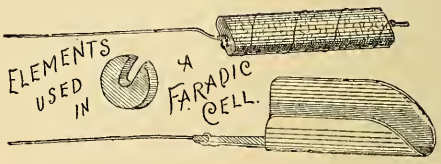
Those most commonly used are: 1, The Le Clanche; 2, Red acid or bichromate; 3, The paste or so-called dry cell; 4, The chloride of silver cell; 5, The blue stone or crow foot, or gravity cell.

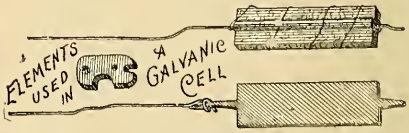


The Le Clanche Cell

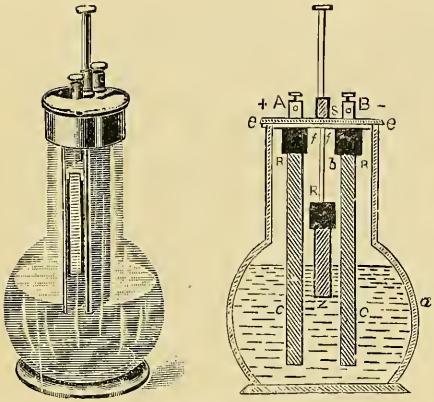
The Paste or
so-called Dry Cell



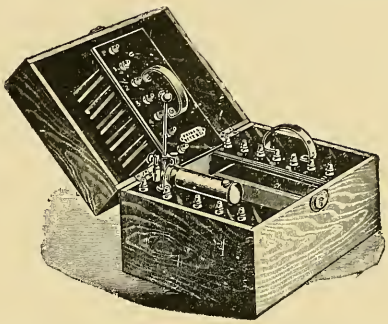




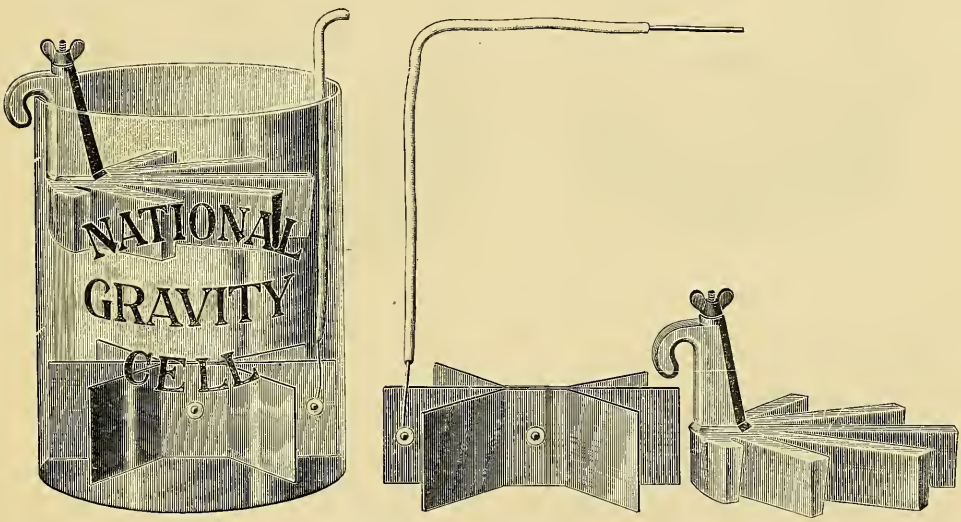
The Chloride of Silver Cell and Elements



The Grenet Acid Cell



Nested Acid Cell Galvanic Battery



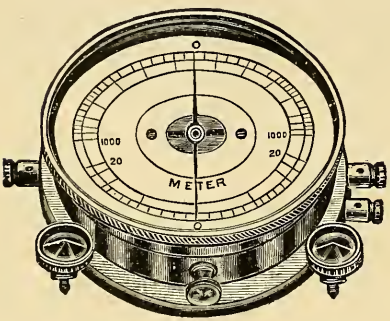
The Blue Stone or Crow Foot, or Gravity Cell

What is a Battery?

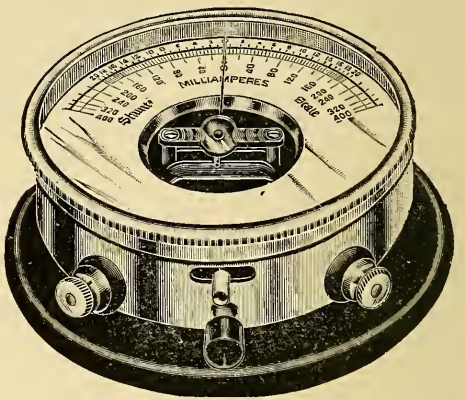
A battery is composed of two or more cells. Those known as "dry cell" are best for portable batteries, for the reason that they are cheap, compact, clean and efficient and require no attention. In fact there is no such thing as a "dry cell." They are called "dry" for want of a more expressive term. They contain a minimum amount of fluid which combines the chemicals to form the excitant in the hermetically sealed cells.

What is a milliampere meter, and its use?

A milliampere meter is an instrument for measuring amperage and may be of the terrestrial, or of the dead beat form. The first is in fact a compass needle which is deflected from its proper position on account of the passage of a current of electrification through a wire placed near it. The amount of deflection is read upon an appropriately arranged scale. The second form consists of a magnet suspended upon pivots between two other magnets, and the indicator comes to its proper position on the scale without oscillation, and the position of the instrument is unimportant, hence it is the more desirable form to use.



Terrestrial Meter



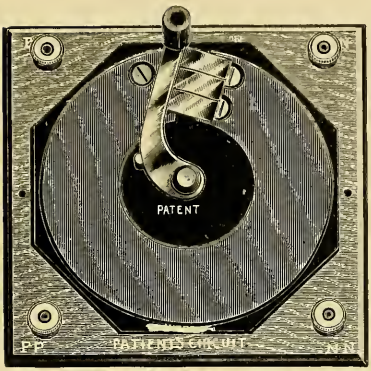
Dead Beat Meter

What is a rheostat, and its use?

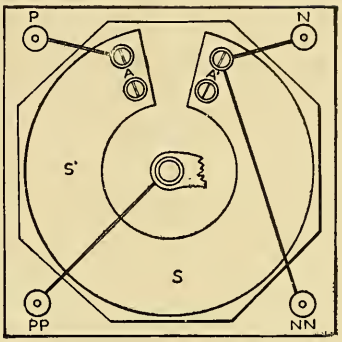
A rheostat may be made in several ways, but the best consists of a sickle shaped sheet of graphite upon a base of slate through which the current is made to pass by means of a revolving arm with a spring contact, the wires being attached to the graphite and arm by the way of binding posts, connected therewith.

A rheostat is used to vary the amount of resistance in the circuit and to do it so gradually that any shock to the patient will be avoided.

The graphite rheostat is constructed on the shunt principle, thus insuring safety in its employment with either battery or dynamo currents, for the most delicate operations. The current can be controlled from zero to the full voltage of the circuit absolutely without break or shock to the patient, as indicated by the perfect eveness with which the needle of a sensitive milliampere meter travels forward or backward as the current is increased or diminished.



Graphite Rheostat



Shunt Wiring

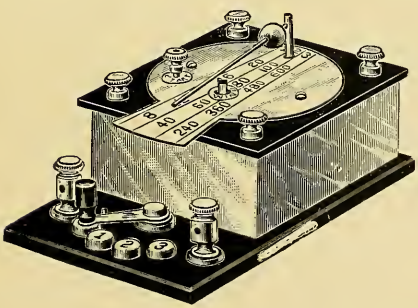
In delicate operations a current as small as one-thirtieth of a milliampere is frequently sufficient; but if the operation is to be painless, the control of the current must be absolutely perfect.

Remember:—This is a shunt rheostat with carrying capacity of one-half ampere, therefore, in using this controller with either the constant or the alternating dynamo current, it should be used in series with a 16 candle power lamp.

Caution:—Use care not to allow either grease, vaseline or oil to come in contact with the graphite surface, as the graphite is quickly removed by any free oil.

What is a rheotome, and its use?

There is a current breaking device, the "rheotome," which works automatically, breaking in gradations either the galvanic or faradic.



We show you here an automatic graduated interrupter or rheotome, which can be connected with any battery, to give slow or rapid breaks of the current; and may be adjusted so as to give from 8 to 660 breaks per minute. It runs by a clock work, and has a switch inside and a sliding ball or pendulum on a rod outside for regulating the number of breaks, at the will of the operator.

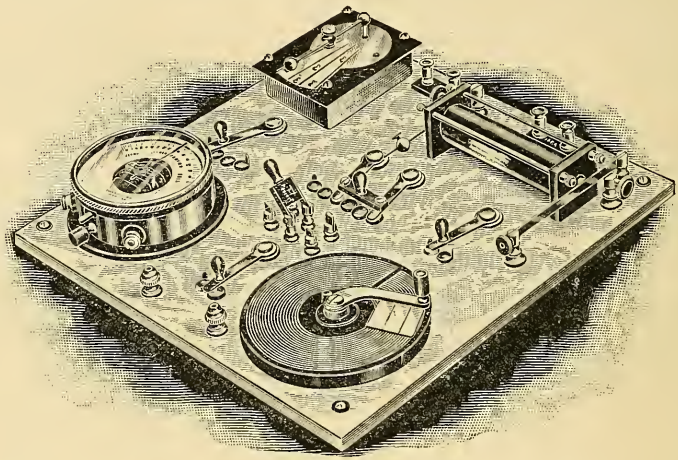
It is a well known fact that long after a muscle has lost its faradic irritability and will not respond to that current, it retains its galvanic irrita-

bility and can be exercised by the interrupted galvanic current, and the graduated automatic rheotome is a valuable aid in this class of work.

The clock work is most satisfactory where the interruptions range from 8 to 660 per minute. The hand motor is best suited for slower and irregular interruptions, the electric motor for a higher number per minute.

What are switchboard essentials?

Switchboard essentials are a milliampere meter, rheostat, rheotome, pole changer, with appropriate switches for each, also binding posts for attachment of battery wires and rheophores. A faradic coil may also be added.



We show here a table or wall plate with the essentials for complete galvanic and faradic outfit. It can be used with either cells or the incandescent current. When this switch board is used the cell selector is not used, and the cells are all connected in series, and the wires leading from the carbon of the first cell and the zinc of the last cell, are brought up to the intake posts of the switch board, the same as the wires brought from the street mains, and thence conducted through the different apparatus to the out-let posts or the patient's circuit. When used with cells, they are all used, and the voltage cannot be controlled as in the case of the cell selector, which is sometimes a disadvantage where there is very little resistance to overcome, as the current of 5 milliamperes from a battery of 50 cells with a pressure of 75 volts behind it, is much more painful about the face than the same strength of current, from 10 cells with only 15 volts behind it. Please remember that the important parts of the galvanic outfit are as follows:

1, Galvanic cells; 2, pole changer; 3, interrupter; 4, rheostat; 5, milliampere meter; 6, binding posts; 7, conductors; 8, electrodes.

1. The cells may be of any kind you may select. Those best adapted to an office cabinet are the LeClanche wet sal-ammoniac cell, or the paste or dry cell, and may be placed in any convenient place, closet, cellar, attic, or in the cabinet itself. Be careful that they do not touch and see that they get fresh water added to them occasionally to replace the loss by evaporation.

2. A pole changer is usually a double lever switch so connected that by moving it over, the poles are the opposite to what they were at first. This switch is simply for convenience. One simply avoids having to change electrodes or cords when wishing to change the polarity. The pole changer is also a slow alternator, by means of which powerful shocks may be given where great stimulation is required.

3, 4 and 5. The interrupter, rheostat and meter have been fully described before.

6. The binding posts are small metal posts to which the ends of the conducting cords are attached. They are simply used on account of their convenience.

7. Conducting cords or rheophores are for conveying the current from the battery to the electrodes or applicators, and they may be of wire, or tinsel cord covered with cotton, wool or silk.

The tinsel cords are the cheapest and most flexible, but the wires are the best conductors. The silk cover is the best insulator, and the nicest looking, but the cotton or wool covers wear the best.

8. Electrodes or applicators are the devices used for conveying the current to the patient. The surface of the ordinary electrode should be of carbon or of metal, nickel plated. The electrodes, for ordinary purposes, are covered with sponge or absorbent cotton. The latter is the most cleanly and should be used oftener than it is.

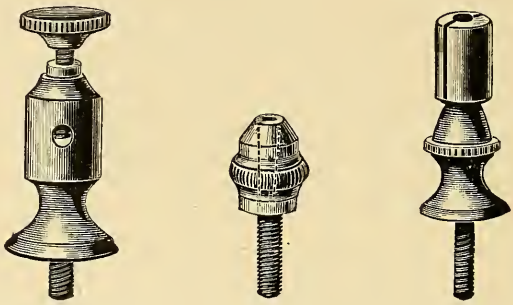
Whether sponge or cotton is used it should be moistened in a saline solution.

Adjustable Cord Tips

The above cuts show an adjustable cord tip to attach to the ends of the rheophores. These can be easily removed and replaced when the cords

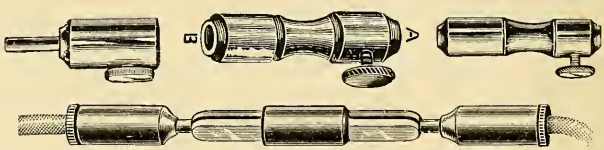
wear off. They have a tapering tip so as to fit into any hole of different sized binding post.

BINDING POSTS



Thumb-screw Socket Slot

The three cuts above show three forms of binding posts, for the convenience of attaching conducting cords or rheophores to either the battery plates or to the various electrodes.



This cut shows a very convenient "handy connecter," to join short cords together to make a longer one, if needed. The holes A and B are for the ends of the cord tips.

How are the cells connected to the switch board and each other?

Cells are connected to a switch board by wires, one from the zinc of the first cell, and the other from the carbon of the last cell in the series. Cells are connected to each other by means of short wires from the carbon of one cell to the zinc of the next cell.

(This diagram showing cells and connections does not refer to any particular cell, but is intended to show how to connect the negative and positive elements of any form of cells in series, and with the plate.)

From ZINC of 40th or Last Galvanic Cell to Galvanic Post Marked "N"
From CARBON of 1st Galvanic Cell to Galvanic Post Marked "P"
From ZINC of 3rd Faradic Cell to Faradic Post Marked "N"
From CARBON of 1st Faradic Cell to Faradic Post Marked "P"
Gal.
Far.
P
N
P
N
110
B
SHORT WIRE
SHORT WIRE
SHORT WIRE
SHORT WIRE
SHORT WIRE
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40

DIRECTIONS FOR SETTING UP AND CHARGING GALVANIC CELLS

Charging the cells:—Fill each jar two-thirds full of clean water, add a package (4 oz.) of sal-ammoniac; stir with a stick of wood until all the salt is dissolved. Place the carbon and zinc in the jar, being careful not to get the fluid on the outside of cell or connections.

Connecting the cells:—Place the cells in a cabinet, or on shelves, as desired, then connect zinc of first cell by means of a short wire, with the carbon of next, and so on until all are connected; (that is, zinc to carbon; zinc to carbon; zinc to carbon) and so on until all are connected in a continuous chain. Do not connect zinc of last cell to carbon of the first. See diagram of cell connections, shown on page 31.

VOLTAGE MODIFICATIONS

What is voltage, and how modified?

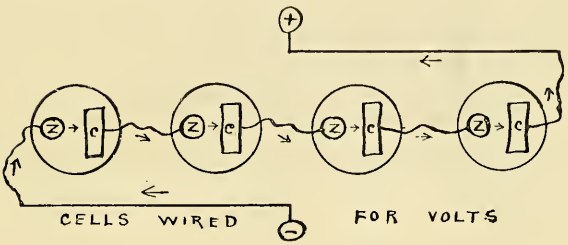
Voltage, or electro-motive force, is the push, pressure, or drive of the electrification, and this can be modified, according to Ohm's law, by varying the resistance. But this modification is made after the initial voltage is started. It now remains to be shown how the initial voltage may be changed.

This may be influenced by the kind of elements in the cell. Difference of potential is greater between a metal easily corroded by acid, as zinc, and an element not at all corroded, as carbon.

The voltage is modified by the kind of electrolyte. A strong acid will attack zinc more powerfully than a weak acid, or an alkali.

It would also be made weaker if the zinc was covered with salts, or nearly destroyed, or not properly amalgamated, or by the length of time in use. The voltage depends largely on the number of cells used. We can vary the voltage by adding cells. The voltage of a battery depends on the number of cells, not on the size of the cells. Every cell has a certain voltage, no matter what the size of the cell. Different kinds of cells, with different kinds of elements, and different electrolytes have different voltages. *Every thing else being equal*, the voltage of a cell the size of a barrel is no greater than the voltage of a cell the size of a gun cap.

The accompanying sketch shows four cells connected together in series for voltage. The carbon of the first cell, connected to the zinc of the second, the carbon of the second to the zinc of the third, and the carbon of the third



to the zinc of the fourth. Then the wires from the zinc of the first cell and from the carbon of the fourth cell have four times the voltage, or power of overcoming resistance, in an outside circuit, than would the wires from any one cell. The current strength of the four cells is no greater than that of one cell, but as we have shown by Ohm's law, increased voltage overcomes more resistance, allowing greater amperage to pass through the resistance.

AMPERAGE MODIFICATION

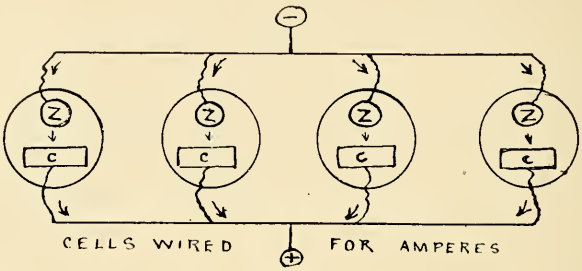
What is amperage, and how modified?

Amperage is the quality of current and it is modified by the size of the elements, the depth of their immersion in the electrolyte, their nearness to each other, and the amount of resistance in the circuit. The number of cells added, increases the amperage by enlarging the amount of area of the elements exposed to chemical action, when they are connected in parallel, that is, all zincs connected to one supply wire and all carbons connected to the other supply wire.

The current strength or output of a battery may be varied by the size of the elements, by their proximity and by the area of the surface acted upon by the electrolyte. Larger elements offer more surface for corrosion and a consequent increase of chemical energy and potential. The closer the elements are together in the cell the less the internal resistance offered. The deeper the elements are immersed in the electrolyte, the greater the surface for corrosion and current strength. As we cannot get large elements into a small cell, therefore the size of the cell makes a great difference in the output of electrification, or current strength or amperage.

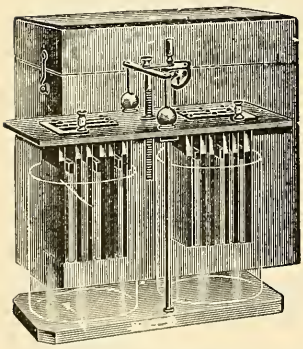
The accompanying sketch shows four cells connected together in parallel for current strength, (amperage). Here we have four small cells all alike, each with a certain voltage and amperage, but by connecting all the zincs to one wire and all the carbons to another wire while we have not in-

creased the voltage at all, we have increased the amperage four fold, because we have the equivalent to one large cell with just four times the corrodable elemental surface. This method of connection is called "multiple," or "parallel," and is the method used when it is desired to pass heavy currents through slight resistance, and therefore, according to Ohm's law requiring low voltage. This plan is employed in cautery work.

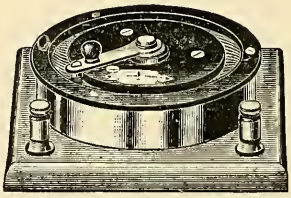


What is a cautery battery, and its use?

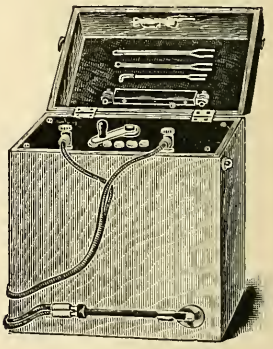
A cautery battery is one where the cells are connected in "parallel" for amperage, and the resulting current is compelled to pass through a wire whose resistance is great enough to heat it red hot. It is used for any purpose that requires cautery. If a "wet" battery, the zincs should not be allowed to remain in the electrolyte, except when the battery is in use.



Plunge Cautery



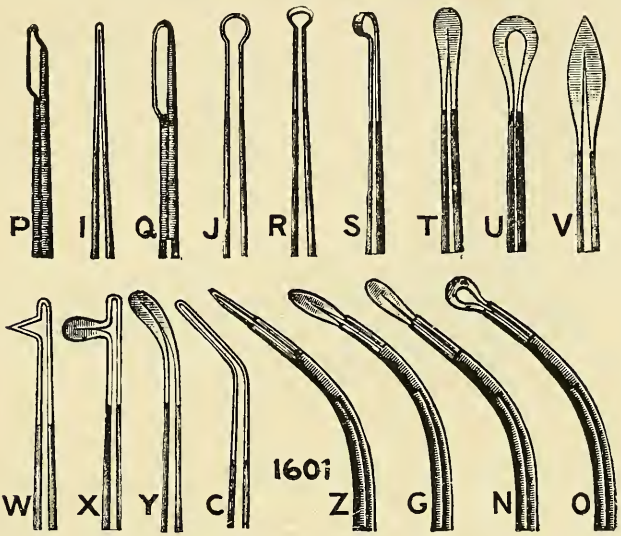
Cautery Battery Rheostat



Dry Cell Cautery

Any kind of cautery battery is used to burn or cauterize the tissues, wherever such treatment is desired. It is based upon the principle that the passage of a large current of electrification through a small wire, offering high

resistance, generates heat. The cells of a cautery battery are few in number, generally from three to eight, but the elements are very large, in comparison with those of the galvanic battery, thus creating a current of very large volume or amperage, and of very low pressure, or voltage.



Cautery Knives and Points.

Fig. 1601 shows a number of platinum knives and points, which experience has proven to be best and adapted for cautery work.

What is a storage battery, and its use?

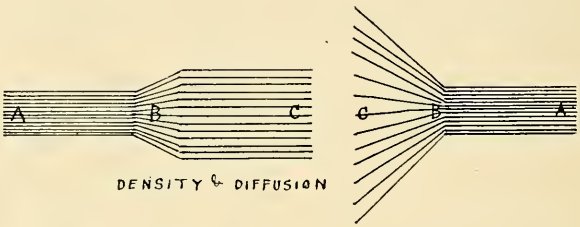
A storage battery consists of two elements, an electrolyte and a jar, or a number of them, connected together. The elements are both lead. There is no current, on account of the similarity of the elements, until a current of electrification has been passed through the battery, which changes one of the elements to oxide of lead, by electrolysis of the water in the electrolyte. Then the current begins for the same reason that it begins in any cell. Sometimes one of the elements is partially prepared in advance by perforating it with holes and filling the holes with oxide of lead. This kind of battery may be used for cautery work, or for running such machinery as fans etc. It is heavy and not easily moved about. It is also an expensive kind of battery. This prepared element is called a "*grid.*"

DENSITY AND DIFFUSION

What is understood by density and diffusion?

Density and diffusion are terms used to refer to the mode of transmission of the current through the patient's body. They vary with the size of the electrode. Where the current passes through a small electrode the current is concentrated at the point of application, and therefore more dense. With a larger electrode the lines of force are spread out more, or are diffused.

The density and diffusion of a current is directly proportional to the conductivity of the conductor and the area of the contact surface.



By referring to the above sketch we can see that if the conductivity of the left hand conductor is the same at A, B and C then the density of the current will vary in different places. The lines representing the current at A are closer together than they are at B, and at B more than at C. By referring to the right hand sketch we see that the dense current at A begins to diffuse at B, until at C, the point of contact, the current is widely diffused over a large area, and that the current is equally distributed over all parts of the surface at C.

We can take advantage of this when we wish to apply a large dose to a sensitive surface. By spreading it over a larger area it divides the resistance, and lessens pain.

POLAR AND INTER POLAR EFFECTS

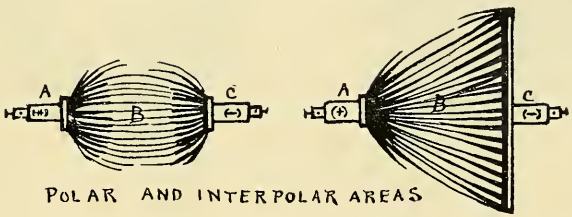
What are the polar and inter polar effects?

We have shown the local action going on inside the cell, resulting in polarization. It now remains to speak of the local polar, and inter polar effects of the electrification, outside the cell, and in the body tissues.

The chemical, mechanical and physiological polar effects of electrification will be explained later under the heads of electrolysis, phoresis, and catalysis. We will here only briefly state that the results or effects of elect-

rification, passing through the body tissues, are very different under the two poles, and between the poles. These effects may be increased or diminished, according to whether we condense or diffuse the current through the tissues, and is directly proportional to the density, diffusion and current strength.

Electrification is a great worker under all conditions and circumstances, but is also somewhat of a lazy dog, and always takes the easiest route, and goes by the way of the least resistance, regardless of distance. It also expends its greatest efforts where there is the most work to do, i. e., the greatest resistance to overcome.



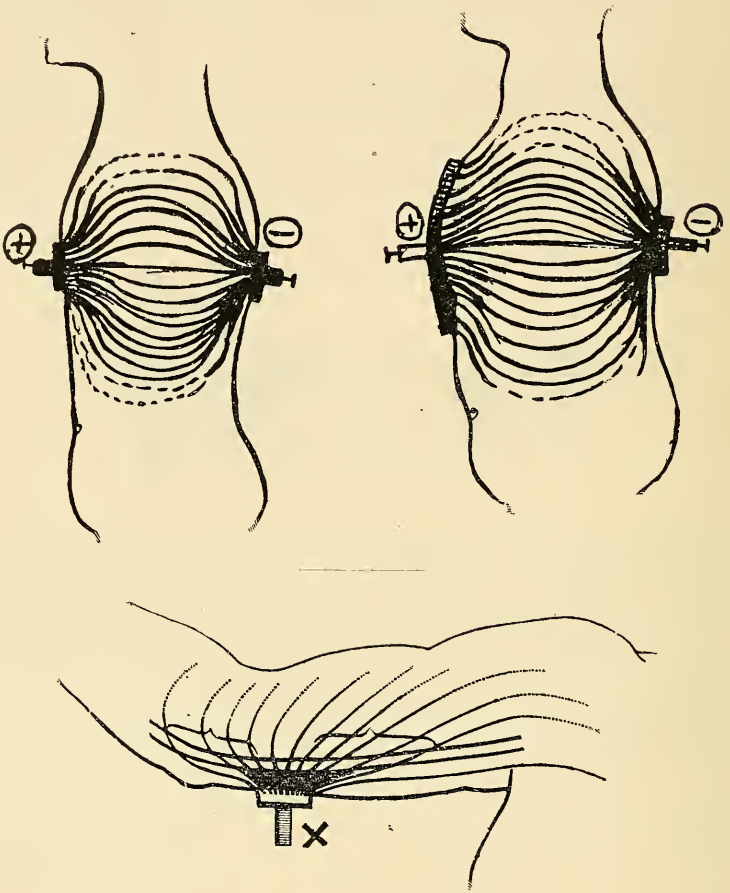
POLAR AND INTERPOLAR AREAS

The accompanying sketch will illustrate the polar effects at A and C, and also the inter-polar effects at B. In the left hand cut we have two electrodes, A and C, of equal size, thus giving equal polar effects under them, and a uniform diffusion of the inter-polar effects at B, where the lines spread out, become thin, then thicken and again come together.

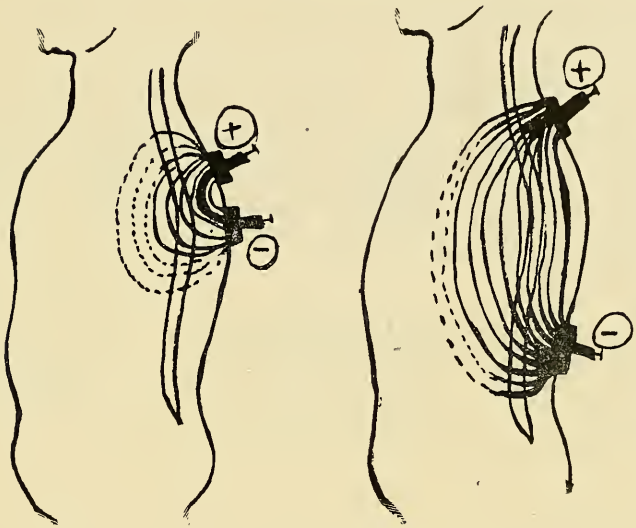
In the right hand cut we have the same size electrode at A, but an electrode eight times as large at C. Hence the local polar effect manifested at A will be just eight times as marked as it will be at any spot of the same area under the electrode C, and while the aggregate polar effect at C will be the same as at A the same will be so distributed as to be of less effect in any part of C. Also the inter-polar effect at B gradually diffuses between A and B.

These effects are still further shown in the accompanying sketches, showing the diffusion of the field of influence of the current, when passed through the human body from chest to back. The left hand cut shows the positive (+) electrode on the front, and the negative (—)electrode on the back with the same size electrodes. Here we would get marked local polar effects at both terminals, and an equal inter-polar effect through the body. In the right hand cut we have a large positive (+) electrode in front, and a small negative (—) at the back and a more uneven interpolar effect between them. In these treatments while both poles are at work we usually

speak of the smaller electrode as the active pole, and the larger one as the passive or "dispersive" electrode.



The accompanying sketch shows a concentrated effect under the active pole, which in this case is the positive (+), applied to the extensor surface of the upper arm. The two parallel longitudinal lines are made to represent an ulnar nerve, which is being treated with a (+) current, for the local polar positive effect, while just beyond the local positive (+) area, is a more diffuse general (+) zone of action. In this case the indifferent or passive pole is placed so far away as to obliterate any decided inter-polar effect, except in a mild and general way, for tonic effect, which will be explained more fully under the head of catalysis in another part of the book.



The above two sketches show the polar and inter-polar effects of electrodes of the same size when applied to the spine. The left hand cut showing a local or restricted field, in the upper dorsal region, and the right hand cut showing general or extended field of action, between the lower cervical and the lumbar regions. In these treatments, both poles may be said to be "active," and the inter-polar action pronounced.

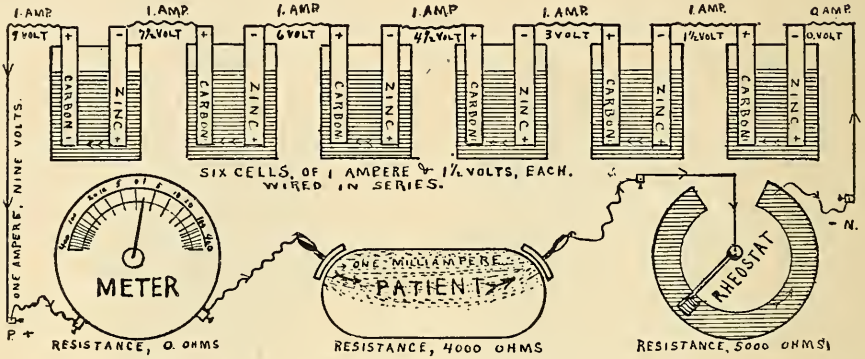
What is meant by "series" connection?

Cells are in "series" connection when the carbon element of the first cell is attached by a short wire to the zinc of the second cell, and the primary wires lead, one from the zinc of the first cell, and the other from the carbon of the second cell. Any number of cells may be thus connected to each other, being careful to have the primary wires leading from the battery, one from the zinc of the first cell, and the other from the carbon of the last cell.

We have shown before how cells connected in "series," like a train of cars, or a tandem team, give increased voltage.

The accompanying sketch shows the scheme of connecting in a series circuit, the battery, milliampere meter, rheostat, conducting cords, electrodes and patient. It is not necessary that they be joined exactly in the same order as here shown. The patient may be placed anywhere in the outside

circuit, but the current must pass through the meter, rheostat, etc., and patient to complete the circuit.

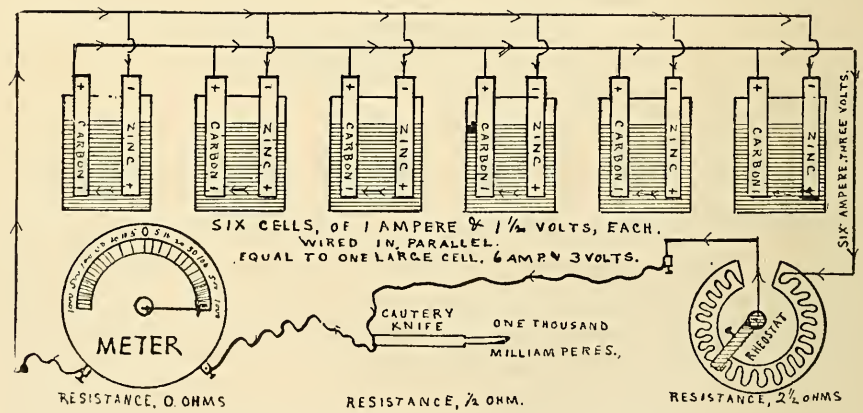


SCHEME OF WIRING OF GALVANIC CIRCUIT

What is meant by "parallel" connection?

Cells are in "parallel" when one primary wire running the length of the battery, is connected to each and all of the zincs, while the other primary is similarly attached to all of the carbons.

We have shown how amperage or current strength can be modified by connecting cells in "multiple" or "parallel," thus greatly increasing the



SCHEME OF WIRING OF CAUTERY CIRCUIT

surface of zinc to be corroded, and therefore increasing the potential and amperage. This way of connecting cells, to get a current of great strength or amperage, and little pressure or voltage, is used in the cautery battery for cautery work.

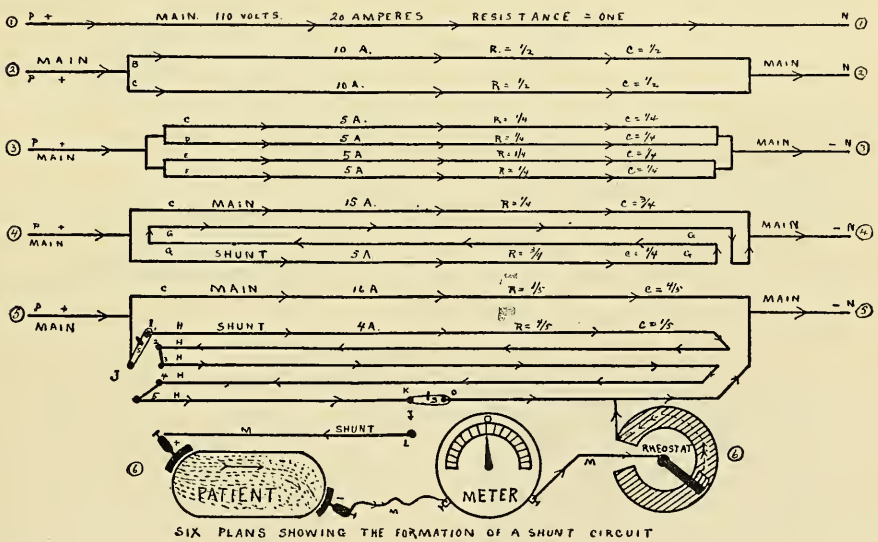
The accompanying sketch shows the scheme of wiring of a battery of six cells, arranged in "multiple" or "parallel" for volume and also shows how such a multiple battery is connected, in series, with a milliampere meter, rheostat, cautery cables and cautery knife.

How do galvanic and cautery currents differ?

Galvanic currents proceed from batteries connected in "series," and are different from cautery currents in that their voltage is high and the amperage is low, whereas the latter have low voltage and high amperage. The cautery currents are derived from batteries connected in "parallel."

What is meant by "in shunt?"

"Shunt" means where a heavy current is made available for therapeutic use by subdividing it by means of several wires of different sizes, or lengths, or both, whereby a current approximating the desired strength may be obtained by putting into the circuit, the branch wire carrying such reduced current.



SIX PLANS SHOWING THE FORMATION OF A SHUNT CIRCUIT

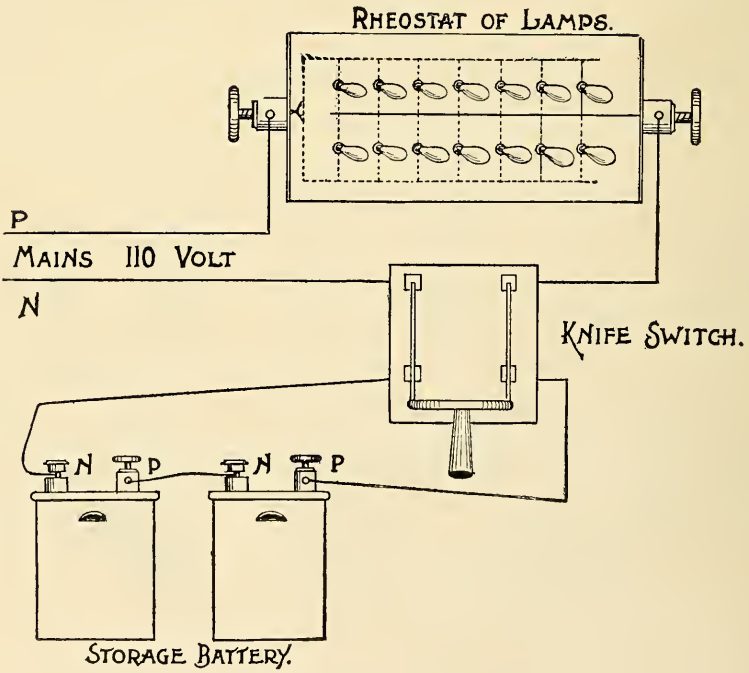
If a current of electrification is allowed to traverse a number of conductors, it will always choose the path of the least resistance, without regard to length, just as water running down hill, and meeting with some abstruction in its path, will flow around it.

"Shunting" is sidetracking and may be compared to the branching of a stream or river as shown in the mill race, where the water supply may be derived from a river running at any velocity; by grading the race to a given fall the velocity is attained independant of the river. The rheostat may be used with either the galvanic or faradic currents.

We will call attention to the accompanying sketch in which are shown five main wires, each different, but showing the varions steps in the development of a "shunt" as adapted for the control of heavy currents, so as to modify them for use in electro-therapeutics.

When we speak of the wires coming from a chemical cell or battery, we call them the "primary" or "prime" wires, carrying a "primary" current in contra-distinction to a "secondary" wire, which carries a "secondary" current. When we speak of the wires coming from an incandescent or street circuit, we call them "mains."

SHUNT LAMP RHEOSTAT



The accompanying sketch illustrates the principle of a shunt when used to charge a battery of storage cells. Here the storage cells are wired in series with a double knife cut-out switch, one side with the negative main (N), the other in series with a rheostat made of fourteen incandescent lamps wired in parallel and connected to the positive main (P).

HOW TO TELL THE POLARITY OF YOUR BATTERY

How do you tell the polarity of a battery?

The positive pole galvanic is acid, and the negative alkaline.

Wet a piece of blue litmus paper; place upon it the cord tips from battery, and turn on current. The paper under positive end will turn red, and the negative tip will turn bluer. Reverse the position and the red spot will again turn blue, showing both acid and alkaline reactions of different poles.

Place cord tips in water and turn on current. Bubbles of hydrogen will come from the negative tip, while positive tip will turn black, be covered later with white, and nickel will be destroyed.

Place cord tips in saturated solution of iodide of potash; turn on current, and free iodine will be liberated at positive pole and will color water brown.

Attach cords to steel needles, and insert them into a piece of fresh, moist beef, turn on current, and the positive needle will stick fast, while the negative will remain loose, and be surrounded by froth.

What is meant by electrification?

Electrification is a term applied to the force manifested when, through chemical action, friction, or otherwise, the normal electric equilibrium existing in any substance is disturbed, thereby creating between it and some other substance, what is called "difference of potential". This difference of potential causes a current of force to flow from one substance to the other, when a suitable conductor intervenes, which is called a current of electrification.

What is meant by magnetization?

Magnetization is a force somewhat akin to the force of electrification, but differs principally from it in that its force is not prevented from exerting itself by the interposition of a di-electric, which is any elastic, transparent substance, of which air is an example. It manifests polarity. Lodestone possesses this force naturally. Magnetization may be intensified by electrification.

What is meant by "dielectric?"

A dielectric is an elastic, transparent insulator, and this term is usually applied to the atmospheric air.

What is meant by "field" and "lines of force?"

Any conductor, when energized by a current of electrification is surrounded by an area or zone of electric influence, the strength of which is directly proportional to the initial electric potential, and to the distance from the conductor.

The accompanying sketch represents this zone, or series of zones, of influence surrounding a live wire. The right hand cut shows the heavy concentrated zone close to the live wire in longitudinal section, while the small left hand sketch shows the same in tubular or ring zone arrangement around a live wire in a cross section. This area of more or less active influence surrounding the live wire is called the "*field*," and the different zones, as represented by the parallel and circular lines, are called "*lines of force*."

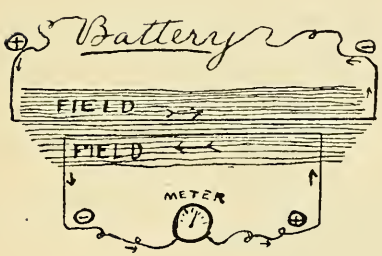
What is meant by electric induction?

Electric induction is the process by virtue of which a current of electrification is created in a wire, by the passage of a current of electrification through another wire lying parallel to it. It is by this same process that magnetization creates a current, when the wire is brought within the "magnetic field."

What is an induced current, and in which direction does it flow?

The induced current is the secondary current set up in the parallel conductor, immersed in the "field," and flows in the opposite direction to that of the "primary" or inducing current.

This is shown in the accompanying cut. Here is a primary live wire from a battery, showing a field, the influence of which is exerted from left (+) to right (—). Immersed in this field is a secondary wire, insulated from and in no way connected with the first. To the ends of this secondary wire we attach a meter of the galvanometer type, which is most sensative to slight currents. The needle of the meter in this secondary current will be deflected to one side. Mark the direction. Now reverse the primary current direction and immediately the needle of the meter swings over to the opposite side. Thus, reversing the primary reverses the secondary. Now connect the meter direct to the primary circuit, with the current flowing in a known direction and you will get the deflection just the opposite to what it was when the meter was in the secondary circuit, with the primary flowing.



The secondary current which is generated in the secondary wire, in the primary field, is called the "*induced current*" and this process is known as "*induction.*"

What is meant by electro-magnetic induction?

Electro-magnetic induction is a process similar to electric induction, by which is generated a magnetic field and lines of force, which influence a conductor immersed in the field, generating an induced current in the parallel conductor. The combination of the two is known as electro-magnetic induction, and the combination greatly increases the potential of both, and the combined generator is known as an electro-magnet, and consists of a coil of insulated copper wire wound around an iron rod known as a "core," and forms the basis of the induction machine known as the faradic battery.

What is meant by hysteresis?

Hysteresis is a term applied to rapid magnetization and demagnetization of a soft iron core lying within a coil of insulated wire, through which an automatically interrupted galvanic current is passing.

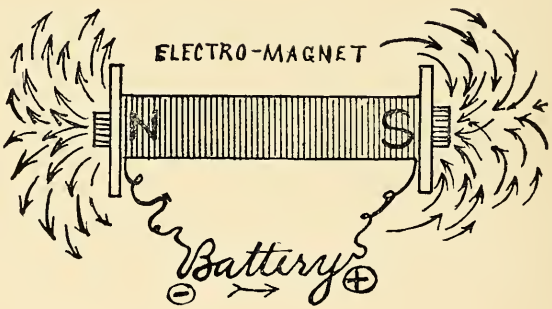
THE PRIMARY COIL

What is a primary coil?

A primary coil is one of coarse wire, wound about a cylinder, called a helix, through which a galvanic current is caused to pass interruptedly for the purpose of inducing hysteresis in a bundle of soft iron rods within the helix, called a core.

Thus we see, by the accompanying sketch, where a bundle of iron wires is immersed in a primary field. This bundle of iron wires, insulated from the coil of wire, is called a "*core*". The wire so wound about the core is called the "*primary coil*".

How is induction modified?



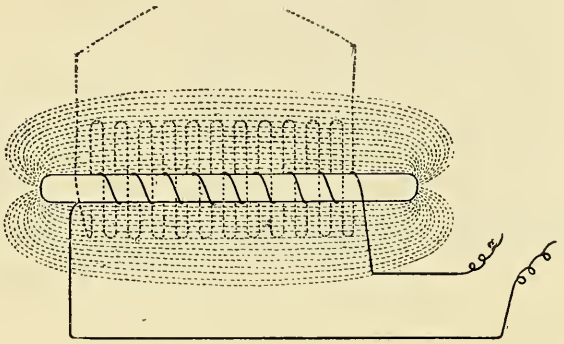
The induction is modified or varied by several factors:
First—By the strength of the primary current.
Second—By the size of the primary wire.
Third—By the number of turns in the primary coil.
Fourth—By the length and thickness of the core.

THE SECONDARY COIL

What is a secondary coil?

A secondary coil is one of fine insulated wire outside of the primary coil. It is of great length, and the only current that it carries is the one

created by induction from the magnetized core and primary coil. Its current is an alternating one, inasmuch as the current induced by the "make" of the galvanic current is in an opposite direction from the one induced at the "break" of the same.



The accompanying sketch shows a core, primary coil, field and secondary coil. The heavy lines represent the primary coil around the core, throwing out many lines of electro-magnetic force and generating a very strong *field*. The light dotted lines represent many turns of a secondary coil parallel to the primary coil and immersed in the strong field. This secondary coil cuts many more lines of force at right angles, and there is generated an induced secondary current of very high voltage potential. The longer the secondary, the more magnetic lines of force cut and the greater the inductive force, within the limit of saturation.

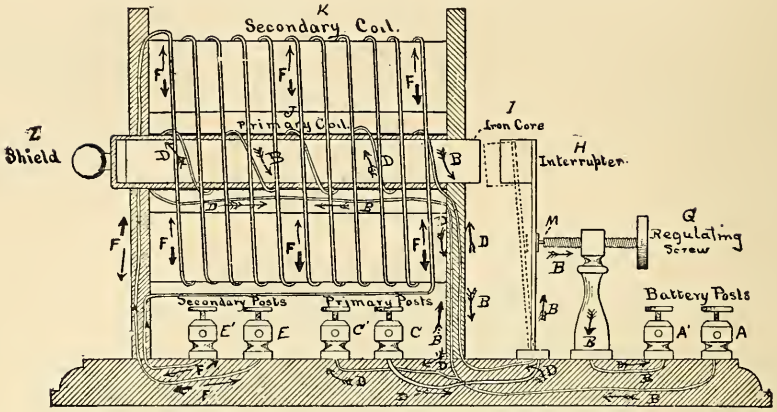
What is the limit of saturation?

There is a limit to the extent of the combination or electro-magnetic field beyond which the induced current is not strong enough to overcome the resistance to the passage of the secondary current through the secondary coil. This is called the "*limit of saturation.*"

THE PHYSICIAN'S INDUCTION COIL

What are the essentials of a faradic battery?

The accompanying sketch shows a complete electro-therapeutic induction coil. It consists of the following essentials for the best results in therapeutics.



Working Diagram. Physicians Induction Coil

1. Some form of chemical or other generator.
2. A primary coil.
3. A soft iron temporary magnet, or core.
4. An interrupter or circuit-breaker (vibrator).
5. A secondary coil.
6. A means of varying the primary current.
7. A means of varying the secondary current.
8. Binding posts.
9. Electrodes and conducting cords.
10. A shield, or muffler (not absolutely essential).

What is the function of the vibrator and muffler?

The vibrator is in fact a rheotome, whose function it is to automatically interrupt the current in the primary coil, thereby producing hysteresis in the soft iron core within the coil. The muffler's purpose is to restrict the extension of the electro-magnetic field into the substance of the secondary coil. The amount of restriction depends upon the degree to which the core is covered by the muffler. The muffler acts as a short circuit to the magnetic flux. It may be (and usually is) placed between the core and primary coil, in which position its restrictive influence is also felt upon the primary current.

What is the nature and effect of faradic currents?

Faradic currents are of two kinds: primary and secondary. The primary current is an interrupted constant current or rather an interrupted galvanic

current, increased and modified in effect by the process of hysteresis going on in the central iron core. Its effects are superficial, and more painful than those of the secondary coil. The electrolytic and other chemical effects are so slight as to be of no consequence. It affects chiefly the superficial nerves and muscles.

The secondary current is an interrupted, alternating, induced current, created wholly through the inductive influence of the primary current and hysteresis in the central iron core. Its effects are entirely mechanical and will extend to the deeper nerves and muscles. It is sedative and anaesthetic, and owing to its high voltage, it will penetrate deeply into the tissues.

VARIATIONS OF THE INDUCED CURRENT

How may the faradic current be varied?

The secondary, induced or faradic current may be modified or changed in the following various ways:

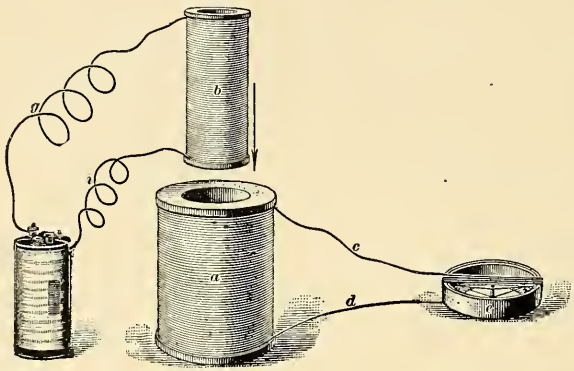
1. By the size and number of the cells.
2. By the size, length and number of turns in the primary.
3. By the rapidity of the interruptions at the vibrator.
4. By the muffler, in three places:
   (a) Between the core and primary.
   (b) Between the primary and secondary.
   (c) Outside the secondary,
5. By the kind, length and diameter of the core.
6. By the size, number of turns and length of the secondary coil, which is still further regulated by the number of taps of the secondary at different lengths, or by the number of interchangable secondaries.
7. By the distance the movable "sledge" secondary covers the primary.
8. By a shunt primary controller, if the street current is used.

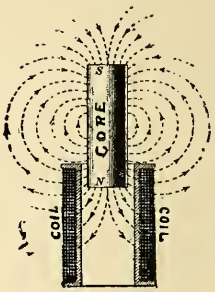
What can you say of the polarity of the faradic current?

The primary current from a faradic battery has the same polarity as any other constant current of similar strength, except that it is interrupted. The secondary current, being an alternating one, reverses polarity at each interruption, being in the opposite direction from that in the primary coil when the current is "made," and in the same direction of that which flows in the primary coil when the "break" occurs. The "break" current is somewhat the strongest.

What is a "sledge" coil?

A sledge coil is a secondary coil which is made to slide on and off the primary coil, for the purpose of varying the strength of the current which it carries. The current is weakened by drawing it more or less from the the magnetic field, and strengthened in the opposite way.

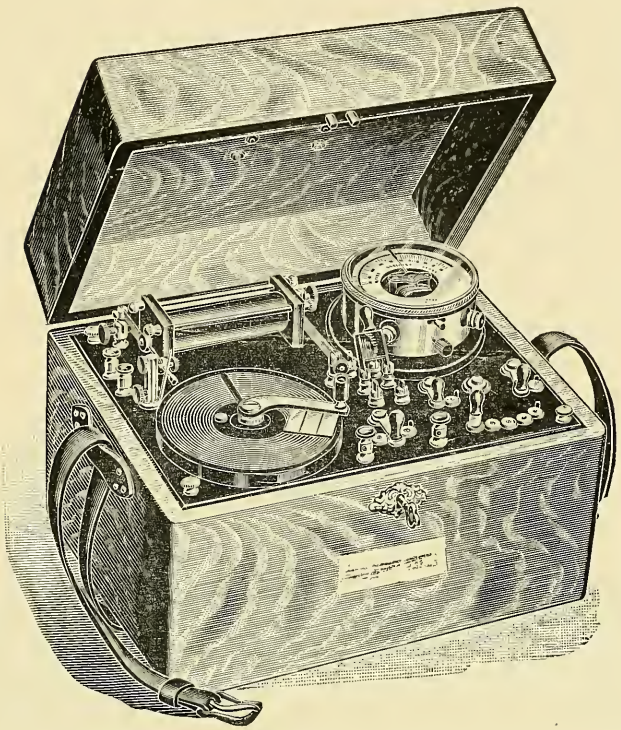




The accompanying cuts illustrate the complete separation of the core and primary connected to a galvanic cell, from the secondary connected to the meter. Simply lowering coil (b) inside the coil (a) starts the induction. This is shown in the left-hand cut. The small right-hand cut shows the lines of electro-magnetic force soaking through the outer end of the secondary coil. You can at once see how, by merely pushing the core and primary further into the secondary coil, that more turns are saturated, more lines of force cut and more induction and secondary current is generated in the outer coil.

What is a combination battery?

The cut (p. 51) shows a new design for a combination of galvanic and faradic batteries, both in the same case, for convenience and portability. It can be used with a number of small dry cells or can be connected and used with the 110 volt direct incandescent light current, only requiring a connecting cord and plug, to screw into a lamp socket at your office or at the patient's home. It consists of an improved double scale (0-20, 0-400) shunt milliampere meter, graphite rheostat, pole-changer and other necessary switches. The coil has both the hammer vibrator, with heavy ball attachment for slow vibration at one end, and a ribbon rapid vibrator or "singing rheotome,"



at the other. This gives a wide range of usefulness, both for office and outside work. The case is 10 x 11½ x 15 inches, and is strong, light, handsome and durable, with a carrying strap.

What is a sinusoidal current?

A sinusoidal current is an alternating current, whose alternations occur gradually, practically without interruption. The potential in one direction is gradually overcome, neutralized, and finally succeeded by an equal amount of potential in the opposite direction. These changes follow the line of a sine curve, when illustrated diagrammatically, hence the name.

What is the nature and effect of the sinusoidal current?

The sinusoidal apparatus consists of a permanent magnet, between the poles of which an armature revolves, while a coil with a soft iron core is connected with each pole upon the outside. This current produces physiological and therapeutic effects, which are not obtained by any other form

of current. The applications are painless, and afford excellent exercise to muscles, producing marked contractions without any other sensation than that of motion. The effects can be limited to a single muscle or set of muscles. When the machine is run slowly it produces interrupted contractions, and when run rapidily causes tonic or continuous contractions. This current relieves pain and excites the nerves of special sense. Applied to the region of the eyes it causes luminous impressions, without any pain, prickling or the sensations that attend the galvanic or faradic current. Applied to ears, entirely deaf, from disease of the middle ear, sounds are heard. The sinusoidal current is often anæsthetic when all other currents are not. The machine can be run by foot, water or electric motor power.

What is the difference between sinusoidal and faradic currents?

The faradic current, as distinguished from the sinusoidal current described in answer to the preceding question, is an induced current whose

Fig 1. Tracing made by current from sinusoidal apparatus.

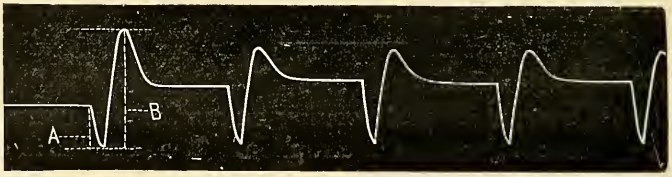


Fig. 2. Current from faradic apparatus. A, make; B, break.

Fig. 3. A, current from faradic apparatus. Same as Fig. 2, but with different adjustment of rheotome. B, current reversed.

interruptions are abrupt, especially the one caused by the break in the primary current, consequently the current is accompanied by shocks, which may be severe and painful, if the current is strong enough, and the interruptions come too slowly to produce tetanization of the nerves and muscles. The sinusoidal current is painless in its passage through the tissues. Both currents are alternating, and hence devoid of polar effects.

What is a dynamo?

A dynamo is a machine for the purpose of generating a current of electrification. It consists of a revolving part, called an armature, from which a current is conducted to the wires leading from the dynamo, and which is induced in the coil contained in the armature, by the revolution of the armature between the poles of a magnet, which constitutes a part of the dynamo.

What is the nature of a dynamo current?

A current generated by a dynamo is made up of a large number of impulses caused by the armature passing the magnet as the armature is revolved. When a commutator is used on the dynamo these impulses all flow in the same direction in the line wires; and this is called a *direct* current; but when no commutator is used, the impulse travels out on one line wire, and when the armature has traveled ½ revolution, the impulse travels out over the other line wire, or in other words, these impulses change the direction in the line wire to the opposite direction each half revolution of the armature. If you number these impulses, the even numbers will all travel in one direction and the odd numbers will all travel in the opposite direction in the line wires. This is called *an alternating current.* Each impulse is called an alternation. Two consecutive alternations are called a *cycle.* The ordinary alternating current has 60 cycles a second, or 7,200 alternations per minute.

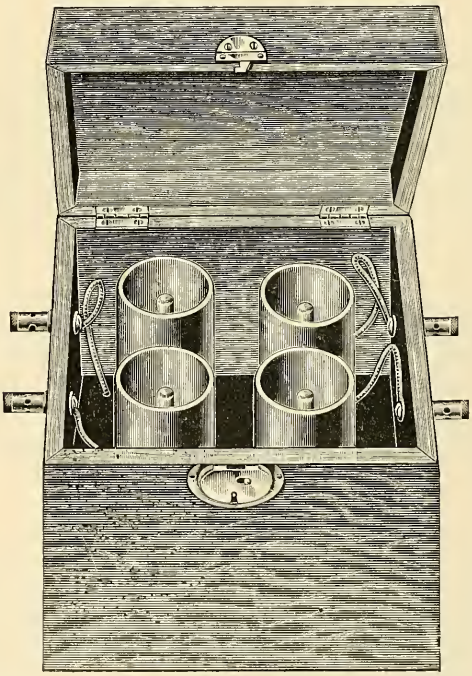
How may alternated commercial currents be utilized in electro-therapeutics?

Alternating commercial currents may be used to produce the sinusoidal current, for cautery purposes, for diagnostic lamps, and by the use of a transformer it may be used to produce the effects of a direct current. The transformer is a motor whose power is derived from the alternating current, and is utilized in running a direct current dynamo. This apparatus is called a motor-generator. A motor generator can be used to transform an alterna-

ting current to a direct, but this is expensive. An alternating current can be used for lighting and power, and can be transmitted long distances more cheaply than the direct current.

What is a rectifier, and its uses?

A rectifier is an apparatus by means of which it is possible to so change or transform an alternated commercial current, as to make of it a direct or unidirectional current, which may be used for electrolytic work. It will not however remove entirely the pulsating character of the current, and therefore is not to be advised for delicate operations about the face, such as the removal of hairs and small facial blemishes. For the ordinary run of electro-therapeutic work the rectifier can be used in connection with the alternated current. Neither a direct or a rectified alternated current is as mild or as good in effect as the true galvanic current which is derived from the chemical cell of a battery.



ALTERNATED CURRENT RECTIFIER

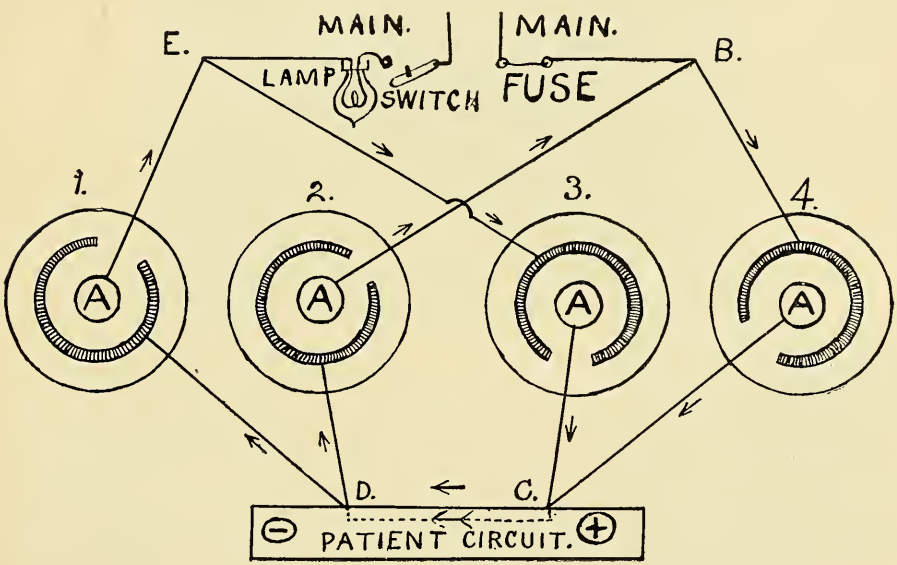
The accompanying cut shows the common form of rectifier, with four

aluminum cells arranged in a quadrangle, although they may be arranged in a row, if more convenient, to place on top of a wall plate case.

There are several kinds of rectifiers, as the magnetic, inductive, mechanical, and electrolytic, but the last named kind is the best, because it is the most reliable, simplest and cheapest, and most economical, and having no moving parts, will not get out of order.

They are called aluminum cells, because one element of the cell is made of aluminum.

The practical value of the rectifier depends on the peculiar property possessed by aluminum, in that it will offer a very high resistance to the passage of the current, when it is so placed as to be the anode of the cell, but does not so act when placed so as to be the cathode in the cell.



PLAN OF WIRING OF ALUMINUM FOUR CELL RECTIFIER.

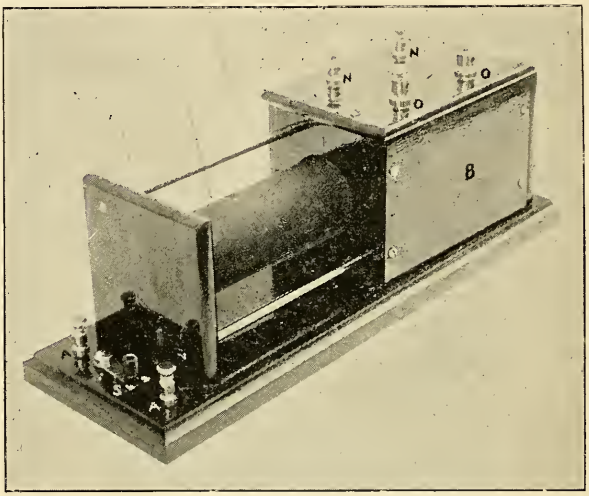
This disposition of the cells was arranged by Grætz, and is an application of what is known as the Wheatstone bridge.

If we pass an alternated current through an aluminum cell, as mentioned above, we will have an almost complete and instantaneous arrest of an impulse in one direction, but there will be no change in the impulse in the

alternate direction, and we would have an interrupted current, and it is on this basis that the four cells of the rectifier shown in the accompanying cut are grouped so as to lead all the impulses of both alternations in the same direction, and deliver a continuous current.

NATIONAL COLLEGE SINUSOIDAL TRANSFORMER

What is a transformer, and its uses?



This apparatus is for use only with the alternating incandescent current, and can be wound to suit currents of any voltage. It consists of a large stationary core and a thin primary winding, through which is sent the alternating street current, which rapidly magnetizes and demagnetizes the core, making corresponding fluctuations in the lines of force around the primary coil and core. By means of an endless screw, not shown in the cut above, which works with a crank, the secondary coil is moved smoothly and easily over the primary after the sledge manner, cutting the field of the lines of force, which generates a secondary or induced current of high voltage, having the power of producing anæsthesia, and powerful painless muscular contractions. By means of another secondary of different size and length of wire, this little coil produces a current for cautery work and for lighting exploring lamps.

It is always ready, no battery to keep in order, and is as handy as the lamp that lights your office. It draws about the same current from the

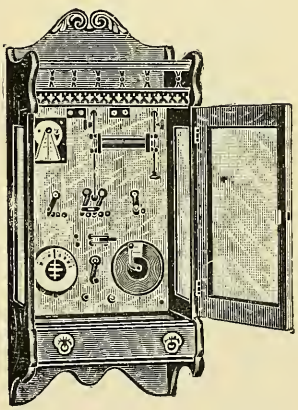
street mains as would be necessary to light a 32 c.p. lamp, when heating the heaviest cautery knife. To use it you only have to connect it in where you do a lamp and attach your cautery cords to binding posts marked O, then move the box B to the left gradually, until the desired heat is obtained; also for exploring cavities with a small lamp it may be connected in the same way as the cautery cords. The alternating current can be used with perfect safety in the office with this apparatus either for diagnostic, cautery or therapeutic purposes.

For treating patients you connect cords in the smaller binding posts N and move the box B to the left, until the desired strength of current is obtained. This gives the sinusoidal current, which has been found invaluable in treating rheumatism and other diseases of that nature. A rotary direct current alternator can be used if the alternating current is not obtainable.

THE WALL PLATE

What is a wall plate?

Many physicians want some apparatus for the practice of electro-therapeutics, which will be complete, well made and reliable, compact, ornamental and attractive, at the same time reasonable in price. The plate shown herewith contains the essentials. It is mounted in a handsome well-made oak, imitation rosewood, or white enamel case, to be attached to the wall, with glass front door and sides, and a drawer below for electrodes, and a shelf above. The cells may be in an adjoining room, or in some convenient closet, or in the attic or cellar, or if the street current is used, the wires are easily attached and concealed.



When closed it adds to the appearance of the room, and the different parts are protected from dust and moisture. When open it is ready for use at a moment's notice. The plate contains a long fine wire high tension faradic coil, with a fine and coarse interrupter, also double singing ribbon and ball vibrator, giving a great variety of effects. The graphite rheostat, which is the best kind, will safely and surely control either the galvanic, faradic or combined currents so that the operator may give any dosage from the mildest to the full capacity of the battery without danger of shock.

The shunt milliampere meter is the most important part, as it measures

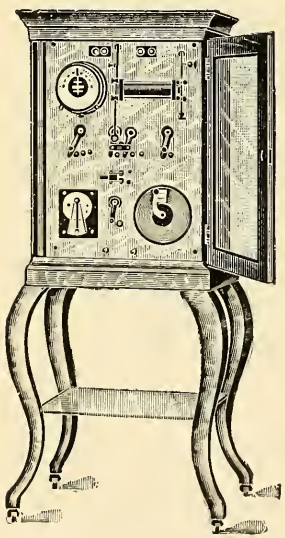
the dose. It has a long scale for heavy doses registering from 0 to 400 ma., a short scale for light doses, from 0 to 20 ma. You always should know the amount of current passing all the time. The rheotome gives various interruptions of either, from 8 to 600 per minute. It is automatic, and has a scale on the face with guide to set the ball on the pendulum so as to get any desired number of interruptions. All needed switches are in place and the whole is simple and easily operated, and will not get out of order. This wall plate is not intended for diagnostic or cautery work, but for general electro-therapeutics, and aside from the fact that in neatness and elegance the outfit leaves nothing to be desired it is guaranteed to be substantial, and will give many years' service.

The plate is made of white Carrara marble, 18 x 24 inches, wired for either cells or 110 volt current. One pair of cords, one pair of hand electrodes, one foot plate go with each case. Shipping weight about 150 pounds.

A ROLLER CABINET BATTERY

What is a cabinet battery?

We show elsewhere, a large floor-wall cabinet and a smaller wall cabinet battery, both of which are good and adapted to certain conditions. Both of these may be classed as permanent office fixtures. However, it is sometimes more convienent to have something which, while complete and permanent, may still be movable. Such a cabinet is shown in the accompanying cut. This consists of a cabinet with a glass door which, while protecting when not in use, still does not hide. This contains a switchboard complete with all of the essentials enumerated elsewhere, mounted on a white marble plate 18 x 24, with ample room behind it for forty dry cells, which will not spill. The case is placed on a base with iron legs, making it strong. It has rollers underneath, so that it may be easily tranpsorted about a room, or from one room to another, if necessary. It may also be operated with the 110 volt direct incandescent light current, the adaptation and use of which will be taken up in detail later. In this event, all that is necessary is a flexible cord and plug to screw into suitable sockets placed at convenient points, where you desire



to use the roller cabinet. A plate glass shelf below will temporarily accommodate the electrodes, etc., but all these should be protected from atmosphere, to preseve their finish when not in use.

What is the nature and effect of the commercial current?

The constant current generated by a dynamo or storage battery differs in action in no essential particular from the constant or galvanic current produced by chemical action in some one or other of the many forms of galvanic cells customarily used by physicians, while the electro-motive force is, as a rule, much less variable. The advantage to the physician of having a current supply from a central station and thereby freeing him from the innumerable annoyances inseperable from the attempt to keep a series of primary batteries in efficient working condition, can be readily seen and appreciated by all who have worked in this field. If, then, incandescent light currents or dynamo currents used for propelling street cars or running other motors were accessible to all physicians, it has occured to many that electro-therapeutic apparatus might be greatly simplified, for then provision for controlling the current and adapting it to the physician's work would alone be needed.

THE CURRENT CONTROLLER

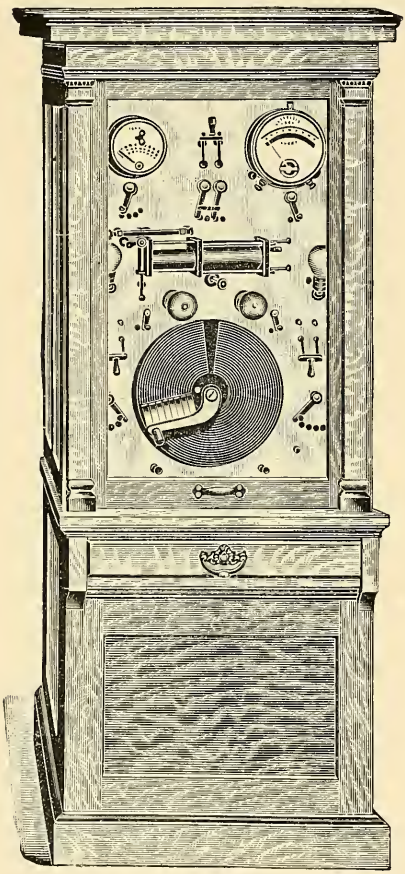
What is a current controller, and its uses?

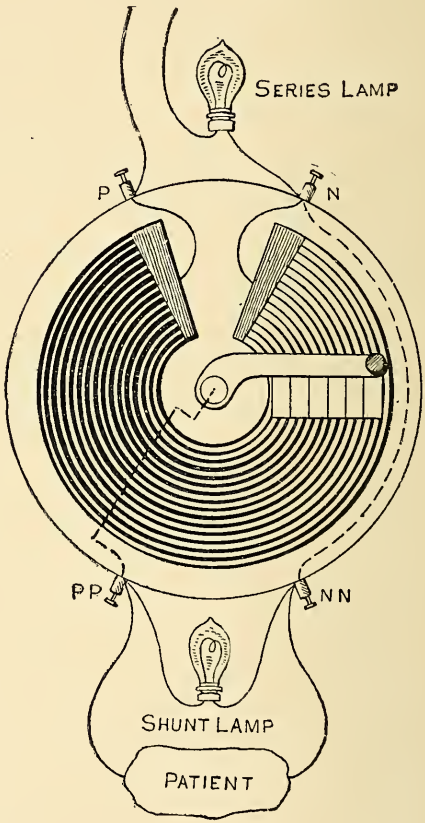
The cut (p. 60), at the left, shows the complete Massey electro-therapeutic cabinet, in which is a current controller in the shape of a round graphite rheostat.

The sketch (p. 60), at the right, shows the arrangement and working plan in detail of this graphite shunt rheostat or current controller, which we will explain fully. In order to have a controller for heavy current, so as to be able to administer large doses, such as are necessary in the phoric treatment of cancers and other growths, the rheostat is enlarged, till the graphite surface is twelve inches in diameter. This adds a wider range of resistance and will allow of a fractional and perfectly smooth reduction of resistance, and consequent increment of electrification passing, with a range of dosage from a mere fraction of a milliampere, up to as high as 1500 milliamperes, if desired. It may be used with either the 110 volt direct street current, or a battery of primary cells.

But when we use very slight currents, we should have correspondingly low voltage, so as to lessen the painful effects, when removing hairs, or

when working about the organs of special sense. Therefore, in order to adapt this controller to the street current, the shunt principle of control (which has been fully explained before) has been added to this controller. By referring to the sketch below and following this explanation of it, it will be made clear. First, you will notice an incandescent lamp is placed in series with the negative main and connected to the post N. This adds





resistance and according to Ohm's law, reduces the amperage. The other street main is attached to the post marked P. These posts connect with the graphite surface of the rheostat, and the main current passes around through the graphite, shown by the concentric circles, and out through the series lamp. Then, if the patient's circuit be connected to post marked

P P and N N, we know that the patient will be *in shunt*. The meter should be in the patient's circuit. So far the new controller is just the same as the ordinary shunt wired graphite rheostat, and differs from it in no respect except in size. The improvement lies in the addition of another wire from N to N N, which is then connected to a second incandescent lamp, *in series* with post marked P P, which is connected by a wire, shown as the dotted lines, from post P P, to the pivotal end of the sliding contact switch. This arrangement puts the patient still further removed from the primary mains, and makes the patient's circuit really a double shunt, or a shunt within a shunt. This makes the voltage and amperage still more reduced. The milliampere meter should be placed in this secondary patient's shunt circuit, so that it will measure only the electrification flowing through the patient, and not the current passing through the lamp also. By this arrangement, the most of the voltage is used in the lamp circuit, which is a better conductor than the body of the patient. Therefore, the patient gets a small dose of current under diminished pressure.

Now if the key of this lamp is turned on, and the rheostat switch arm moved over the graphite, the electrification will traverse the three tracks shown in the sketch above, and be distributed proportionally, according to their several resistances. Thus, so small a current will pass through the patient that the large switch arm will have to move half way around to get the patient's meter to register one milliampere, while the shunt lamp will glow a dull red. This very gradual increase very much lessens the disagreeable sensation of the current, and there is a marked difference in the feeling of the passage of a current of two or three milliamperes, under a full 110 volts, and the same dose under the greatly reduced voltage of this secondary shunt circuit. In the cut of the complete cabinet this rheostat is shown in the center of the plate, with one lamp on either side, the *one in shunt*, the *other in series*, as shown in the sketch at the right. The one in series is to cut out part of the amperage and protect the graphite from burning. This series lamp may be cut out of the circuit if desired, and thus enable an *expert* to utilize the full potential of the street mains, in series circuit only, for giving very heavy currents.

When both lamps are in use, as shown in sketch, the patient's dose may be made very small, and be almost identical with the galvanic current from a primary battery. With both lamps off, you get the effects of the dynamo current, with series control, and it can be used with either the direct current for electrolytic and phoric heavy work, or for controlling the faradic secondary induced or the sinusoidal currents, in therapeutics.

With both lamps on, and the meter and patient cut out of the circuit,

the patient's secondary shunt circuit current is adapted for use in lighting small power diagnostic lamps, for exploring and illuminating cavities. A large battery of primary galvanic cells may be used with this cabinet and controller, as well as the street current. This controller may be had also in portable form, mounted in a seperate receptacle, so that it may be transported easily, and used in connection with some other source of power, as occasion may require. We believe that this new controller answers all requirements for the safe, successful and satisfactory control and use of what is otherwise a sometimes disagreeable and dangerous current.

By aid of this device the physician may utilize the 110 volt direct or constant dynamo current for therapeutic work—*electrolytic work.*

Or by aid of this device the physician can utilize the 52 volt or 104 volt alternating dynamo current for therapeutic work—*faradism.*

THE MASSEY CABINET.

The cabinet is beautifully designed and made of thoroughly kiln-dried quarter-sawed oak, hand-rubbed and polished, and special care has been taken to make it free from all joints and all gingerbread work and perfectly plain, so that it can be easily kept free from dust by simply wiping with dry cloth. It stands 69 inches, is 26 inches wide and 22 inches deep, and will weigh, boxed for shipment, about 400 pounds. In back of the handsome polished slab is room for 88 giant dry cells, while in the cabinet below 96 giant dry cells can easily be stored, or entire case both top and and bottom will hold 50 Le Clanche cells.

Should 110 volt or 220 volt direct electric light current not be obtainable it can be operated by either 50 wet cells, or 60 dry cells, whichever may be preferred.

The polished marble slab upon which the essentials of this magnificent cabinet battery are attached, measures 23 inches wide by 34 inches high and is 1⅛ inches thick, and attention has been given to have it free from all imperfections.

The milliampere meter is of low resistance variety, and is known as the "dead-beat instrument." This means that the needle at once stops at the proper mark indicated by the current and does not flutter, as do the ordinary meters. This effects a saving of valuable time when operating. It reads from 0 to 30 milliamperes on the upper scale and from 0 to 1,500 milliamperes on the lower or shunt scale.

When treating cancers and tumors a milliampere meter measuring the current up to 1,500 milliamperes must be used.

There can also be attached a volt meter which will give a correct read-

ing of the voltage in use. This meter will register from 0 to 125 volts in one-volt divisions.

The primary and secondary coil is a marvel of perfection and has a sliding motion and is operated by a screw knob which operates very smoothly and coil can be moved from right to left or left to right almost imperceptibly to increase or decrease the current, as may be required. The primary consists of 200 feet No. 20 wire, the secondary contains a total of 7,000 feet of wire and is made in four sections, one or more of which can be used at one time. The first section tap contains 900 feet No. 30 wire, the second tap has 1,600 feet No. 30 wire, the third section tap has 1,500 feet No. 36 wire, and the fourth section tap has 3,000 feet No. 36 wire. Sections are numbered so that the operator can note amount of wiring used at a glance. There is nothing like it in general use anywhere.

The shunt graphite rheostat or current controller which has been previously described measures 12 inches in diameter and is adjusted so finely that it will absolutely control any current from the midest up to the full capacity, which is about 1,500 milliamperes. These heavy currents are uses in treating cancers and tumors, which no other rheostat will do.

The specially designed rheotome will interrupt either the galvanic or faradic current or the combined currents at the same time, and by simply turning a knob, periods of interruptions from 0 to 350 per minute can be obtained and given with even regularity.

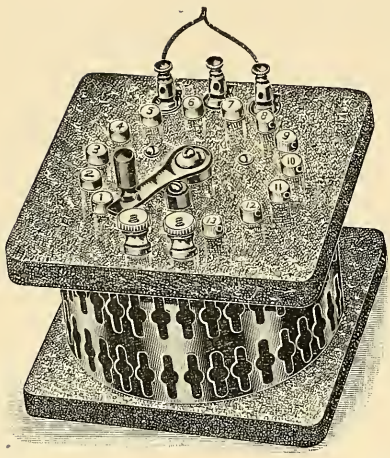
By simply throwing in proper switch, a galvanic or faradic current or a combined current can be obtained and readings are made on proper portion of the apparatus. If the cabinet is operated with cells, there is a special switch, so that on faradic side any number of cells, from 1 to 6, can be selected as desired.

If apparatus is operated with cells, the cabinet is provided with proper switch and connections to use either a 2 or 8 volt diagnostic lamp. If operated with electric light current (110 or 220 volt direct) it would operate a 4 to 8 volt lamp and will also operate a head-lamp to the amount of 8 volts.

Special cautery attachments may be added if desired, same to be operated by dry cells on the inside of the cabinet.

What is a cautery-transformer, and its use?

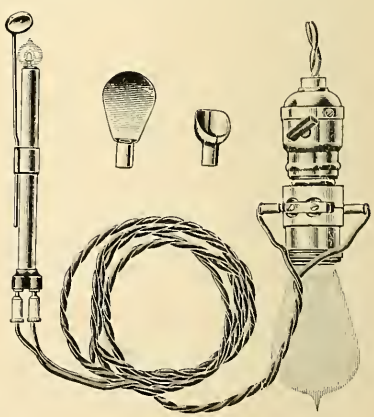
Another mode of employing this current, although a surgical rather than a therapeutic method, is in galvano-cautery. This is quite an impor-



tant branch of electrification with the physician making a specialty of eye, ear, nose and throat work. The great advantage of cautery in many minor cutting operations is in the almost certain avoidance of hemorrhage. A transformer working on the principle of an induction coil is used to adapt the current to cautery work. The 110 volt or 55 volt alternating current is attached to the proper binding posts of the transformer; a current of about two amperes is thus fed to the appliance. The transformer converts this current of 110 volts and two amperes to a current of about six volts and thirty or forty amperes, which is sufficient to heat most platinum cautery knives and loops. The cautery transformer is a very simple device and makes a most valuable addition to the equipment of a physician who has the alternating current available.

How is electrification used in diagnosis?

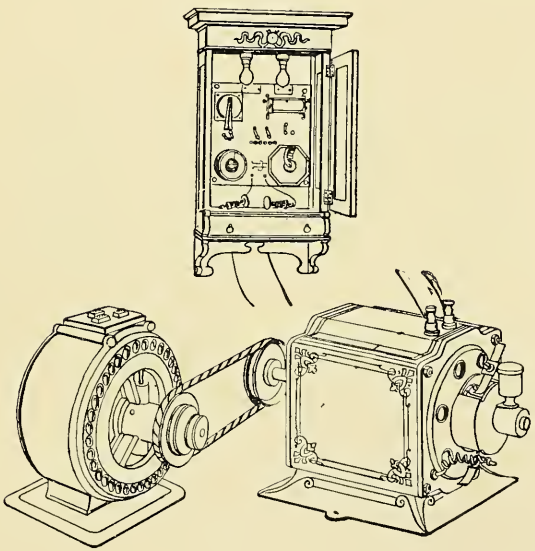
Another use to which the alternating current may be subjected is to light diagnostic lamps. Perhaps this matter may seem a very simple one to dwell upon at first thought, but upon further consideration the complexity of the subject will be appreciated. There is frequent call for a wall plate or other piece of apparatus which will combine a current for diagnostic lamps among other features; this is an easy matter to arrange, regardless of whether the plate is to be used with either direct or alternating current; but especial stress should be laid upon the fact that a seperate contrivance, such as a large, heavy current graphite rheostat will prove more suitable to the purpose. Another manner of using the alternating current to light small lamps is by using series lamps in connection to regulate the flow of current. A number of diagnostic lamp sets are on the



market which embody this principle, among which will be found a very unique one, in that the small lamp is absolutely guarded against an excess of current; which may be accidentally encountered when used with a wall plate or other controller.

What is a motor-generator, and its use?

Another method of utilizing the alternating current in electro-therapy, although in a rather indirect manner, is by transforming it to a direct current which may be employed in producing galvanic effects; a motor-dynamo outfit, so styled, is used for this purpose. The process of transforming the current really amounts to developing power by passing the alternating current through a small alternating current motor; the shaft of this motor is either geared or connected directly with the shaft of a small direct current

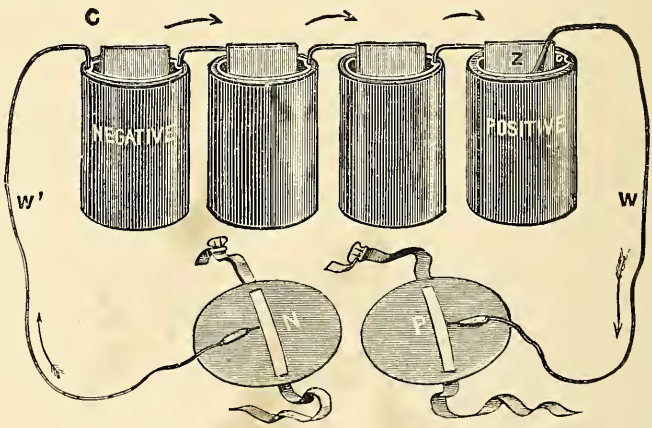


dynamo; the power thus produced operates the dynamo, which generates a direct current of suitable voltage and amperage to be used in connection with a galvanic wall plate; this current may also be employed to excite the action of the faradic coil of a physician's switchboard. Strictly speaking, the alternating current employed in this method is used as a mechanical agent, rather than as a therapeutic force.

What is an electric belt, and its uses?

The ordinary so-called electric belt is a fake pure and simple, made to sell, and then to disintegrate. This is for two reasons, one to make room for another sale, and the other is to destroy the evidence of the first fraud. They are usually a flexible chain of pieces of zinc and copper, covered with felt or some other absorbent material, which is soaked in some dilute acid, usually acetic. This comes in contact with the two metals and creates a slight current. The cheap, impure materials used soon cause local chemical decomposition where the metals hinge, corroding them, so that they soon fall apart, and that is the end of that man's cure, money and "vinegar belt," as well as his patience. He knows not the difference between the genuine and the counterfeit and says batteries and electrification are "no good," and brands all, whether "fakes" or scientific electro-therapeutists, as dishonest.

There is nothing to prevent a galvanic battery being made in the form of a belt and worn around the body, but in order to do so it must be made of very small cells, which we know will have very small current strength,



and a corresponding diminution of results. The accompanying cut shows the proper construction of a galvanic cell belt.

If you must use a battery in the form of a belt and in my twenty years of active experience I have yet to see the first case of absolute necessity for one, then get one made of real cells, built on scientific principles, and not a toy. You cannot afford to risk your reputation experimenting with any apparatus with such a "shady past," having no real "present," and such a faint and far off promise of a future. It is safe to say that the result offered by the use of a belt is only a delusion and a snare.

Catalysis

What is meant by catalysis?

By catalysis we understand the nutritional, chemical and physical effects produced in tissues and organs of a body by the passage, over or through, of electric currents.

This catalytic action, is that peculiar action of electrification, or that effect which it has or exerts upon the vaso-motor nervous system, by which it affects nutrition, and is the most important of all the attributes of electrification, and catalysis is the keystone of the entire arch, and upon its thorough understanding depends our success or failure in the science of the practice of electro-therpeutics.

Therefore, let me urge upon you the great importance of thoroughly mastering this subject, and if you do so, I assure you that you will never be at loss to know what application to make, to get a desired effect, and all the therapeutics of electrification which follows in this book will be plain and easy.

Catalysis, however, is entirely a physiological process, dependent altogether upon the definite action of all the known variations of the electric condition, known by whatever name they may, galvanic, faradic, static, sinusoidal, cautery or X-ray phenomena.

We see at once from this fact, how universal and far reaching is this catalytic action, and how necessary it is to know and understand, because it follows in some way either beneficial or harmful, good or bad, upon every application of electrification, from every known source of generation, and from all methods of application.

By the catalytic action, the nutrition is directly and indirectly, locally and generally affected, and by this process the stimulation, sedation, temperature, growth and function of every part of the body can be more or less accurately regulated through the vaso-motor nerve supply to the part, thus controlling the circulation.

All positive applications will produce sedation, relieve pain and inflammation, contract blood vessels, thereby quickening circulation. All negative applications produce stimulation and dilate blood vessels, thereby slowing the circulation.

These are the local effects, while at the same time there are manifest reflex general effects in remote parts.

This accelerated flow of blood will, by osmosis, hasten the removal of waste products, and at the same time replace the loss with fresh deposits which feed the parts, making them grow. The increased blood supply also has a thermic effect, warming the cold parts and cooling the hot parts by re-establishing the normal equilibrium. This removes deposits, hypertrophies and effusions, and on the other hand nourishes and feeds atrophied and wasted and starved conditions.

You at once readily see that this nutritional effect of electrification is of the greatest importance. If we increase the nutrition of a weakened or diseased organ or tissue we assist in strengthening it and restoring it to its normal condition.

How does electrification effect nutrition?

Electrification effects nutrition by stimulating the circulation and hence bringing or sending more blood to the parts and providing more pabulum for the cells of the tissues. It also stimulates and assists the absorbents in their work and hastens the depuration of the tissues and organs, of effete products. The direct effect upon the trophic nerves and also the reflex nervous stimulation is also marked.

It is through the process of nutrition that the majority of chronic cases are cured. Improve the nutrition of an atrophied part and it grows larger. Improve the nutrition of a hypertrophied part and it grows smaller.

Electrification appears to effect its curative results first in acting as a general tonic to the entire organism. By stimulating the circulation, the whole vegetative system seems to put on renewed action. Glandular secretions are stimulated, absorption promoted, the waste of the system is carried off with greater rapidity, repair is hastened in still greater proportion. Nutrition is increased, the vital nerve force is endowed with greater strength,

and the whole well being of the organism becomes improved to a wonderful extent.

How electrification acts, whether through its mechanical action upon all muscular tissues, or its physiological action upon all the organs and glands of the body, or its chemical action upon the contents of the minute cells of which the tissues are composed, or the blending of these combined effects, would require volumes tell it, but the fact remains that electrification will build up a reduced system better and quicker than any other known means.

These effects are brought about in various ways, and the processes are mechanical, thermic, physical, chemical, physiological, secretory and absorbent.

What are the physiological effects of electrification?

The catalytic action is doubtless responsible for the results produced in the treatment of chronic exudations of the joints, glandular enlargements, cicatrices, swellings, fibrous adhesions, contusions, sprains, etc.

The process started by the action of the current continues for some time after the treatment has ceased.

Through proper electrical treatment we may increase or diminish or modify the action of an organ or tissue.

We may affect the circulation and the absorbents and promote secretion or excretion. This is through a physiological process.

In the same manner we may, with the proper current and the proper method of application, produce various phenomena upon the skin, increase the process of exudation, raise the temperature, affect the nerves of special sense, causing flashes before the eyes, a peculiar taste and odor, and by electrizing the pneumogastric nerve increase or diminish the heart's action.

Through the effect of electrification upon the heart and upon the muscular fibres of the arteries we may affect the circulation most decidedly. We may also influence the circulation through the central and peripheral nervous system.

Through a general treatment of electrification, either current being used, we may affect capillary circulation, increase the flow of blood, dilating the veins and producing an elevation of temperature.

Through the increase in circulation the warmth of the parts is increased and will usually remain at an elevated temperature for some time after the treatment.

What are the secretory effects?

A current of sufficient strength will stimulate the activity of the secreting organs.

The SECRETION of the mucous membranes, the salivary glands, the stomach, liver, kidneys, etc., may be very greatly increased by proper electrical treatments. Both currents are capable of stimulating the secretions of all these organs, but the galvanic current acts more powerfully and produces better results. Many cases of catarrh may be cured by stimulating the secretions of the mucous membranes.

We may also stimulate the menstrual flow, the secretion of milk, the flow of saliva, the spermatic fluid, the action of the sweat glands, etc. Under the proper heading will be given directions for the proper application of the current in producing these conditions.

It should be understood that the benefits derived through the use of electrification in influencing nutrition is due partly to the reflex as well as the direct action of the treatment.

What are the absorbent effects?

The ABSORBENTS may be stimulated through the use of the galvanic current and through the stimulation of circulation and also through the chemical effect, influencing the process of osmosis, we may reduce hypertrophies, morbid growths, effusions, etc.

Electrification properly applied is the most valuable treatment known in removing thickening of the skin, enlarged joints and glands, and in many kinds of tumors.

There is scarcely a chronic disease treated with electrification where we cannot trace at least a part of the good results of treatment to the results of nutrition. In treatment of almost any chronic disease always remember that electrification properly applied will stimulate the circulation, and that the increased flow of blood will bring an increased amount of nutrition; that the contractions of muscular tissue produce the same effect as massage or gentle exercise; that nutrition may be affected through a chemical process; that the process of waste and repair may be promoted, and that the nutrition of the entire system may be improved through the reflex action as well as by the direct effect of treatment, securing a constitutional, tonic, stimulating effect.

What are the mechanical effects?

The MECHANICAL EFFECTS of electrification as pertaining to nutrition can be explained in quite a similar way to massage. The faradic current produces better mechanical effects than the galvanic current.

The interrupted current, being constantly opened and closed, during its passage through the body produces very much the same effect as gentle tapping or pounding or rubbing of the parts. This communicates an effect to even the more deeply seated tissues.

The corpuscles of the tissues through which the current passes are agitated and the beneficial results obtained are due in a certain degree to the endosmotic action which has been stimulated by the current.

The static potential variation, which will be fully explained later, is very marked in this respect, as is also static vibration.

Phoresis, which will also be taken up fully later on in our study, is purely a mechanical process, and is brought about by the galvanic and the static currents and also by the X-rays, but it remains yet to be shown that it is any way secured with faradism.

What are the thermic effects?

THERMIC EFFECTS.—The passage of the current through the tissues also creates heat. This is more noticeable in using the galvanic current, but it has been demonstrated that even mild faradic currents temporarily raise the temperature of the parts through which they pass.

A static insulation almost invariably raises the body temperature and produces a restful feeling.

What are the physical effects?

PHYSICAL EFFECTS.—One of the physical effects of the passage of an electrical current through the body is to cause transference of substances from one pole to another. The stimulation of this osmotic action depends upon the physiological rather than the mechanical or chemical effect of the current.

What are the chemical effects?

THE CHEMICAL EFFECTS of electrification are secured by the galvanic current there being very little, if any chemical effect from the use of the faradic, or sinusoidal, and none at all from the static current.

The chemical effects of electrification are chiefly of an electrolytic na-

ture. Many of the chemical substances of which the human body is composed may be decomposed by the action of the current. The effects produced by what is known as catalytic action of electrical currents are by an increased absorption produced by dilation of the capillary blood vessels and lymphatics, an increased capability of the tissues for imbibing fluid through osmotic processes, changes in the nutrition of nerves resulting from the stimulating and refreshing effects produced, changes produced in the molecular arrangement of tissues caused by electrolytic action and the result of the transportation of fluids from one pole to another.

Electrolysis, which will be explained in another place, is a chemical process, and is brought about only by the constant galvanic current.

SEDATION AND STIMULATION

How do you cause sedation and stimulation?

The positive pole has a soothing sedative, anodyne effect on irritated nerves, relieving pain. The negative pole has a stimulating or irritating effect upon irritated nerves, and will increase pain. In inflammatory and congested conditions there is usally pain. Here the positive pole has a double action, both upon the vaso-motor and sensory nerves. Where there is pain without inflammation, it exerts its influence upon the sensory nerves only.

NO CONTRADICTION

Is electro-therapy contradictory?

Some who are not acquainted with these various polar effects, have condemned electro-therapeutics as being contradictory and paradoxical. They say that electrification is used to produce or relieve pain; to cause or reduce congestion; to enlarge atrophy and decrease hypertrophy. Therefore it is contradictory. But we, knowing the different and diametrically opposite polar effects, can explain the *seeming paradox*, and by following the known laws of electrification can get uniform results, and just as we want them. He who is ignorant of the fine points, has one chance out of two of getting the application right or wrong. We, who are instructed, take no chance and get the application right every time.

Phoresis

What is meant by phoresis?

Phoresis is the generic term for that property that is had by the constant current to drive compound substances—a compound salt in solution for example—into and through the tissues of the body. Also of moving substances in solution from one part of the body to another.

By phoresis is meant that power possessed by a galvanic current to convey medicinal substances in solution and in contact with anode or cathode, through and into the tissues of the body with the view of securing the local effect of such remedies. The term need not be, nor should it be, confined to the introduction of substances without the body into it by this method, but may include the transfer of substances already in the tissues, whether normal to their composition, or not, from one part or place in the body to another; or from within the body or any part of it to the surface, with the view of removing such substances from the body. The primary physical phenomena illustrated by phoric action are those long since observed when the ordinary processes of osmosis were found to be modified by the passage of a direct or galvanic current through the solutions and members in which osmosis was taking place. It was found that processes of osmosis could be hastened or retarded by the passage of such a current according as the current was made to flow in one or other direction. Though the fluids in tissues are themselves repelled from the anode and increased at the cathode, this is not true for all substances that may at any time be dissolved or suspended in those fluids, since certain elements and compounds are known to travel in the opposite direction from that which is usually assumed to be the direction of the electric current, that is from anode to cathode.

In the light of the present knowledge, as the result of observation and experiment, the phenomena which we include under the name phoresis or electric-osmosis, must be regarded as the result of several causes operating at the same time and more or less inter-dependent, since certain of these phenomena are electrolytic, some are mechanical, while others should be classified as chemical.

What is meant by anaphoresis?

Anaphoresis is the driving of substances in solution that are electro-negative, by the positive pole to or toward the cathode.

What is meant by cataphoresis?

Cataphoresis is the process of driving substances in solution that are electro-positive, by the negative pole to or toward the anode.

CURRENT DIRECTION

Of what importance is current direction?

Much has been said and written concerning the different effects of the ascending and descending currents, but it is now conceded by the best authorities that what was supposed to be a difference in the effect of current direction is due to the difference in action of the two poles.

We pay particular attention to the location of the two poles in the application of electrification and recognize the difference in action and effect of the positive and negative pole, but we do not recognize any particular difference in the direction in which the current flows.

It is stated by some authorities that the descending current, or the current flowing from the center to periphery, is more sedative in its effect, while the ascending current, or the current flowing from periphery to center, is more stimulating. We know that this difference in effect is produced by the two poles and have no reason for thinking that the direction of current of itself has anything to do with the different effects produced.

VASO-MOTOR EFFECTS.

What vaso-motor effect has electrification?

Electrification in its various modalities has different effects upon nutrition through the vaso-motor nervous system, affecting circulation. This is due to the polar effects of the current. This effect was noted long ago, before we knew the polar effects of currents, and it was then thought that

these effects were due to the current direction, and much stress was laid on *ascending* and *descending* currents. That is, from the periphery toward the centers. Now, we know that these effects are not due to current direction at all, but entirely dependent on polarity.

The positive pole will act on the vaso-motor nerves, supplying the muscular coats of the blood vessel walls, causing the circular fibers to contract, and the longitudinal fibers to relax, thus lessening the caliber of the capillaries, and consequently lessening the amount of blood flowing through them. This produces anæmia. The negative pole has the opposite effect. It relaxes the circular fibers and contracts the longitudinal ones, thus enlarging the caliber of the capillaries and increasing the amount of blood flowing through the capillaries, inducing congestion and hyperæmia. The larger vessel not only carries more blood, but carries it slower. This favors the process of osmosis in both directions, and favors the nutrition of starved tissues, bringing them food and oxygen, and hastens the process of repair, while at the same time assists in the elimination of waste and dead matter.

Thus we see we can control the blood supply to a part, and cause or reduce both anæmia and hyperæmia, and feed atrophy, or rob hypertrophy by restoring the normal electric equilibrum or electro-tonus.

ELECTRO-TONUS

What is meant by electro-tonus?

When each ultimate particle of the body or part is in its own normal condition, and in its normal relation with its surroundings, it is in a state of normal electric equilibrium, and is in tune or tone. This state we call electric tone, or *electro-tonus*.

Electro-tonus is that condition of the nervous system and the body through it, in which there is an electrical equilibrium established, and the nerves and system of nerves act and react to physiological stimuli in a normal manner and to a normal degree. All electro-therapeutic treatments and applications are given with the end in view of establishing or restoring the normal electro-tonus.

What is meant by swelling application?

By swelling application is meant the process of beginning an electric treatment with a mild current and gradually increasing to the highest point of tolerance without producing pain, and gradually decreasing it. This will

produce more or less of a rhythmic contraction and relaxation of muscles, which is beneficial.

WHICH POLE TO USE?

This question is often asked and is important to know in using medicine by phoresis. Every element is an *ion*, with either a positive or negative electrification. It is one law of electrification that like poles repel and unlikes attract, so that if corpuscles are free to move, there is a double action going on, of attraction and repulsion, and if we know the relative potential we can do good phoric work. Two elements may be of very unlike polarity like sulphur and chlorine, which are highly negative ions, and potassium, sodium and lithium, which are the highest positive ions; therefore, sulphate of morphine and hydrochlorate of cocaine having a negative attraction will be repelled by and driven into the tissues by the positive poles from which they are farthest removed *by repulsion*. Likewise iodide of potassium being attracted by the positive would be best applied under the negative which would most *repel* it, for in phoresis, although attraction and repulsion are both manifest, the *repulsion is the stronger*. A great deal of experiment has determined the relative position of the different elemental ions, and Berzelius's final series stands thus:

Electro-Negative

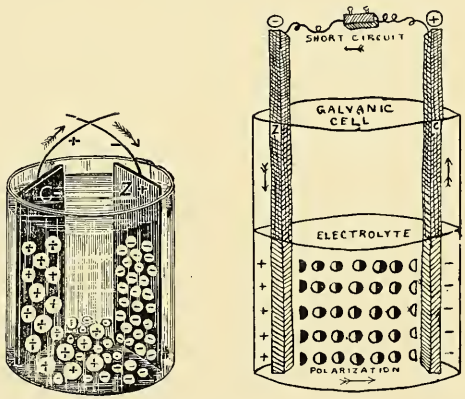
Oxygen	Boron	Mercury	Thorium
Sulphur	Carbon	Silver	Zirconium
Selenium	Antimony	Copper	Aluminum
Nitrogen	Tellurium	Bismuth	Didymium
Fluorine	Tantalum	Tin	Lanthanum
Chlorine	Titanum	Lead	Yttrium
Bromine	Silicon	Cadmium	Glucinum
Iodine	Hydrogen	Cobalt	Magnesium
Phosphorus	Gold	Nickel	Calcium
Arsenic	Osmium	Iron	Strontium
Chromium	Indium	Zinc	Barium
Vanadium	Platinum	Manganese	Lithium
Molybdenum	Rhodium	Uranium-Radium	Sodium
Tungsten	Palladium	Cerium	Potassium

Electro-Positive

At first glance the above statements and table would appear contradictory, but remember the Berzelius table is based on the attraction of the

ions, and not the *repulsion on which we depend most* for phoric effect, so that potassium being the highest negative ion is the most attracted to the positive pole, therefore gets closest to it and vice versa with oxygen and the negative. Change the poles and the ions would, if possible, all reverse their position on the list, metallic mercury, being near the center, would not care much which way it went, but the oxy-chloride of mercury, negatively attracted would be repelled most under the positive electrode. Two ions may be on the same side of the neutral point, and partake of and be attracted by the same polarity, but would be mutually repellant, and the weaker would be pushed back, just as two strong men will contend for the same prize but the stronger will overcome the weaker and keep him away from first place.

When a difference of potential is established by a direct current of electrification sent through a collection of molecules, each atom or corpuscle of any substance that is free to move, deports itself according as the electric charge it receives is positive or negative. Those atoms of corpuscles with a negative charge will move toward the anode, and those with a positive



charge, toward the cathode. The direction therefore, which a medicine in solution will travel, whether from anode or cathode, or the reverse, when the attempt is made to use it phorically, will depend on its initial charge.

Solutions of cocaine, and adrenalin hydrochlorate, aconitine or tincture of aconite, helleborine, mercuric bichloride, mercuric succinide, lithium chloride, strychnine nitrate, menthol, thymol, hammemelis and thuja, can when used in contact with the anode, be conveyed into the tissues by anaphoresis; while sulphur, ichthyol, eosine, calcium, lithium, sodium and potassium iodide and bromide, find entrance by way of the cathode.

The drugs most used in electric phoresis are the alkaloids and halogen salts, the chief ones being cocaine and iodide of potassium. Cocaine hydrochlorate is a complex salt containing oxygen, nitrogen, chlorine, carbon and hydrogen, and by referring to the table, you will see that all of these are electro-negative elements and are therefore best applied under the positive pole.

Iodide of potassium, contains iodine and potassium, the iodine which we wish to use, being loosely carried in the vehicle, potassium, which is the element with the highest electro-positive attraction or affinity, is most *repelled* by the negative, and should therefore be applied phorically under the negative pole.

The potassium being very soluble, easily carries the iodine into the tissues in a much less caustic form than iodine alone, and being higher in the scale than iodine, goes in faster and in greater quantity. Iodide of potassium is also a very unstable salt; having only one bond of union it is easily decomposed after it gets into the tissues, so that the iodine acts free within the tissues, and it is iodine we want in a rheumatic joint, and we can put in more in a local spot, by cataphoresis, than by the mouth, and do it more quickly, safely and pleasantly. Remember to apply cocaine and alkaloids under the positive pole (anaphoresis), and iodide of potassium and other halogen salts under the negative pole (cataphoresis).

How may we save these costly drugs?

The Bennett Phoric Electrode

The accompanying cut shows the improved Bennett slip center reservoir phoric electrode, which is the simplest and best of its kind. The stem (A) and cup (B), is of hard rubber. The disc (C) is aluminum. To use it, simply unscrew the binding post on the stem, slip out the central rod attached to the perforated disc (C) for an inch, cover disc with absorbent cotton, tuck edges of cotton in behind the disc, and replace in cup, and screw on the binding post. Soak the cotton with the drug to be used and attach to the proper polarity, apply the wet surface to the part and turn on the current. The cup should be level full of the wet cotton. When done using, lay aside, and allow to dry till needed again. Then simply wet with water or more of the drug solution, it is ready for use as before.

Ten drops of the tincture of aconite so applied gives relief from neuralgia for from eight to ten hours

When used upon a constricted limb, it is quicker and more effective in action, for the self-evident reason that there is no circulating blood to carry the medicament away. Goiters have been atrophied by the electric diffusion of iodide of potassium into their substance.

No special current strength is required. There should be no pain, and not more than moderate discomfort. But it is a fact that the stronger the current, the sooner the effect. It should also be remembered that the larger the electrode, the stronger must be the current. Therefore the value of this small electrode.

Small operations upon a limb may be done under electrophoric anæsthesia, if aided by arrest of circulation. Thus, for instance, a section of the tendon on the back of the hand of pianists may be done in this way. The forearm is constricted so as to slow circulation. Cocaine and aconite may then be applied with the anode until the part is anæsthetized, when the section is at once begun.

Cocaine anæsthesia is more quickly produced, is more enduring in effects, and necessarily requires less of the drug, by this method, than by the usual injection without arrest of local circulation.

A four per cent. aqueous solution of hydrochlorate of cocaine placed in contact with a cutaneous surface by means of absorbent cotton or sponge will ordinarily have no effect in numbing the sensibility of the part, even if kept in place an hour or more. If, however, the same solution is used in the same way, but with tee addition that a direct current of 12 to 30 ma. is passed through it by means of the anode, the cuticle in the region of the anode is soon found to be in a state of cocaine anæsthesia and will remain so for a period varying from a few minutes to several hours, depending upon the strength and density of current, the length of time it was applied, and the per cent. of cocaine in the solution used.

Every electro-therapeutist should have at least two of these, one for cocaine, and one for potassium iodide, both of which are costly drugs, but as there is no waste with Bennett phoric electrodes, they will save their price and value many times over.

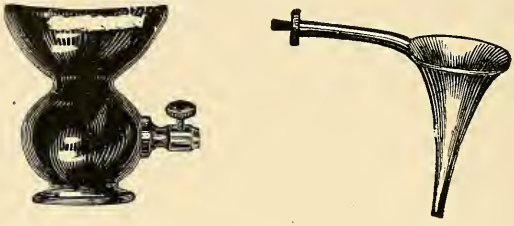
LOCAL ANÆSTHETIC

What is a good local anæsthetic?

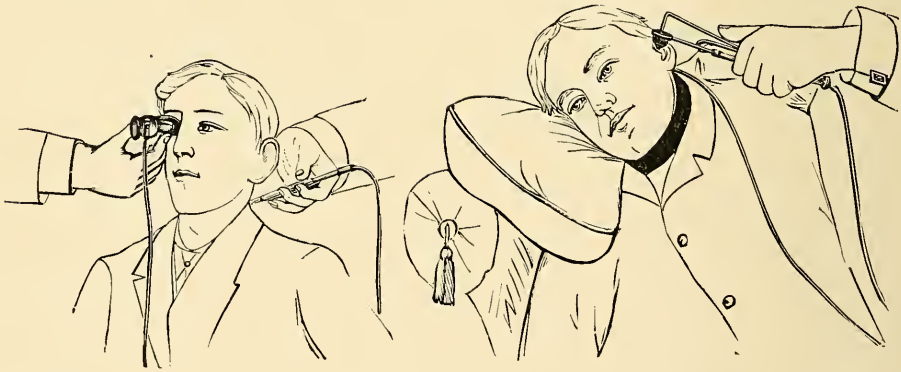
Adrenaline chloride, 2 drams; cocaine, 5 grains; water, half an ounce, Soak the cotton in the Bennett phoric electrode with the solution and apply

as the positive electrode; place a negative electrode elsewhere and slowly induce a current of 15 to 30 milliamperes, five to ten minutes. Then wash the surface with ether, when any small operation may be done without pain.

SPECIAL HYDRO-ELECTRODES



The above cuts show two special phoric electrodes, for treatment of troubles of the eye and ear. These are to be filled with either plain or medicated water and applied to the eye or inserted into the ear, and then attached to whichever pole or current is indicated. By means of these the most sensitive membrances and delicate tissues of the eye and ear may be safely treated. In these the water acts as the active electrode. The conducting cord is fastened to a binding post, which passes through the insulator and makes contact with the water.

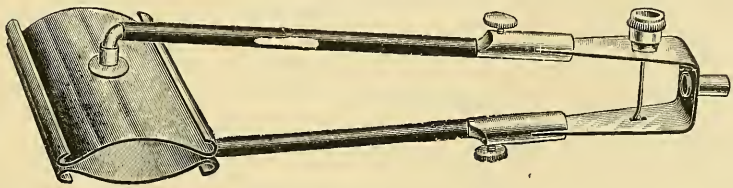


The above sketches show the technique of the application of the special hydro-electric or phoric eye and ear electrodes. Fill the eye cup with water. Then lean over and apply it to the eye. Then holding it in position, straighten up with the eye cup as shown in the left-hand sketch above.

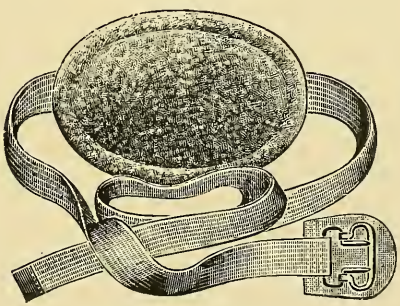
To use the ear cup, let the patient recline on his side. Introduce the

funnel of the ear cup into the canal. Then fill with water and attach to battery and use as shown, in the right-hand sketch (p. 80).

VARICOCELE PHORIC ELECTRODE

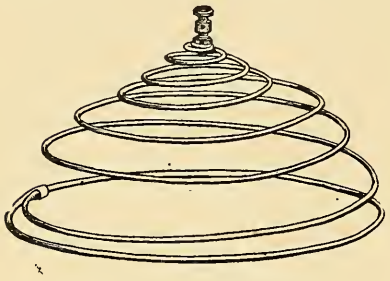


The above cut shows a special spring clamp electrode for the phoric treatment of varicocele. The drugs usually used with the varicocele phoric electrode are hammemelis (witch hazel), thuja, iodide of potash solution, or adrenalin solution. The electrode is divided, with a block tin concave terminal on each side. Cotton saturated with the drugs is applied to the scrotum with the varicocele enclosed, then the clamp electrode is applied and tightened by the thumb-screw and connected to the battery, the other pole connected to the back electrode, held in place by a strap about the body, as shown below.



Flexible Rubber Back Electrode, 3 x 5 in. Can be buckled around any part of body.

THE BENNETT SPIRAL SPRING DISC ABDOMINAL ELECTRODE



The accompanying cut shows the abdominal electrode invented by Dr. H. C. Bennett, and is the simplest, and at the same time the most convenient and inexpensive electrode of the kind yet invented. It is light, cleanly, aseptic and strong. It is adapted to fit any surface or part of the body, and can be applied to the knee, hip, elbow, shoulder, head, back, or abdomen, but is intended mainly to fill a long felt want for a light, clean, strong and efficient abdominal electrode. It is applied thus: Wring out of hot water a towel or pad of cotton, square or round, and a little larger than the base of the spring. Place the spring on it and tuck the edges or corners between the spirals, then place it on the abdomen, with the patient on the back, with a dry towel over it to protect the clothing and retain the heat, then have the patient press it down with her hands, insuring a perfect contact with a good conductor. We have given 200 milliamperes through this electrode without any discomfort. It is made of No. 14 spring steel wire, with a binding post at the apex, handsomely plated, and weighs only 4 ounces. Outside spiral is 7 inches in diameter.

Electrolysis

What is meant by electrolysis?

Electrolysis is the chemical decomposition of a compound body by electrification; anything that is subject to electrolysis is called an electrolyte, and as a compound body must contain water and a salt.

Nicholson and Carlisle discovered the process of electrolysis, and in the year of 1800 decomposed water into oxygen and hydrogen—so that the theory and process is not new. Electrolysis is the process of dissociation or analyzing a fluid, by an electric current, hence the term electro-analysis or electrolysis.

The galvanic current is the form that causes chemical decomposition, and the two poles have each a different potential, and for convenience the pole having the higher potential is called the positive, and the one with the lower potential is called the negative pole.

The direct or constant commercial or incandescent light current has the same properties and characteristics of the chemically generated galvanic current and will also produce electrolysis. However, owing to the usually high voltage of the street current, and the sensitive nature of the parts where we usually desire to produce or cause electrolysis, it is generally advisable to use the galvanic current for this work.

The galvanic form has a constant, steady, silent current, and when applied mildly, will stimulate absorption and is useful in the removal of strictures, sub-involution, hyperplasias, exudates and foreign deposits, while with a powerful current you can burn, cauterize or even destroy tissues.

Remember, this thermic or cautery effect is produced only by very strong currents, and is therefore not to be considered in electro-therapeutics, as an effect. Persons coming in contact with live wires, where a bare metal electrode or wire, a good conductor, is in contact with the skin, a poor conductor, the high potential current concentrates its local polar effects at the point of contact and we have the same result we get in the cautery point, viz., a rapid production of heat and incandescence, and cautery or thermic effects. But these effects of lethal doses are not what we mean when we speak of electro-therapeutic doses. Therefore, we say that electrolysis is not cautery or thermic, as some claim, but is a purely chemical effect on the tissues.

According to our understanding of the term, electrolysis refers essentially to the decomposition, re-arrangement, etc., of chemical compounds, induced by means of the electrical current. This particular effect of electrification in its passage from one pole of an electrical generator, through any matter acting as a conductor back to the other pole, is a property belonging to the galvanic current only, and is not produced by the faradic, magnetic, sinusoidal or static currents.

Again, this action of the galvanic current upon various compounds is due to the polar effect of such current, which must be unbroken or uninterrupted for a certain considerable length of time, in order that there may be demonstrated any decided change going on in the electrolyte.

This action of the galvanic current is called its polar effect, because the principal energy or force of such action appears at the two poles where the terminals of the rheophores come in contact with the electrolyte.

The two poles have a still further dis-similarity in the marked difference in the chemical action of each. At the postive pole oxygen and the acid elements are liberated, and with powerful currents it has the effect upon living tissues of an acid caustic, causing coagulation of albumen, a shrinking of tissues and a superficial, dry, white, hard cicatrix, and with a few exceptions, when a bare metal electrode is used there is a corrosion of the metal and a deposit of the metallic salts in the tissues.

Gold and platinum, the "royal metals," are not corroded by electrolysis, and aluminum, to but a slight degree, by the negative pole. These are the only exceptions.

At the negative pole, hydrogen and the alkaline elements are liberated, and upon living tissues it has the effect of an alkaline caustic, not coagulating albumen, nor shrinking tissues, but produces a deep, red, moist, soft condition, and when bare metallic electrodes are used there is no corrosion of the metal (except aluminum, slightly), nor deposition of metallic salts.

Thus when we see what a vast difference there is between the action of the two poles, we realize how important it is to understand that difference, for if we go to guessing or applying it haphazard, we have only one chance in two of hitting or missing it, and that chance of success or failure.

Now, in moles, warts, corns, papillomata and the like, we have a dense fibrous tissue, and knowing the different action of the two poles, it is easy to select the negative pole to resolve and remove them.

In other conditions, even where we have soft vascular growths to remove, as epitheliomata of the lip or nose, angiomata of the cheek or eyelid, where, for cosmetic effect, we do not wish any scar or white contraction to appear, the negative pole is again indicated, although the positive, at first thought, seems the more preferable.

Nickel plated Urethral Electrode—Flexible with Binding Post.

Urethral Stricture Set, 12 Tips and Base

Probably the greatest field of usefulness of electrolysis is in the removal of strictures of the various canals of the body. The details and technique of these applications will be more fully detailed later in the part on electro-therapy.

There is no one branch or principle in relation to medicine and surgery that is more clean, exact and scientific than that of electrolysis of the living tissues, when intelligently and properly applied.

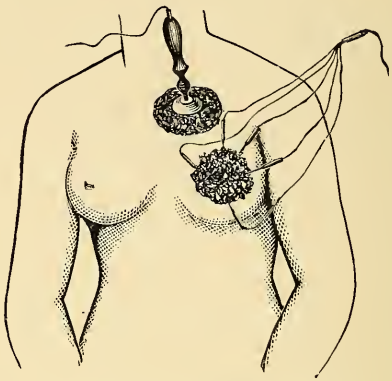
Electrolysis of living structures is (except dry epidermis and bone) like that of weak saline solutions.

The active electrode is usually a partially insulated needle, which is attached to the negative pole. To the other pole is connected a large surface-electrode (well wetted) which may be placed on any part of the body. The needle is then inserted into the growth and the circuit closed, and electrolysis begins immediately to take place around it.

The needle attached to the negative pole, of course attracts the hydrogen corpuscles and alkaline bases, repelling the oxygen and acids, which are attracted toward the positive pole. There is always an escape during the operation of a portion of the products around the needle, especially of the

hydrogen gas, yet there is always a portion of the products retained in the tissues so acted upon, which becomes as foreign matter. The forces of

Electrolysis of small growth on face.



Electrolysis of Mammary Carcinoma.

absorption promptly set to work to take up and carry away this disorganized matter, the process being completed in a few days following the operation. Should the growth be small, the one operation, as partially detailed, may complete the removal, provided always that the details have been properly carried out. When the growth is a large one, a proper interval should elapse before a second puncture should be made.

An electrolyte to be susceptible to electrolysis, must be a compound body, consisting of water and a salt in solution.

All soluble inorganic, as well as all organic compounds in solution or in a moist state, are susceptible to electrolysis.

We have shown that the passage of a galvanic current though water, for a given length of time will decompose a certain volume of the water into its elements. Hydrogen, which is electro-positive, will collect at the negative pole, while the oxygen corpuscles, being electro-negative, will gather at the positive pole, thus corresponding to the old principle in magnetization, that like repels like, but attracts unlike, or positive repels positive, but attracts negative.

This operation of electrolysis on certain forms of tumors is safer against their return, and also much less disagreeable to the patient, than an operation with the knife. The most delicate and particular work in electrolysis of living tissues is for the permanent removal or epilation of hairs, which is exceedingly tedious, requiring great care and accuracy.

The details and technique of epilation and electrolysis in applied electro-therapeutics will be taken up fully in the part devoted to these subjects.

Be cautious about using the current for electrolysis from a continuous commercial circuit about the face and head, brain and organs of special sense; why? Any interruption of the current may prove fatal to your patient. Such interruptions may be caused by the electrician at the station changing circuits from one machine to another, or the grounding of a wire, and melting out the main fuse, as well as various other mishaps.

What effect has anodal electrolysis?

Anodal electrolysis occurs at the positive pole, and is similar in action to an acid application owing to the liberation of oxygen and the formation of acids.

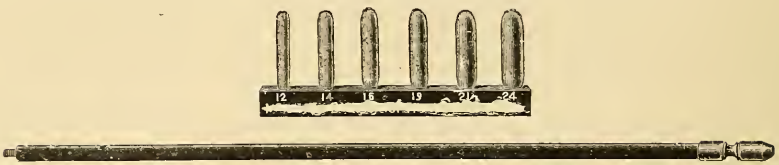
What effect has cathodal electrolysis?

Cathodal electrolysis occurs at the negative pole, and is similar to the application of an alkaline caustic owing to the liberation of hydrogen and the formation of alkalies.

What is metallic electrolysis?

This term is used in electro-therapeutics to designate the use that is made of the secondary products formed at the anode or cathode, when the electrode employed is composed of a substance that will, by uniting with the *ions* set free, form secondary products of some medicinal value. Thus needles, or urethral, uterine and nasal electrodes made of pure copper or zinc and used as the anode, have been found of service by reason of the oxides and chlorides of copper or zinc that are formed at the point of application. By *phoresis*, which is also an effect of the direct current, these metallic salts are made to penetrate the contiguous tissues for a greater or less depth, and whatever local medicinal effect they possess is thus intensified.

Metallic electrolysis is for obvious reasons almost exclusively a function of the anode. One metal, aluminum, which is frequently employed as a material for making electrodes, is corroded by the alkali *ions*, but it is not yet known that the aluminates of potassa and soda are of any value as local remedies. It must be remembered that such decomposable electrodes should not be used for the anode where a deposit of the metallic salts in the tissues would be objectionable.



Copper and Zinc Set for Positive Metallic Electrolysis. Six Tips and Staff.

In using electrodes with direct current for electrolytic effects, ordinarily the action at only one of the electrodes is desired. This is then the "active electrode "while the other electrode, broad and well moistened is the "dispersing electrode" and should be placed on some remote surface of the body, as the palm of the hand, the sternum or the back.

The anode is the "active electrode" in anodal electrolysis. But both anode and cathode can be actively employed at the same time in an electrolytic treatment if the operator so desires.

ANAPHORO-ELECTROLYTIC METALLIC INTERSTITIAL DIFFUSION.

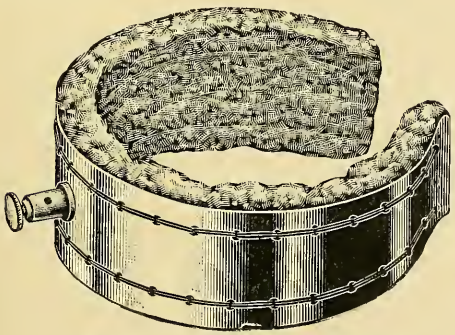
What is metallic interstitial diffusion?

We know that the acid positive pole attacks corrodable metals, and an oxide is formed. This unites with the chlorine in the tissues in the form of the soluble chlorides, forming an oxy-chloride of the metal. This oxy-chloride follows the law of polar affinities of unlikes repelling and is driven into the interstices of the tissues, where they exert their chemical properties. This is astringent and antiseptic. The metals usually employed are copper, zinc and mercury. This form of treatment has been found very useful in various forms of acute and chronic conditions, and especially so in the treatment of malignant growths, etc. The method consists of an electric interstitial diffusion into, through and beyond the cells of the malignant growth, of the nascent mercuric and zinc oxy-chlorides developed within the growth by a powerful electric current, the patient being under an anæsthetic. These substances are developed by electrolysis from metallic mercury and zinc inserted into the tumor, the pure mercuric salt requiring the use of a gold electrode to diffuse it. These chemical substances are fatal to the germs of cancer, causing an area of total destruction corresponding in limits to the apparent limits of the growth, surrounded by a zone of infiltration reaction within which colonies and prolongations not evident to the senses are destroyed without harm to the healthy tissue.

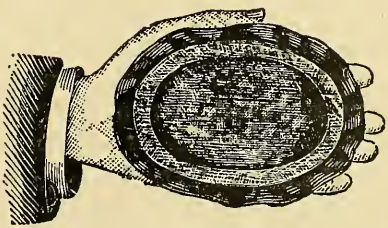
By this treatment the salts of mercury are driven into the cancer by phoresis with heavy electric currents; the patient being etherized and placed on a large leaden plate covered with heavy pads, constituting the negative electrode, the positive being a tube of gold with amalgamated tip through which mercury is injected; three or four hundred milliamperes of current are used, sometimes for two hours or more. An inodorous slough seperates in from one to three weeks.

PROSTATIC PHORIC ELECTRODE

The above cut shows a phoric electrode for treatment of deep urethral trouble and prostatic enlargement. It consists of a hard rubber catheter, perforated at the distal end for about two inches, with numerous small holes. Inside this is placed a flexible twisted copper wire, around the tip of which is wrapped absorbent cotton, wet with a solution of the drug to be used phorically. The water acts as the conducting medium to convey the drug to the membrane by phoresis. If it is iodide of potash, it is to be connected to the negative pole of the battery, and the effect produced by cataphoresis. If you desire the local effect of the oxy-chloride of copper, from the wire, then attach to the positive pole, for the anaphoric effect. The other pole of the battery can be attached to a self retaining sponge electrode, either the back electrode shown before, or to a band spring electrode, which holds itself around the leg, as shown in the cut of the electrode below, or held on the skin by the hand pad.



Leg or Arm Band Electrode.



Hand Pad.

SOLUBLE ELECTRODES

What are soluble electrodes, and their use?

For many years it has been almost impossible (not to say impractical) to treat internal organs of the body, on account of having to use metal electrodes, which could not adjust themselves to the irregular walls, villi, and folds which are in abundance in all the cavities of the body, and for this reason I have adopted the soluble process. Taking first the treatment of the stomach. We can readily dilate it with a saline solution, and introduce an electrode through the œsophagus and we have a large electrode covering the entire stomach. This will be an invaluable aid in many cases of dyspepsia and other diseases. And if we wish to concentrate the current to any one side it is only necessary to place the outside electrode (size to suit) on a convenient spot to secure the proper direction of the current. Either kind or any current can be administered with these electrodes.

We call these *soluble electrodes*, not because they are soluble, but because the copper wire in them can be dissolved by chemical action, and will then, in the form of an oxy-chloride of copper, be diffused through the water, which acts as a positive active electrode. Thus we can apply both the positive sedative galvanic treatment, for the relief of pain, congestion and inflammation, to a mucous surface internally, where we would not dare to apply a bare metal electrode. At the same time we get the positive or anaphoric introduction into the tissues of an astringent, germicide and antiseptic. Thus we get a double action, which in some cases is most desirable and beneficial.

The rectal electrode can be used to great advantage in constipation and neuritis of the abdomen, intussusception, aperistalsis, appendicitis, and many other disordered conditions of the viscera, as the saline water can be forced, not only to dilate the colon, but also reach the small intestines, so that they will also be available as electrodes, and with this electrode one can accomplish decided results that we have not had the means of doing before.

The vaginal soluble electrode. Most of our practicians know that the orifices of the reproductive organs are a network of sensory nerve cells, or plates, and a tonic to the nerves in these parts is like the gardener sowing his seed in good ground, then hoeing and watering it. Thus we can apply electrification to these organs, without feeling that we may burn the patient, or cause any erosion or unfavorable results.

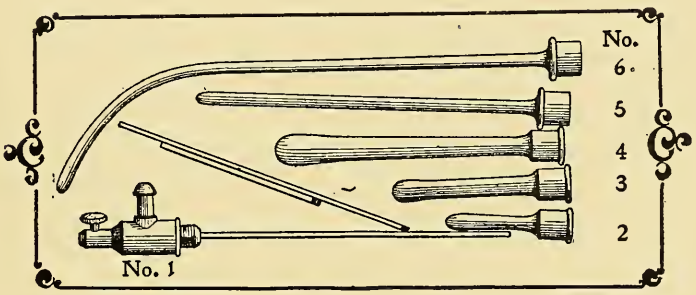
Urethral soluble electrodes for both male and female, can be used with great success, especially in cystitis and other complications of the bladder, as it can be used to wash out that organ, or dilate it, with saline

water and then you have converted it into a large electrode. These same electrodes can be used (with care) as intra-uterine, with great success.

The soluble electrode for the ear is a valuable adjunct to the armamentorium of the electro-therapeutist, as you can touch the tympanum with many of the saline solutions with ease, when you cannot touch it by any other electrode, and one that is adept in the use of the currents for disease will readily see the value of these electrodes. Much more might be said about these electrodes, but they will be mentioned later where indicated in therapeutics.

SOLUBLE ELECTRODES

FOR USE WITH THE POSITIVE POLE



There is no known case that requires internal treatment but can be readily reached by this process, such as inflammation, congestion, strangulation, obstructions, ulcers, erosions, or absorption of pathological conditions. Any medicament can be administered by the osmotic process through these electrodes, as a perusal of the list below will show.

No. 1 is the adapter, and is used to connect both the water and electric supply to the electrodes which screw onto it.

No. 2 for the ear, and No. 3 for the rectum, are used for giving treatment for all aural and bowel trouble.

No. 4 is for vaginal treatment, electric douche, and is a good treatment for leucorrhoea or whites, and inflammation of the vaginal walls and cervix, invaluable in all cases of ulceratiou and infectious diseases of the female organ. Marvelous work can be done by the application of electrification with thiselectrode.

No. 5 is to be passed through the female urethra, and by admitting enough saline water to dilate the bladder, it makes an electrode that is val-

uable for treating any disease of that organ, as the galvanic current acting on the salt in the water creates hyperchlorates, which is a germ destroying agent, as well as the action on the copper, which gives off copper oxide, which is a germicide of itself.

No. 6 is the same as No. 5, only is used in the male organ.

These electrodes are made of hard rubber, and protect the mucous membranes from being injured by coming in contact with any metal. Inside is a copper wire which carries the current; and in connection with the galvanic current it produces oxy-chloride; which is an astringent, germicide and antiseptic agent, and is invaluable in that respect to the practician.

Normal salt solution gr. 2—oz. 1, is used with all these electrodes.

ELECTRO-THERMO-VAPOR BATHS

How give electro-thermo-vapor baths?

The modus operandi of the electro vapor bath is as follows:

A suitable cabinet and proper electric connections being at hand, the patient is stripped and put inside, the cabinet closed and the heat turned on, having the pan half full of water. As soon as the skin becomes moistened the electrodes are placed in position and the currect turned on, the patient moving them as desired. After a few minutes, or when the sweat begins to show on the face; the heat is turned off, the current turned off, and the patient removed, sponged or douched, massaged, and allowed to rest in bed.

RESUME OF THE ELECTRO-VAPOR BATH

What advantages have these baths?

The electro-thermal bath is given in a cabinet, specially designed for the purpose, or constructed to suit the convenience of the physician. In the cabinet, the patient is subjected to the influence of hot air or vapor, and to the electric current chosen for the treatment.

The patient receives the benefits of either the Russian or Turkish baths, and is, at the same time, submitted to the influence of the physiological and therapeutic properties of the electric current employed.

The Russian or Turkish bath constitutes the best known means for re-

ducing to a minimum the resistance of the epidermis, thus facilitating the application of electrification to deep-seated organs.

In the thermal bath, the patient is undressed and general electrization is quite easily performed. The general tonic, stimulating properties of general faradization give tone and energy to a system which would be depressed and relaxed by a vapor bath alone.

The Russian bath is a sedative tonic. Blood in increased quantities is brought to the skin, perspiration is stimulated and becomes profuse, poisonous products are eliminated from the system through all the glands of the skin. The nervous system is calmed by the vapor bath and all symptoms of nervous irritation rapidly disappear.

The Russian bath is, so far as elimination alone can do it, the best known blood purifier. The increased cutaneous circulation relieves promptly congested conditions of internal viscera, and allows these organs to continue their functions under more nearly normal influences.

The electric vapor bath is, next to static methods, the best means for producing general electrification. Like static methods, the patient in an electric bath is subject to general electrification, and at the same time the current may be localized on any portion of the body requiring local treatment. The direct or alternating current may be used, and the treatment can be made local or general or both combined. This method of treatment combines the effects of hydro-therapy and electro-therapy, and further, it diminishes cutaneous resistance, and permits the use of stronger currents, if these be desired, than could be tolerated outside the bath.

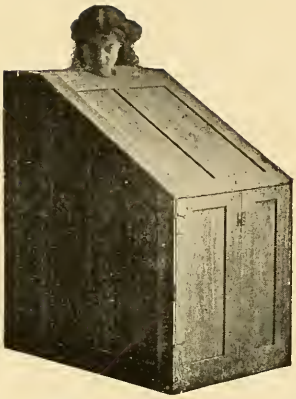
Whenever the physician desires to eliminate toxic material from the system, electro-thermal baths are indicated. Tonic sedative effects are also produced at the same time that the toxic materials are eliminated.

The electro-vapor bath is useful for increasing the skin elimination, for its reflex effect on the nervous system, and for lowering the arterial pressure. The addition of electrification gives it a decided tonic effect. The baths are convenient, inexpensive and devoid of the depression caused without the use of electrification.

A HOME-MADE BATH CABINET

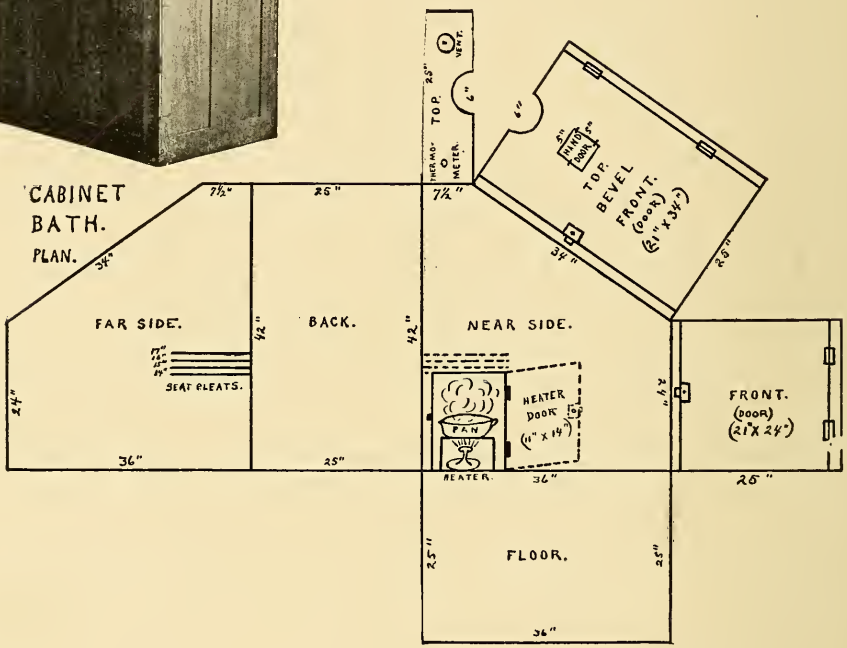
How construct a bath cabinet?

If it is not desired to invest in an elaborate or expensive office electro-thermo-vapor bath cabinet, one may be constructed by yourself or your



local cabinet maker at small cost, and do just as well as one costing a hundred dollars.

I will tell you how to build one yourself. You make it just as elaborate and ornate as your fancy dictates, and the cost will be what you may decide, and it will do just as well as any other.

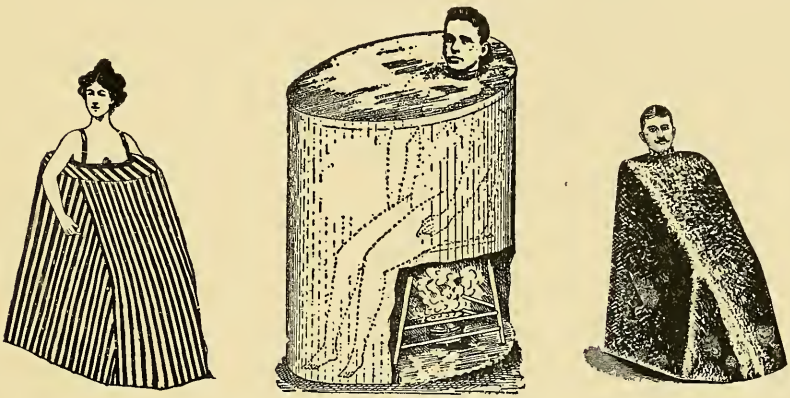


The above sketch shows an outline diagram or pattern of a home-made electro-thermo-vapor bath cabinet. Draw off the plan then fold along the inside vertical, horizontal and slant lines, and you will have a working model from which any carpenter can build you a bath cabinet.

The dimensions are not exact to the fraction of an inch, but are approximately correct. It should be made of only clear, throughly kiln-dried wood, as the heat will shrink and warp unseasoned wood. The material may be any straight-grained wood and should be at least seven-eighths of an inch thick. The floor may be left off, if desired, and the shell set on an oil cloth, but a floor makes it stronger and it will keep its shape better with a floor, besides fitting it for rollers, if desired. The seat is to be placed on

cleats one inch apart so it may be raised through four inches to accommodate different people. One of these will pay for itself many times over. It should have at least three coats of hard paint inside and out, and a new coat every six months, if used much.

PORTABLE ELECTRO-VAPOR BATHS



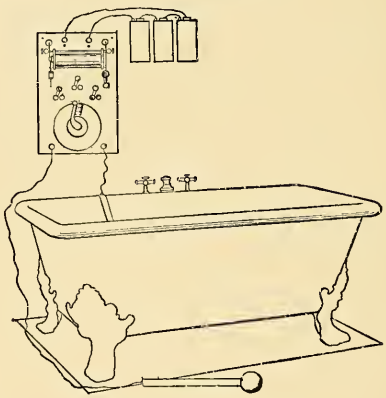
It is sometimes necessary to give an electro-vapor bath treatment at the home of a patient who may be unable to come to your office for treatment. You may give such cases treatments by means of portable, collapsable baths, similar to the three shown above. Two of these fit about the neck and envelope the body, while the left-hand cut shows one leaving the arms and shoulders exposed. This may be advisable in cases of obesity, where you wish only to heat and deplete the body below the bust. These are cheap and durable and will answer the purpose in cases of necessity and emergency. The patient sits on an ordinary chair with the heater and vaporizer underneath. The material should be some heavy waterproof cloth, similar to cravenette, not rubber or oilcloth, which will crack and break, and be affected by the heat. This bath may be slipped under the buggy seat, and with your portable battery between your feet and your electrodes in your pocket, you are prepared to administer a beneficial electro-thermo-vapor bath treatment anywhere, in a scientific and satisfactory manner.

THE HYDRO-ELECTRIC BATH

How give hydro-electric baths?

Hydro-electric baths are given in tubs which have no connection with the plumbing. One electrode is put in the water and the current is thus diffused over the whole of the body immersed in the water. The other is applied to the part of the body out of the water.

Much stress has been placed upon the benefits following the hydro-electric bath, or the bath in which the patient is immersed in water, through which an electric current is passing. We know that water is a better conductor than the body, and therefore, according to Ohm's law, the current will follow the path of the least resistance, and pass *around* the patient, rather than *through* him, so that the amount he gets will be exceedingly small. If, however, the water is connected to one pole of the battery and the patient, in the water, holds in his hand the other electrode, above the water, then of course, the current must traverse his body and the water in order to complete the circuit. Because of the water being such a good conductor, it may be used as an electrode, with the part to be treated immersed in the water in which is one pole. By this method phoresis may be employed by medicating the water with the remedy to be used. Very painful conditions like arthritis and gout may be treated thus, when the contact of the ordinary electrodes would be unbearable.



The accompanying sketch shows an ordinary bath tub equipped for the hydro-electric bath; one cord from the battery is attached to the submerged electrode, the other pole is connected to the electrode on the floor. The patient's body is either wholly or partially immersed, the water acting as one electrode, and the other (on the floor) is applied to some part of the body out of the water, thus completeing the circuit. However, the hydro-electric bath is not as useful as other forms of treatment.

Do not use the street current in the bath tub that is in any way connected with the ground. Ground circuits on dynamos are of frequent occurrence.

Electric bath tubs should in no wise be connected with sewer or water pipes.

General Constitutional Electric Treatments

How give general galvanization, and faradization?

General galvanization and faradization is given with the negative electrode to the feet while the positive is moved along the spine and to the muscles in general.

In many constitutional diseases, among which we might name rheumatism, paralysis, neurasthenia, etc., as being more frequently met with, it is necessary to give a treatment that will affect the entire system.

General treatment may be given by general faradization, general galvanization and central galvanization.

GENERAL FARADIZATION

As its name implies, is general use of the faradic current. This treatment has a direct influence upon the entire system and by reflex action may indirectly have a therapeutic effect on some particular organ or part which may be diseased. General faradization is indicated wherever a general constitutional tonic influence is called for, in conditions of depressed vitality, in tedious periods of convalescence, wherever there is poor ciculation, defective assimilation and in nearly all nervous conditions.

One pole is usually placed at the coccyx or feet (preferably the latter), the other passed slowly over the entire surface of the body.

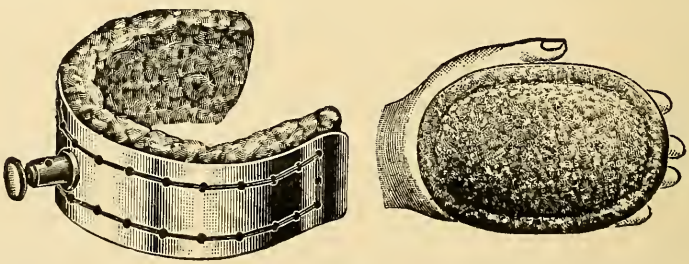
The clothing of the patient must be so arranged that the current can be passed over every part of the body. Many operators have the patient remove all clothing and substitute a light robe made for the purpose, open either in the back or on the sides, so the active pole can without delay or inconvenience be used wherever it is desired.

Others loosen all clothing around the waist and arrange to pass a small electrode over the surface, adjusting the clothing separately for each part. In this method there may be less embarrassment to the patient, but the treatment cannot be given as successfully, the skin can not be moistened as thoroughly, hence the greater resistance to the passage of the current and the patient's clothing is invariably soiled and wet by the moistened electrode.

These treatments are given with the patient seated upon a stool so the operator can give a thorough treatment and not be impeded by the arms or back of a chair. The general treatments are also given with the patient in a recumbent position, all clothing removed and their person protected by a sheet or blanket. This is a very easy and efficient manner of making general applications.

In many cases these treatments may be given largely by the patients themselves as far as the manipulation of the electrodes is concerned. If the patient is in an erect position during treatment one wire from the battery may be attached to a zinc or copper plate upon which the feet rest; or the feet may be immersed in a bowl of water and the one pole placed in the water.

In the former method the zinc and copper is frequently unpleasantly cold to the patient, and as the skin upon the soles of the feet is so thick as to afford great resistance, it does not make as good a conductor as the water. The water may be warmed, a little salt added to assist in overcoming the resistance of the skin, and as the water comes in contact with the sides and



upper surface of the feet as well as the soles, it makes a much better mode of application.

If the treatments are given while the patient is in a recumbent position, the zinc or copper plate may be used at the feet, or sponge or cotton-covered electrodes preferably attached to the ankles instead of the soles, on account of less resistance.

The question, "Which pole shall be passed over the body?" is the one

first asked by nearly every physician and by them is considered the all-important point.

The question of polarity is not of as great importance in the use of the faradic currents as galvanic.

These points, however, may be borne in mind:

If in the treatment of nervous conditions or whenever it is desired to relieve pain, a sedative effect is indicated, the negative pole should be at the feet or coccyx and the positive pole applied over the seat of pain and passed all over the body.

If an irritating or stimulating effect is desired, as for instance in amenorrhea or paralysis, place the positive pole at the feet or coccyx and pass the negative over the seat of disease and all over the body. In other words the positive pole should be applied to the diseased part where pain is present or active irritation exists; and the negative pole should be used to influence morbid chronic processes. The primary coil would be the preferable one to use where it was desired to obtain relief through muscular contractions, and the secondary coil where it was desired to reach a deeply-seated trouble or treat the nervous system. The peripheral nerves and capillary circulation could be affected to a greater degree by the use of the primary coil; and the spinal cord, the sympathetic nervous system, and the circulation and nutrition of internal organs, or deeply-seated structures could be influenced to a greater extent and with better results, if the secondary coil was used.

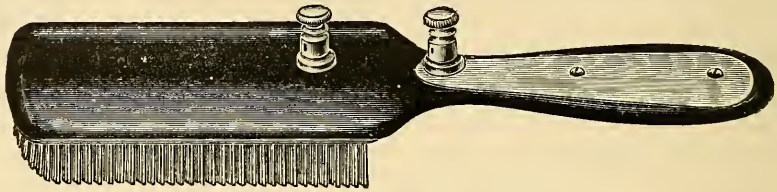
Rapid vibrations would be much more preferable in nervous diseases, and in fact nearly all conditions where a mechanical effect was desired, and violent muscular contractions were to be produced. In this, even, slow, interruptions would be preferable.

The strength of current should be regulated by the sensations of the patient. Never carry the treatment to the point of pain. If the patient says it is unpleasantly strong the current should be reduced.

It is best to begin the treatment of general faradization with the positive pole at the base of the brain, pass it slowly down the spinal cord for three to five minutes, then pass it over the chest and hold it over the epigastrium for a few moments to influence the coeliac-plexus, then over the abdomen to stimulate intestinal action and the abdominal muscles, then upon the thighs, arms and legs, varying the strength of the current to suit the resistance afforded by the different parts.

In giving general faradization it is important that the treatment should not be neglected at the back of the head, down the neck, the upper portion of the spinal column and over the coelio-spinal center. The most important nerves of the body can be treated here.

In giving treatments to the head it is frequently advisable to pass the current through the operator's hand so it will not be felt as plainly by the patient as if the ordinary electrode had been used over the sensative nerves of the forehead and face. As the hair is practically a non-conductor, it must be thoroughly moistened or a wire brush electrode used.



Hair Brush Electrode (either monopolar or bipolar).

The usual length of treatment is from 15 to 20 minutes. They should be given daily or every other day—very seldom more than once a day.

Any intelligent physician would understand that in the use of these treatments for chorea, neurasthenia, hysteria, etc., particular attention should be paid to the treatment of the nervous system, while in a case of rheumatism we would direct our treatment to a greater extent to the muscles affected.

The effects of general faradization are:

To act as a sedative upon the nervous system, allaying irritability and pain. Sleep is facilitated.

To temporarily act as a stimulant.

To improve nutrition. This may be local or general.

To promote the process of waste and repair.

During and after a course of general faradization the patient will feel exhilerated and stimulated. Tone has been given to the entire system; pain has been allayed; all feelings of weariness, lassitude and lameness removed.

The temperature has been equalized, the circulation improved, an increased warmth given to the surface and extremities, digestion improved and appetite increased and the bowels regulated.

The muscles develop in size and hardness. The body, responding to increased appetite, improved digestion and circulation, increases in weight.

Nervousness is allayed, sleep is facilitated, the brain and mental faculties strengthened and there is a greater capacity for, and endurance of, brain labor.

The good effects of general faradization usually continue for a considerable time after the treatments have been discontinued.

GENERAL GALVANIZATION

General galvanization, or the general use of the galvanic current, is given in precisely the same manner as general faradization.

Many of the directions given for the use of the poles should be the same.

The differential effect of the two poles is much more marked in the galvanic current than in the faradic, so that rules laid down for the use of the positive pole to allay irritability and pain and the use of the negative pole where a stimulating or irritating effect is desired should be more particularly observed.

Some authorities attach more importance to general faradization than general galvanization, while with other authorities this is reversed. Either treatment would be of benefit in the same conditions.

Galvanization has the advantage that stronger currents can be used, that it has greater penetrating power and will reach a deeply seated trouble where in some cases the faradic current would be ineffective, and that it has a chemical effect which the faradic current does not possess.

To produce muscular contractions through general galvanization it would be advisable to use the interrupted galvanic current.

Ordinarily general faradization would be preferable in muscular trouble and general galvanization in nervous diseases. The sedative effect is much more marked in the latter treatment than in general faradization, as is also the effect upon the absorbents.

The general nutrition of the entire system can probably be more profoundly affected through general galvanization than by general faradization. Either treatment is successful in influencing the circulation.

In giving general galvanization, care should be taken that the current is not suddenly interrupted while the electrodes are in position, as this causes a shock to the nerves which may aggravate the trouble. The treatment cannot be properly given without the use of a rheostat and milliampere meter.

CENTRAL GALVANIZATION.

How give central galvanization?

Central galvanization is given with the negative electrode over the solar plexus, the positive being moved over the head and spine, and over the pneumogastric nerve in the neck.

By this term we mean a treatment with the galvanic current which

will bring the entire central nervous system—the brain, sympathetic, and spinal cord—under the direct influence of the treatment.

This treatment may be given independently of any other, or co-jointly with general faradization or galvanization, and is applied by having one pole, usually the negative, at the epigastrium and the other at the vertex or passed over the forehead, down the back of the neck, and down the entire length of the spine. Having the negative pole at the epigastrium and the positive pole at the base of the brain and down the sides of the neck is the best methed of stimulating the sympathetic, pneumogastric and phrenic nerves. Over the forehead not more than from two to five milliamperes should be used, while upon the vertex and down the spinal column, 10 to 15 milliamperes is the usual strength of current, although this may be increased to 25 or 35 in many cases. Treatments to the head should not be continued more then two or three minutes at a time.

Particular care should be taken in treating the head that there is not a sudden interruption of the current. The electrodes at the epigastrium should cover considerable surface to prevent any pain or burning sensation.

The length of treatment is from 12 to 15 minutes.

Central galvanization would be the indicated treatment wherever there is a condition of exhaustion or irritability of the nervous system. It is usually a good idea to combine central galvanization with general galvanization or general faradization. In nearly any patient who would come to us suffering with hysteria, neurasthenia, chorea, epilepsy or analogous conditions, where we desire to use central galvanization we would also find in one case defective assimilation, in another rheumatism, and in others constipation, muscular atrophy, the results of lagrippe, various skin diseases, and so on ad infinitum, and these outlying symtoms or conditions could be removed or improved by general treatment, while the central treatment alone would effect little if anything.

The central treatment and the general treatment may be given on alternate days; or, what is a better plan, give the central galvanization ten minutes and then general faradization or galvanization ten minutes more, during the same sitting.

Central galvanization and general faradization have in the effect of the treatment many things in common. With either treatment a feeling of exhileration and warmth of body is produced, A tonic effect, improvement in sleep, increased appetite, improved digestion, regularity of the bowels and equalized circulation may be secured with either treatment, as can also increased size and firmness of the muscles.

Either of these treatments, both by direct effect and reflex action, will

act as a tonic to the brain and increase the capacity for brain work. General faradization, however, acts more markedly upon the muscular system and central galvanization upon the nervous system.

What effect has electrification on the blood and strength?

Electrification has not only a direct effect upon the circulation, through the catalytic action on the vaso-motor nervous system, but it also has a marked effect upon the constituents of the blood itself, and we find, after careful experiment and observation, that the increased circulation and oxidation of the blood lessens the number of red blood corpuscles. These corpuscles must have gone into the tissues in the form of nutrition. At any rate experiment shows that the muscles are stronger after a treatment by electrification than they were before.

What are the four classes of electrification?

Electrification may be divided into four classes, according to the various phenomena of manifestation, as follows:

1st.—Electrification in motion, or dynamic.
2nd.—Electrification in rotation, or magnetic.
3rd.—Electrification at rest, or static.
4th.—Electrification in vibration, or radiant.

How is the static current generated?

Static currents are generated by friction and induction as we know from experiments with the box, glass, paper, comb, etc., or a pan of sealing wax which, rubbed with a piece of fur or silk, will become charged. If a piece of metal, with an insulated handle is held upon the wax it also will be charged and will carry the charge with it when removed, and when touched will emit a spark.

The modern static machines are mere elaborations of the simple electrophorus which have been adapted for developing electrification continuously. With a number of glass, hard rubber, or mica plates, placed vertically, and so arranged in pairs that the charges of the same polarity are conducted to the same terminal on one side of the machine, and the charges of the opposite polarity to the same terminal on the other side of the machine.

The static machine is constructed with one or more pairs of plates,

mounted on an insulated axle, with two insulated metal rods connected with the plate. The ends near the plate terminate in toothed collecting combs, while the other ends terminate in balls. The current is generated by starting the machine in motion. If it be of the Toepler or self-charging type, which has six small disks cemented to the plates, when the brushes come in contact with these small disks as the plate is revolved past the brushes it causes a slight friction, which generates the initial charge, which is communicated to the other plates, thus charging the machine and keeping it charged. After being charged the induction keeps up the generation.

As the plate rotates, a part of the negative charge is carried over to the inductor, thus charging it negatively. The remainder of the charge being repelled by the negative, passes over into the Leyden jar. Later it becomes charged by induction, this time positively, increasing the positive charge upon this inductor, while the remainder of the positive charge passes over to the Leyden jar, and passes on to complete the cycle.

As the rotation continues the plates aquire stronger and stronger charges, the inductive action becomes more and more intense, the positive and negative charges are continuously imparted to the Leyden jars or prime terminals, the stress of the high potential becomes so great as to overcome the resistance of the surrounding elastic transparent dielectric (the air) when there is a convective discharge in the form of a spray or a disruptive discharge in the form of a spark across the gap between the prime poles. This temporarily relieves the stress, and the same process is repeated.

Friction between two bodies causes a separation of electrification. One body becomes positively, and the other negatively electrified.

In this condition they are mutually attracted to each other. If two bodies similarly electrified are brought into proximity, the ones of the same polarity are mutually repelled, while the ones of the opposite polarity are mutually attracted.

There is a mooted question as to whether the electric charge of any conductor simply resides upon the surface or penetrates into the substance or the tissues of the body, in the case of a patient. No matter which theory is true, the results in therapeutics are the same, so that we need not discuss that matter.

What are condensers?

Condensers are apparatuses consistiting of two conductors, supported and insulated from the earth, and separated from each other by some die-

lectric, or non-conductor. This intervening dielectric may be the air, glass or other insulator. If one plate is charged with one polarity there will be induced in the other an opposite polarity. Glass as a dielectric will induce a greater potential in the second plate than will the air.

The condenser most used is called a Leyden jar, which consists of a jar or bottle of glass, lined on the inside, part way up from the bottom with tin foil, and covered for the same distance on the outside with the same material. The inside coating is connected to a ball on the top of the lid, by means of a chain. If the inside foil be charged with positive static electrification, there will be induced on the outside coating of foil an opposite or negative charge.

How is static capacity modified?

The capacity of a conductor of static electrification depends upon the degree of insulation against the loss of charge by leakage, and upon the size of the conductor, or patient, and upon the state he is in at the time of treatment, and also upon the proximity to the generator.

How is static electrification governed?

Static electrification is governed by the same laws of conduction and insulation as is the dynamic currents, but to a less degree because of the far greater voltage and very weak amperage. On account of its voltage, much greater insulation is required, and a correspondingly poor conductor will carry a charge. Thus a small air space will insulate a galvanic current, but a wide air gap will be leaped across by a static charge.

How is static electrification distributed?

The distribution of the static charge of electrification is uniform, all things being equal, and the potential of any part of a perfect sphere is equal to that of any other part, but this is not true of irregular conductors, as the density of the charge or the potential varies according to the curvature of the conductor.

Thus, a discharge will not be as marked from a flat part of the body as it will from some bony prominence, therefore we must be careful about drawing charges from the smaller parts of the body, as there the conductivity is lessened, and the effect is more marked. This modality therefore, follows the same law of density and diffusion as do the other forms studied in previous pages.

What can be said of static polarity?

The same polar effects are manifested here also, in that the positive is sedative and anodyne, and the negative is irritating and stimulating.

What is the difference between static and faradic induced currents?

The static induced current is not of the alternating character of the faradic induced current. Instead, it is a undirectional current, but interrupted at the same rate that the primary static current which induced it, is interrupted.

Of what use is the hygrometer?

The hygrometer is a little instrument which is placed in the case of the static machine. It indicates the percentage of moisture in the air, and tells the operator why his machine works badly, and when to dry it out.

What is the physiological effect of static electrification?

The static current produces no chemical effect in the tissues, it acts as a general tonic and stimulant to the nervous and circulatory systems. It will increase the circulation, improve nutrition, assist digestion and assimilation, promote absorption, quiet, refresh and invigorate the nervous system.

On account of its great voltage it puts the surrounding air in a state of great stress, liberating allotropic oxygen, which in the form of nascent ozone is inhaled or absorbed through the skin and enters directly into the circulation, thus increasing oxidation. In acute painful conditions, as lumbago, sciatica, locomotor ataxia, etc., static electrification affords a great measure of relief. Being a sedative, the positive static modality is indicated in all nervous functional disorders. As a counter irritant, the negative modality is useful in breaking up adhesions and promoting absorption.

As a stimulant to paralyzed muscles we have in the static modes a

most active agent, producing active contractions, whether due to lack of tone, partial or complete paralysis. In painful and diseased conditions, and where metabolism is to be stimulated or elimination and excretion hastened, or as a restorer of the normal electric equilibruim, it probably acts more generally and quickly than anything else.

Also in all states of poor nutrition, and impoverished blood, it is valuable. The great voltage puts the surrounding air in a state of stress, and breaks up the combination of the gases, liberating allotropic oxygen, which in the form of ozone, is inhaled or absorbed through the skin, and enters directly into the circulation, in the nascent state, thus rapidly increasing oxidation, and purifying the blood, and thus promoting nutrition, and growth. A patient on the insulated platform, is bathed in this ozone bath, and as a result, in a few minutes, the body temperature is raised from a degree to a degree and half.

This fact can be easily demonstrated, with the aid of a clinical thermometer, before and after a treatment by static insulation. Static treatments will also tone up and restore the balance in cases of depressed nervous functions, as in neurasthenia, and in various cachexias.

Mental exhausation, brain fag, and the subnormal states following prolonged literary labor of teachers, lawyers, clergymen, physicians, public speakers, etc., responds most favorably to the gentle but powerful stimulating effects of static electrification. In rheumatism, gout and uremic states it acts well, relieving the pain, and hastening the absorption of deposits, and the elimination of urea.

The positive breeze relieves congestion when the positive pole is used, and, being a sedative, is indicated in headaches, epilepsy, neurasthenia, hysteria, etc. The static spark is a stimulant, producing counter irritation, and is useful in ganglia, rupture, and in breaking up adhesions and in aborting acute rheumatism, etc.

Static electrification is useful in convalescence after operations or prolonged illness, tuberculosis, neuritis, tic douloreux and constipation.

Cases of hysteria, neurasthenia, chorea, melancholia, hypochondriasis, and other allied diseases, will receive greater and more prompt benefit from static electrification than perhaps from any other treatment.

While static electrification produces no chemical effects in tissues, it will increase the circulation, improve nutrition, assist digeston and assimilation, promote absorption, and quiet, refresh and invigorate the nervous system.

In neuralgias, and the acute painful troubles, as lumbago, sciatica, the lightning pains of locomotor ataxia, and in migraine, and "tic" it affords a great measure of relief, sometimes almost like magic.

In the reflex nervous conditions, as in chorea, it is beneficial, and it will sometimes prevent epileptiform attacks, when all else fails. In chlorosis and anæmia, and in incipient tuberculosis, the results obtained are sometimes marvelous. Poor circulation, as evidenced by cold feet, clammy and pale skin, can sometimes be changed in one or two treatments. A dozen inhalations of the fresh nascent ozone, will flush the face of a pale patient to a rosy red, and a static roller massage application, through the clothing, will warm the patient all over for hours, and the roller or sparks to the soles of the shoes will take away the cushion sensation, in threatened paralysis. Static treatments will relax contracted and drawn and even stiffened muscles and joints, and fill out atrophies. In the vague and troublesome symptoms incident to the menopause, static electrification is very satisfactory.

As a stimulant to paralyzed muscles it is the remedy to be used, as it will produce active contractions without pain, and in constipation, due to lack of tone or to paralysis from over distension, or the prolonged use of cathartics, there is nothing better. It may be applied even to children, sensative women, and weak convalescents, without pain, and the peristalsis is at once started, and it sometimes continues for hours after the seance.

There being no direct chemical, electrolytic, or mechanical or phoric effects, then the great and grand function of static electrification is the catalytic effect on nutrition, through the vaso-motor nervous system.

In giving dynamic electrification, we must necessarily make the treatments largely local, where as we can rarely make a static treatment local. When the patient is on the insulated platform, we may concentrate the most of the effects to some part, or local area, but we cannot prevent the excess from traveling all over the patient, thus giving him a general treatment at the same time.

With a proper diagnosis, and a full realization of the needs of the individual case, and a full knowledge of the technique of the treatments, the man with the static machine can accomplish wonders, and do it so safely, quickly, and pleasantly, and withal so profitably to himself, that he will no longer resort to the older and slower, and more disagreeable methods of the past, when once he gets started in the new ways.

Do not get the idea that the static electrification will do everything, or that it is a cure-all, or that it will take the place of galvanism, or faradism, or drugs, in all cases. If you start out with the idea, you will be disappointed, and are only laying up for yourself trouble. Static electrification has its place in our work, and in many instances it has a place which

nothing else can fill. Use it in conjunction, or in alternation, with the other modes and get a combination which cannot be excelled.

There are some advantages in giving this treatment over all others. It may be applied, either generally, locally, or both, without disrobing, exposure, or the annoyance of delay. For this reason it is popular with the women, who are usually our best patrons. Again the treatments take less time, as there is none lost in preparation before or after the treatment. Then you may treat a number at a time if desired. For instance, the platform is usually large enough for two stools upon it, or a mother may hold her child on her lap. You may treat infants this way, which you could not do with any other method.

In static electrification, we possess one of the most useful agents for the relief of painful and diseased conditions, and when properly applied will usually prove beneficial, and where tissue metabolism is to be stimulated, or elimination and excretion to be hastened, there is probably nothing superior.

As a restorer of the normal electric equilibrium, it probably acts more generally and quickly than anything else. Generally catalytic or nutritional effects are more quickly produced with static, than with the other modalities.

The use of static sparks ought to be discouraged. The static breeze will usually do what sparking can do, and is by far more agreeable.

What are the ten therapeutic static applications?

The various modes of static treatment are:

Static insulation, or bath; static crown breeze, or shower; localized static spray; diffused static breeze; direct spark; indirect spark; solenoid shunt current; surging, or static wave; general tonic treatment, with roller; induced current, or Leyden jar shocks; interrupted continuous current, or static vibration.

What size and kind of static machine is the best?

A sixteen plate machine will be amply sufficient for all ordinary static therapeutic work, and will do good X-ray work, but for the more difficult X-ray work you should have a twenty-four plate machine. This is especially so in wet weather, when the machine works at a disadvantage and will not deliver its full potential charge of electrification, on account of

leakage, through the moisture in the air, which will condense on the plates in the form of dew and, acting as a conductor, will short circuit the the machine inside. It is well to always make it your rule never to leave the machine short circuited when not in use, that is never to leave the balls on the sliding rods of the prime conductors in contact. Always leave them wide apart, beyond the sparking distance, when not in use. I have had experience with nearly every kind of static generator, and have found the Tœpler, or self-charging type, to be the most satisfactory, and the twenty-four plate the best. The roller bearing shaft machine, for ease of running, strength of construction, and economy of repairs, is far superior to all others.

What can you say of static voltage and amperage?

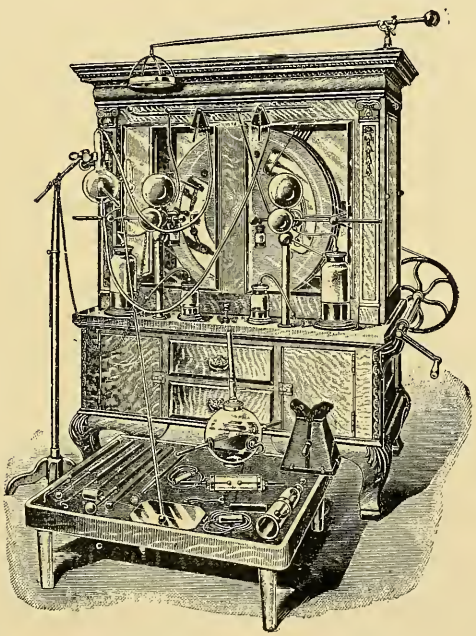
Static electrification manifests enormous pressure or voltage. This is shown by its ability to overcome great resistances, and to pass obstacles which would effectually check the weaker dynamic currents. We have seen that in order to get a galvanic or a faradic current, we must have a complete metallic conducting circuit. Such is not the case with the static, as we are able to give treatment with only one pole of the static machine.

Dry air is a poor conductor, and is a sufficient insulator for even high pressure dynamic currents, but the static machine will generate a potential sufficient to overcome or break down the great resistance of the air dielectric, and cause a spark or discharge to take place through long gaps between poles, or from the machine to the earth. The principle of the difference of the potential, as creating a transference of energy from the higher to the lower, is applicable to the study of the phenomena of static electrification. Thus we speak of the static current flowing in the same sense that we say the same of the other modalities which we have studied.

Static electrification manifests no current strength or amperage and consequently will cause no chemical action, and will not produce electrolysis or dissociation of compound electrolytes. For the same reason it will not have any phoric action. This statement may be disputed by some, but we now know that if there is any transference of medicaments, it is not a a phoric process, but merely a repulsion of electrified particles, which must be either a vapor or a gas, and will not penetrate the tissues.

Static Technique

Directions for Giving the Various Treatments.



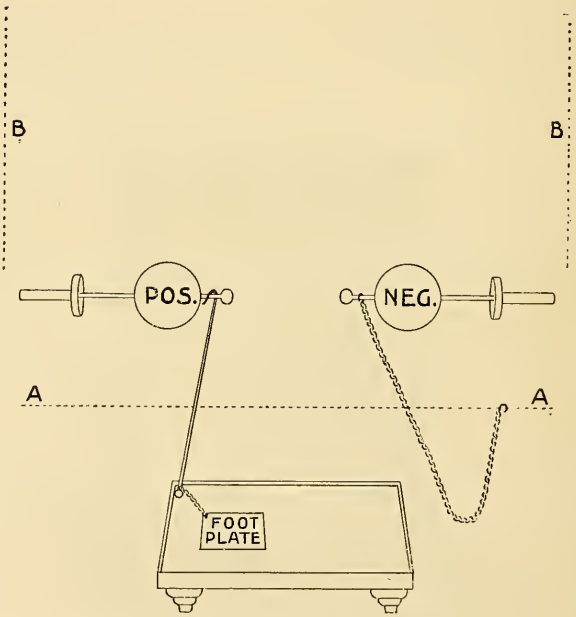
A Modern Static Influence Machine.

Static Insulation—Place the patient on the insulated platform. Connect the platform by means of the rod, cord or chain to one pole of the

machine. Ground the other pole of the machine by means of the chain or cord attached to the water pipe. Separate the sliding rods beyond the sparking distance. Short circuit the outside of the Leyden jars. Start the machine in motion.

Static Crown Breeze—Place the patient on the insulated platform. Connect the platform by means of the rod to one pole of the machine. Connect the other pole of the machine to the overhead crown attachment, the outside of the Leyden jars short circuited. Swing the crown above the patient's head so that it is about fifteen inches above the head. Start the machine in motion.

Localized Static Spray—Insulate the patient, attach any of the point electrodes to the chain or cord and localize the breeze with the point electrode on the part to be treated. The grounding chain attached to the



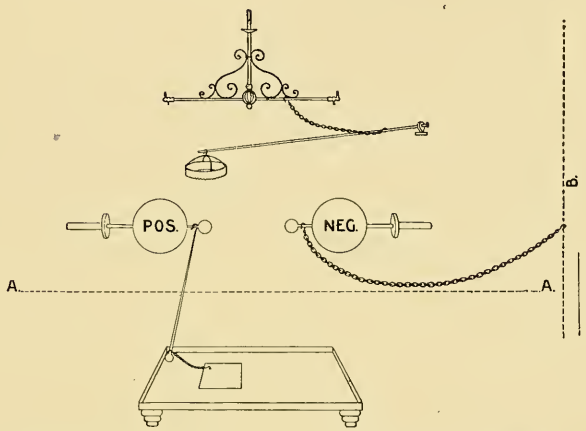
Positive Electrification (Insulation).

electrode may be omitted, and the current grounded through the operator's hand and body.

Direct Spark—Place the patient on the insulated platform connected by means of the rod or chain to one pole of the machine. Attach any of the electrodes by means of the hook and chain or cord to the other pole of

the machine, holding the electrode in the left hand, and using the insulated hook to hold the chain away from the patient and the floor. Approach the electrode to the part to be treated, from which the sparks will be drawn.

INDIRECT SPARKS—Place the patient on the insulated platform connected by means of the rod to one pole of the machine. Ground the other pole by means of the cord or chain attached to the water pipe, with any of the electrodes either grounded to the floor by means of the chain or the electrode held in the hand, grounding the circuit through the operator's body, and approach the electrode to the part to be treated from which the spark will be drawn.



Stationary Negative Crown Breeze (Shower).

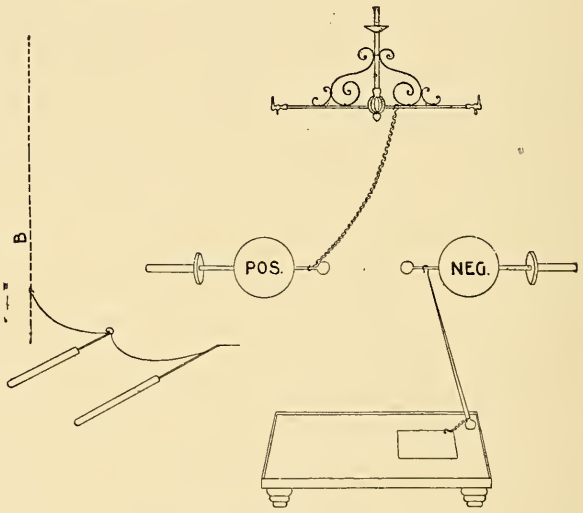
INTERRUPTED DIRECT CURRENT—Place patient on platform; connect a wet sponge-covered electrode to the positive side of machine (with positive sliding rod drawn out) by an insulated cord. Place electrode on bare skin wherever you wish to get a sedative effect. Likewise place another wet sponge electrode on bare skin wherever a stimulating effect is desired. Then connect this electrode to the negative X-ray spark gap, the rod and ball placed on a level, and in line, and in contact with the negative sliding rod. The negative prime pole not grounded. Start machine and regulate impulse through patient by pulling out negative sliding rod, away from negative X-ray terminal. The length of this gap regulates effect on patient. Grounding negative prime pole increases the effects.

TO USE THE CONCENTRATOR—Place the patient on the insulated platform connected by means of the rod or chain to one pole of the machine,

the other pole being grounded by means of the chain or cord attached to the water pipe. Place the point of the concentrator on the standard, towards the part to be treated, the concentrator being grounded by means of the chain attached to the water pipe, or by means of the hand and body of the operator.

Surging—Proceed the same as in the static insulation, but bring the sliding rods within sparking distance, the strength of the surging being regulated by means of the spark gap between the sliding rods.

General Tonic Treatment—Place patient on insulating platform, connect one pole of the machine by means of the chain to metal foot plate on the platform, covered with a thin book, on which the patient's bare feet



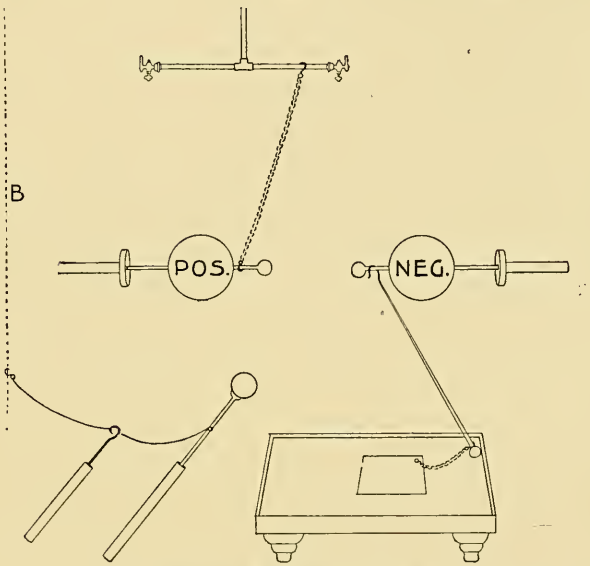
Local or Moving Positive Spray.

are placed. Connect the other pole of the machine to the overhead crown the same as in static breeze. This treatment may be used as a variation of the static insulation, static breeze and surging,

Variations of Current Strength—To get the mildest treatment, use the smallest Leyden jars, run the machine slowly, and give either the static insulation or the indirect breeze, with the wooden point electrode. To give the most severe treatment, run the machine very fast, and give the direct spark with the large metal ball or roller.

Induced Current—Remove the concentrator from the standard. Place in the standard the induced current device. Place the standard and

device directly in front of the machine with the device parallel to the sliding rods with the scale to the front. Disconnect the outside of the Leyden jars. Separate the sliding rods beyond sparking distance. Connect the sliding rods by means of two short chains and hooks to the binding posts on the device. Attach the sponge covered disc electrode to the binding posts in front of the Leyden jars by means of the red and green silk-covered cords, the sponges well wet. Apply the sponge covered discs to the part to be treated, preferably to the bare skin, but it may be given through the clothing. Start the machine and regulate the current strength by means of the wheel on the device. The static induced current may be applied

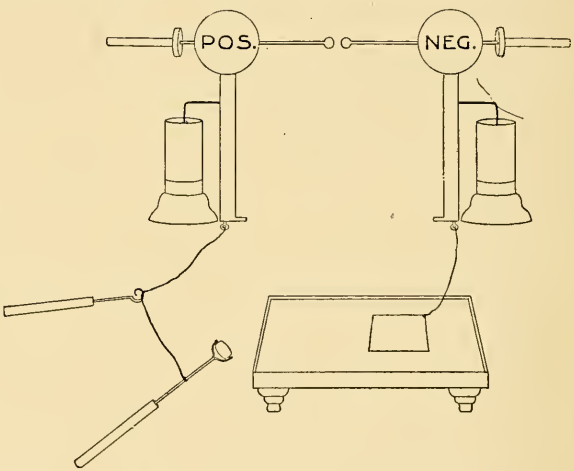


Positive Indirect Spark.

with any of the other electrodes, with the patient either upon the insulated platform or not.

If you do not have the special induced current regulating device, the current may be given without it, by connecting the cords from the electrodes to the outside of the Leyden jars, and bringing the balls on the sliding rods together, with the outside of the jars not connected to each other (switch open). Then start the machine and regulate the secondary or induced current, by the primary current. To do this, gradually separate the sliding rods, the spark gaps between the sliding rods regulating the impulses through the patient, in the induced current circuit from the outside of the jars.

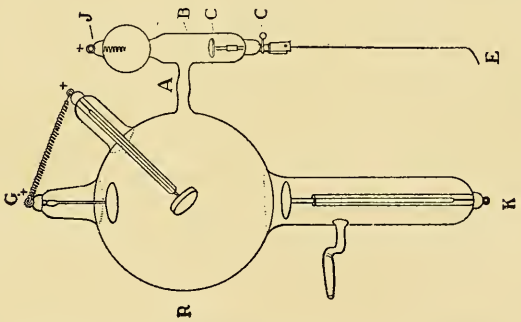
General Instructions Concerning the Electrodes—The hook and ring is for handling the chains, or connecting overhead crown, in order to avoid shocks to the operator. The long rod with the crook is to connect the machine to the platform. The silk covered cords are to be used with the induced current. The short chains are to connect the induced current device to the static machine. The long chains are for grounding the machine or giving the various treatments with the different electrodes. The one with the snap is to be used with the electrode. The wooden point gives the mildest treatment. The wooden ball next. The wooden electrodes are for the breeze treatment. The single metal and the multiple metal points are for localizing the breeze, and are strong-



Massage Roller, with Induced Current.

er than the wooden ones. The carbon point gives the mildest direct spark and the stronger local breeze. The small metal ball is for giving mild sparks, the large metal ball for giving more severe sparks, either metal ball to be used either direct or indirect. The roller is for giving general massage with short sparks either direct or indirect. The felt-covered disc rubefacient is for giving severe localized applications, either direct or indirect, with induced current, and is to be held in contact with either the clothing or skin of the patient, where the effect desired is to be produced. The sponge covered disc electrodes are to be used with induced current device. The spark gaps should be attached to the sliding rods, separated beyond sparking distance, with the small ball close to the ball of the sliding rod, and are of use in X-ray work.

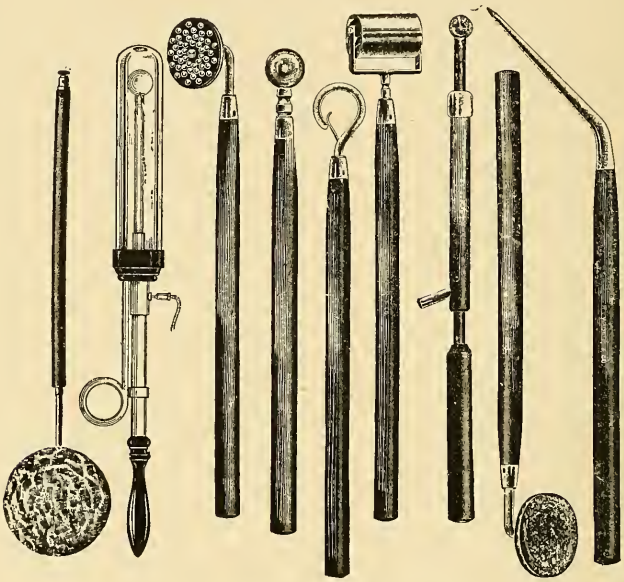
Fluoroscopic Examinations—Remove concentrator from standard. Place wooden tube holder in standard instead of the concentrator. Fasten the Crookes tube in the cork jaws of the tube holder. Attach the spark gaps to the sliding rods of the static machine, with the sliding rods widely separated, by means of the long green silk cords with snaps and hooks; connect the negative pole of the static machine to the ring nearest to the aluminum concave disc in the Crookes tube. Turn the side of the Crookes tube, which is at right angles to the surface of the platinum plate, toward the front. Start the machine in motion, and if the connections are properly made the Crookes tube will develop a yellowish green fluorescence, which will indicate that the X-rays are being generated. Lengthen or shorten the spark gaps on the static machine, sliding rods until they give the steady, continuous white spark and the tube shows steady fluorescence without flickering or spots If the platimum plate becomes red hot, slow the speed of the machine. Place the object to be examined directly in front of the most brilliant field of fluorescence as close as possible. Place the fluoroscope on the opposite side of the object to be examined, and as close to the object as possible, and the shadow will be shown upon the fluorescent screen inside the fluoroscope. This work should be done preferably in a dark room.



Regulating Tube for Radiographic and Fluoroscopic Work.

Radiographic Work—Turn the tube holder and tube so that the most brilliant field of fluorescence points downward, and directly above the object to be radiographed. Short circuit the prime conductors of the static machine. This will darken the Crookes tube. Place the photographic plate which has been previously wrapped in black and yellow paper, with the film side upward, upon the table directly beneath the Crookes tube. Place the object to be radiographed upon the photographic plate as close to it as possible. Remove the short circuit from the prime conductors of

your static machine, then the tube will again fluoresce, and the shadow of the object to be examined will be impressed upon the photographic plate. If the object to be radiographed is thin, it may be placed within six or eight inches of the tube, and short exposure made, varying from one to six minutes. If the object to be radiographed is thicker, the exposure should be longer, and the distance between the object and the Crookes tube greater, in order to avoid a burn.



Various Static Electrodes.

The above cut shows a variety of static applicators, for giving static current treatments. They accompany every machine, and they will be found adapted for giving different treatments, and their uses will be advised in the therapeutic pages, and the needs of the operator will adapt them to his cases, as he meets them.

General Instructions—Should the Crookes tube not fluoresce it indicates that the tube is either punctured, or the vacuum is too high, or the current running backwards. If the vacuum is too high, it may be lowered by gently rubbing the tube with a silk handkerchief, or gently warming it by means of an alcohol lamp. Should the tube be punctured, there will be purple light inside the tube, and no fluorescence on the surface. If the vacuum is too low, it can be raised by running the current through the tube backwards. X-ray work should be done in a perfectly

dark room, and preferably at night. Keep the photographic wrapped plate in a cool, dry, dark place beyond the reach of the X-rays when not in use.

A special automatic vacuum regulating tube is a great advantage where prolonged X-ray therapeutic treatments are to be given. A multiple spark gap device also increases the efficiency of the tube, and a pole changing device avoids much annoyance and delay, but neither of these last appliances are absolutely essential.

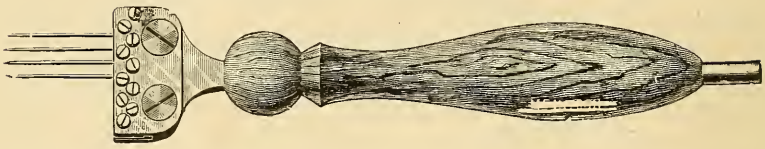
These directions are general and apply to all makes of machines and are only intended as a guide to the beginner. Experience and practice from repeated experiments will elaborate much of this technique, so that the operator can do the best work with the least trouble and loss of time or money.

DIRECTIONS FOR RECOATING THE PLATES

Read carefully; you will see it is very simple and after it is done your machine will be just as good for work as it was the day it left the factory. Remove the plates carefully and all the metal parts on the inside. Clean them thoroughly with a cloth dampened with alcohol. If the old coating is in good condition, that is to say, it has not been damaged by using alcohol on them, which would eat through to the glass, then it is not necessary to remove the old coating. Simply place a piece of asbestos 33x33 inches on the top of an ordinary cook stove, then take three small blocks of wood about one inch square and half an inch thick. Drive a shingle nail through each block, then set the blocks on top of the asbestos with heads of nails down and put the plate on the end of the nails. The blocks should be set so that they will be equally divided. This will keep the plates up about one inch from the asbestos. Keep the room closed so there will be no draughts of air strike the plates when you are coating them. When the glass is hot as you can bear your hand on it, coat the top surface with white shellac. Move the brushes from the center of the plate to the outside, then turn the plates over and coat the other side. Reverse again until you have given each surface five coats. The plates must be thoroughly dry before beginning so that the old coating will be transparent. Coat right over the old paper on the plates, but be careful in handling so as to touch the edge only. The hand should never touch the flat surface.

As full directions for taking the plates out of the static machine should come with it, you will have no trouble fixing up your machine so it will last forever and always do the same work it did when you first received it.

THE BENNETT NEEDLE HOLDER



The above cut shows the first needle holder, invented by Dr. H. C. Bennett, and since it was introduced to the profession it has been improved until now it is the best needle holder on the market. It now has a thumb screw on the handle, and the needle holder is now made in one piece, instead of two as shown in the cut. This needle holder was invented as a result of a necessity for it, and it will hold from one to ten needles, and is adapted to the treatment for the removal of small growths of all sizes and shapes, whose bases are an inch or less in diameter. Each needle is held firmly by a seperate screw which allows of one or more needles being removed without disturbing the others. This holder is strong, handsome, well made and inexpensive, and can be used for a variety of purposes. Its uses are well explained in Lesson No. 25 of the mail course of the National College of Electro-Therapeutics, on the "Removal of Small Growths, Superfluous Hair and Blemishes by Electrolysis." This holder is 5½ inches in length, handsomely nickeled, with polished hard wood handle.

Electrical applications which are painful are hardly ever the proper thing.

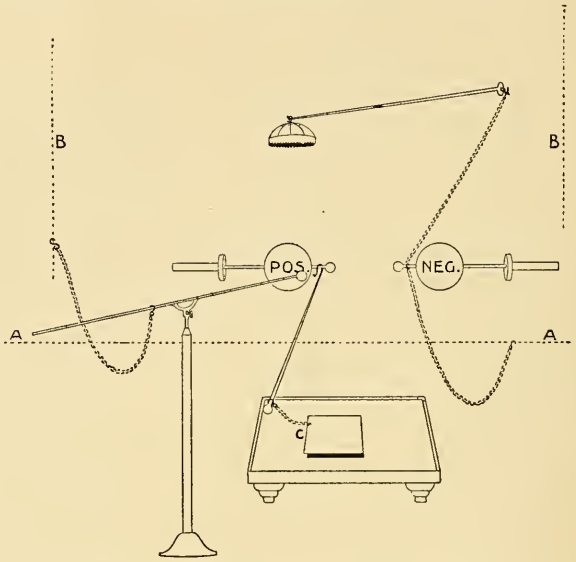
Static Vibration

TECHNIQUE OF AN IMPROVED METHOD OF APPLICATION

Since static machines have become more popular, on account of improved construction, reduced cost, greater knowlege of the laws of electrification, and the excellent results from treatments, there have been many developments in the technique of treatments in order to render the remedy more effective, and more easily and pleasantly applied. Of the various modifications of static treatments, as the insulation, breeze, direct and indirect sparks, induced, and surging, probably the latter has received less attention than any, since its introduction by Morton, but this mode is probably the one that is the most effective when the details of technique are mastered. The static surging is used to produce a wave-like surge or vibration among the tissue cells. It gives the muscles work and stimulates contractions in a mild form. The usual method is to use the ball electrode on the standard as an interrupter, by drawing sparks from the prime conductor, instead of from the patient, with the same prime conductor connected to the insulated platform foot plate, over which a pad of paper is placed, between the plate and the feet of the patient, or the bare feet are better placed on a wet towel, on the plate, to avoid irritation. The opposite prime conductor is connected to the overhead crown, or grounded, or both, according to the effect desired. This technique is illustrated in Fig. 1.

Another simpler, and therefore better way, is to omit the standard and ball rod. Ground the negative side of the machine, or better still, attach it to the overhead crown (same as in Fig 1), placed two or three

feet above the patient's head, on platform. Then attach the positive side of the machine to the bare skin of the patient, with a wet sponge electrode placed directly over the part most affected. Bring the sliding rods of the prime conductors together (instead of being separated as in Fig. 1). Start the machine and gradually separate the sliding rods, as in the static induc-

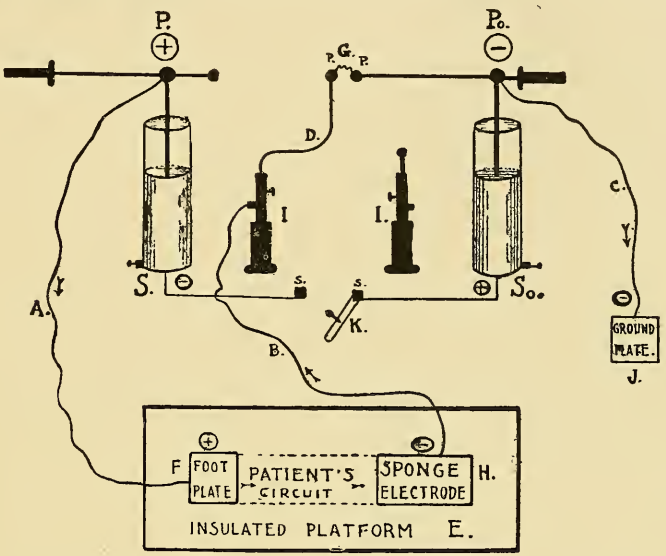


Potential Variation, or Surging Fig. 1.

ed treatment. There is a still better modification which has been used for a long time by the writer, with very satisfactory results. The apparatus is simple and not costly, and it should be an attachment of every static machine. It is easily adjusted to those machines having two adjustable spark gap posts, such as are used in X-ray work.

It is shown in place in Fig. 2, and consists of a curved rod D, made so as to fit into either rubber post I, and held rigidly by a thumb-screw, so that the ball on the top is in the center, between the sliding rods P and Po. It can be used on either side. Experiment has shown that the positive point of entrance to the patient has a sedative soothing effect, while the negative point of exit has a stimulant irritant effect. In this respect it closely resembles galvanism, and those who are in doubt as to static polar effects may note a difference in the static vibration, although it has not been the experience of the writer to note any marked polar difference in the other modifications of static electrification, but to be safe, he follows the usual

rule of polar modalities. The technique of the writer's improved mode of vibration treatment is shown in Fig. 2. If you have one part where you wish sedation, and another where you desire stimulation, you can get both at once, or by placing one electrode on some indifferent part, you can get either effect desired, at any other part, by arranging the connections as



The Interrupted Continuous Current (Vibration). Fig. 2.

shown in Fig. 2, or the exact reverse. For instance, if you wish to stimulate the spine or kidneys: Pull out the positive sliding rod P. Attach same by cord A, to foot plate F. (indifferent). Attach wet sponge pad electrode H, to back on bare skin. Connect by cord B, to the insulated terminal D, close spark gap at G, by pushing in the sliding rod Po, which is connected by C, to ground plate J. The Leyden jars, one or both, may be either off or on. The effect is more pronounced if both jars are on, and still more marked if the outer covers of the jars are connected, by closing the secondary induced current from S to So, by means of the switch K. The effect can also be modified by taking out the ground circuit C, and completing the circuit through the machine. The size of the jars, and the size, number and speed of the plates, all change the effect, but the length of the spark at G, regulates the force of the wave surge, or vibration

When the gap at G is closed there is a constant flow of static electrifiication from P, through A to F, through patient to H, through B to D, to

Po, through C to J, and with patient on platform E, he has a static flowing bath, without sensation. The entrance then is positive at F, and exit is negative at H. Simply opening the gap at G, backs up the positive current, and puts the patient in a state of stress, which increases like a rising wave until the potential pressure or strain is sufficient overcome the resistance of the transparent, elastic, dielectric air space at the gap G, then there is a spark there, which relieves the stress, and there is a consequent reactionary subsidence of the wave, in the patient's circuit, which again rises and falls with successive surgings, regulated to a nicety by the spark gap G. This effect can be made in the ordinary insulation, by drawing direct or indirect sparks from the part to be treated, but it is very paiuful, and a succession of such sparks will blister. The above technique transfers the spark from the sensative skin to the metal terminal D, so that the effect can be kept up a long time, not only without pain, but pleasantly, and with relief of pain. The writer has used the vibration by applying the sedative positive sponge electrode F, to a very painful skin, in gonorrhœal rheumatism, with the effect of completely relieving the pain, and taking the swelling from feet that had not had on shoes for weeks, so that he could wear shoes in three days, and walk without canes. At first a spark gap of half inch was severe, but in a week, with half hour daily treatments, the spark gap was lengthened to ten. inches without discomfort. Sexual neurasthenia has been greatly benefited the same way, with sponge pad to perineum to sacrum. Lumbago in the person of the writer, yielded like magic, and sciatica and other deep-seated nerve troubles are easily handled. All gynecologic cases can be treated the same way, using a bare vaginal, rectal or uterine electrode. If the roller electrode is attached to B, and applied to M, labile, it may be applied to any or all muscles in turn, and rapid or slow, mild or powerful, but painless contractions, may be set up. To give perfect exercise to the arms, wind positive chain around bare forearm, and proceed to interrupt the current, or make a positive connection with bath and immerse the hand. Every muscle of the arm will be brought into play, and with continuous exercise the arm becomes brown and tanned. Writer's cramp is relieved in a few treatments by this treatment. The sponges H, applied to the breasts stimulate circulation and developement. This form of treatment has been found of wonderful benefit in Bright's disease and diabetes, by attaching the positive pole to a bifurcated wet sponge electrode, to the bare skin, over the kidneys. Some apparently hopeless cases have been symptomatically cured, without drugs or diet, with this simple treatment. Cases of hysteria, neurasthenia, chorea, melancholia, hypochondriasis, and other allied neuroses, will receive greater and more prompt benefit from static electrification applied this way to the

spine and genitals than perhaps any other form of treatment. Do not approach or touch the patient or machine with the spark gap open, or you will regret it. Simply closing the gap G renders everything safe to approach or handle on the negative side, and sliding the rod P until it touches D, makes the positive side safe to handle. After giving a vibration treatment as above, it is well to wind up with a static insulation or bath, for a few minutes. To do this, simply pull out the sliding rod Po, quickly, beyond sparking distance; and it is done. Treatments should be given daily, for from ten to thirty minutes, and in severe cases, longer. While it is not known that this treatment produces any chemical effect in the tissues, it will by its catalytic action, increase the circulation, improve nutrition, assist digestion, and assimilation and quiet, refresh and invigorate the entire system, locally or generally.

STATIC INDUCED SOLENOID SHUNT CURRENTS.

The question has been asked as to the advisability of having a static machine or of having a large induction coil. If it is a choice between the two when you may have but one or the other, then by all means take the static machine.

The coil alone is most excellent for prolonged and heavy X-ray work, and it is also useful for what is known as the high frequency current. Both of the subjects will be taken up in detail later, and we only mention them here in this connection, in order to answer the question above.

Aside from these considerations, there is little or nothing to commend the coil, in therapeutic work. On the other hand, the static machine will do all of the work of the coil, as the work of the general practician will need them, and in addition to this, the static machine has such a wide range of therapeutic usefulness, which the coil does not have, and is withal so easily regulated and controlled, that the balance is greatly in favor of the static machine, as against the coil. An oscillatory or vibratory current effect may be derived from the static machine by means of a simple apparatus, in connection with the induced current, from the outside of the Leyden jars. This apparatus consists of a solenoid, or coil of wire, the central part of which conducts the static induced current in short circuit, while the electrodes are attached to the outer ends of the solenoid with the patient "in shunt".

The strength of the current gotten in this way from a static, depends upon the number and size of the plates of the machine, and the size of jars used, while frequency depends upon the rapidity of the discharge

between the prime conductors, which in turn, depends upon the rapidity with which machine can be run.

Solenoids can be made in many shapes, according to tastes, and the space you have for them. The connections are made from the bottom of the Leyden jars, with the solenoid, so that the middle third of its wire is embraced by them leaving the free ends of the solenoid wire to furnish the currents in question. From binding posts at each of these extremities is taken the current, and carried by common flexible light wire to the patient. It is applied in a mono-polar or bi-polar manner. One end is attached to tin foil, wetted pad or other electrode and bound snugly to the opposite side of the part to be treated, or some indifferent point, and the other end is attached to a thick, very fine wire brush, and passed about the part to be treated taking care not to approach too near, lest the patient receive a shock.

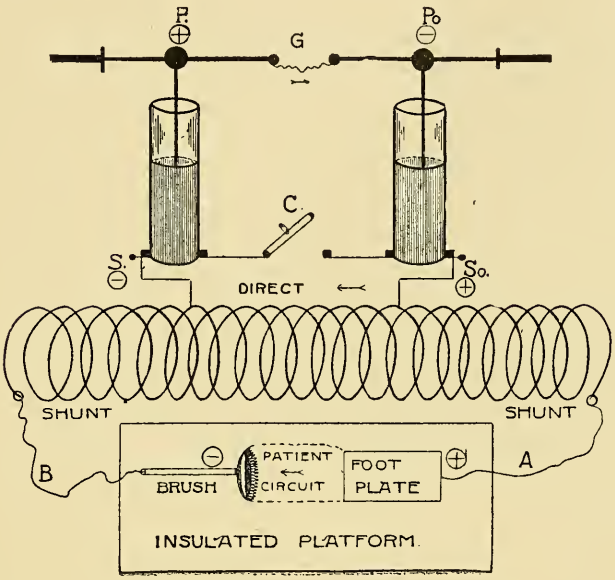
As a rule the brush should not be held nearer than 2 inches, nor more distant than 5 inches from the part, unless it is pressed firmly against the part treated, as we give galvanism. This current can be derived from any static, but the wire used in making the solenoid must be diminished in length and size, according to the number and size of plates in the machine. The larger the Leyden jars used, the longer the effluvial discharge. The room must be darkened in order to see the discharge, which in a darkened room is seen to pour forth in millions of purple streams, all along the conducting wire as well as from the brush, where it throws forth one ray for each fine wire it contains, and the more it contains, the better the effect. The Leyden jar current can be introduced at other points in the solenoid wire, than as shown in the diagram, and the high tension high frequency current, taken from most any point exterior to the introduction of the exciting one.

This current is most excellent in the treatment of cancers, that are exposed, lupus, old sores and other such like superficial skin troubles, whether caused by certain bacteria or not.

A case of tibial ulcer was cured after only twenty consecutive daily applicaticons of this treatment. When the treatment was begun, the ulcer was three inches in diameter, and had resisted all kinds of treatments from several other good physicians, for a period of three years. Other ulcers, skin cancers, and the lungs in consumption, are treated in about same manner.

The technique of the application is to place the negative, back of the part to be treated, and keep it concentrated on the fixed point for from five to fifteen minutes daily, unless it causes too much reaction. In the treat-

mont of rheumatism or paralysis, the technique is about the same. In constipation, put one pole to the nates, or in the rectum, and pass the brush over the abdomen following the course of the colon, from right to left. In goiter and enlarged prostate gland, apply the positive pole to the gland. Most excellent results have been obtained in these cases.



The above sketch shows the details of the construction, and the method of connection of this solenoid, so as to get this shunt current, and by refering to the sketch the following explanation will make the same clear, so that you can construct one, if desired, and get the same results.

This modification of the static current is one of the best drawing cards in the whole electric line, being catchy, impressive, popular, and is painless, requires the removal of no clothing, and at the same time gets splendid results.

It acts on vaso-motor nerves, as is manifested by the patient's perspiring after a fifteen minute seance, and this without any suggestion whatever. This effect has been noted repeatedly, but is not always a constant result. One case who had not sweated for six months, began at the first sitting. In this case the negative electrode was applied to the bare skin over the abdomen, and the positive brush, directing effluvia, was held a few inches from the cervical and dorsal spine. This mode is also a seda-

tive, relieving pain, which subsides as soon as they get warm, and the relief lasts for several hours.

The prime conductors will act as a rheostat to control the effect of the current, by simply regulating the length of the spark gap. The sliding rods should be brought together whenever the electrodes are being placed or moved, so as to short-circuit the machine, and so avoid disagreeable shock to both the patient and operator.

In ordinary cases we can short circuit the secondary or induced current from the outside of the Leyden jars by simply closing the switch at C. By opening the switch at C, and connecting jars to the solenoid we simply lengthen the connection between the jars by interposing the middle third of the solenoid. This will not change the character of the induced current, as it is of such great voltage that the wire would not offer any appreciable resistance. Thus, the middle third of the solenoid connected to the jars, carries the main or direct induced current, so that whatever part of the current that according to Ohm's law, would escape from the two outer thirds of the solenoid, and be applied to the patient as shown in the cut at A and B, would be an indirect or shunt current. This shunt current would be affected in the same way as the main or direct induced current, from S to So, by whatever would change or affect the prime or inducing static current from P to Po, or by length of the spark gap at G. If the prime current P, be positive, then the induced secondary current at S, would have the opposite polarity and be negative, and also the shunt secondary at B, would be negative. The reverse would be true at Po, which would be negative. So, would be positive, and also the shunt terminal A, would be positive. This will settle the question of polarity as long as the prime poles P and Po, are beyond sparking distance at the gap G, and with the switch open at C. If you short circuit the prime current, by closing the gap G, you get no induced current at all, anywhere. If the prime rods, P and Po, are beyond sparking distance, then all parts on both sides are put under great stress. If you make a gap G, and a spark jumps, you get a surge through the whole secondary circuit, both direct and shunt. After the stress at the prime terminals is relieved by the spark at gap G, there is a reactionary wave restoring the stress, all through the circuit, which increases until the strain breaks down the resistance of the elastic air dielectric, at G, and another spark again relieves the stress. This is repeated, the rapidity being governed by the length of the gap at G. The shorter the gap the less the stress and milder the surge or potential variation in the secondary circuit. This potential variation or surge, caused by the spark at G, will account for the glow in the vacuum tube, without reference

to anode, or cathode. While the polarity of this solenoid current does not alternate as does the faradic or magnetic induced current, it varies in potential and remains fixed. As there is no amperage to the static current, either prime or secondary, there can be no magnetic induction.

Which static machine would you prefer and why?

The static machine which is the best for general purposes is the one which will give the most uniform output of electrification, with the least annoyance and expense.

The static machine is a dynamo or generator, and the plates may be likened to the cells in a chemical battery. That is, the more the plates the greater the volume and potential.

However the static machine has one great difference, viz: the enormously high voltage and the correspondingly infinitessimal amperage. The one too great, and the other too small to be measured. There has been great stress laid on the rate at which the plates are revolved, as having much to do with the voltage, but when the voltage is so high as to be beyond measurement, probably up into the millions of millions, what difference does a few millions, more or less, make, and how absurd the statement, that a few plates turned very fast will deliver the same volume that a large number of plates turned slowly will deliver.

A feather and a cannon ball in a complete vacuum will fall with the same rapidity, but when they reach the bottom, one is still a feather, and the other a cannon ball. They are not both cannon balls, and the one will break the bottom out of the tube, while the other will not. A little dog running beneath a carriage will have to move his feet very fast in order to keep up with the horse, although the larger animal may be traveling at a moderate pace.

They both arrive at the journey's end at about the same time, and the canine may even outstrip the equine, but when both stop, what a difference there is in avoirdupois.

Various materials have been experimented with in the construction of the static machine plates, and all have given more or less satisfaction and trouble, and none are perfect, but the concensus of opinion among investigators and physicists is in favor of glass for the plates, both stationary and revolving.

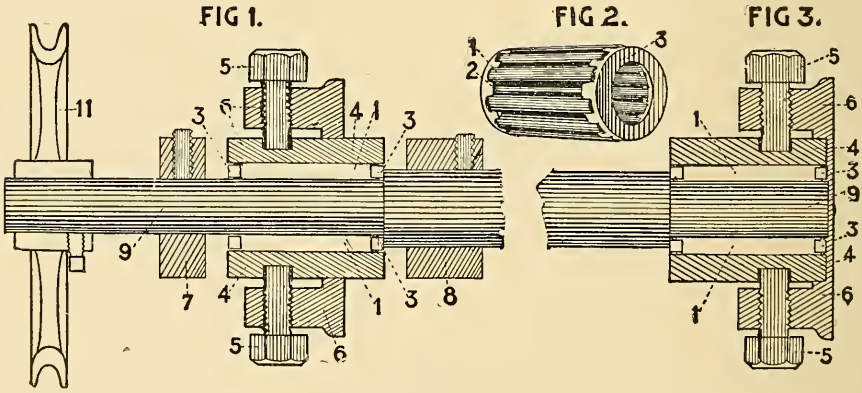
On account of the difficulty of rolling the glass thin, and at the same time, having it cool without warping, some have tried the heavy plate glass, but these have been been abandoned on account of the extreme

weight. Therefore it is a drawback that the glass is seldom true, or balanced, and on account of the elasticity and small power of cohesion, the glass plate cannot be turned very fast with safety. However this is not at all necessary, and the glass being cheap, we may add more plates, and with less expense for power turn more plates slowly, with better results. The different thicknesses of the various plates can be so evenly balanced on the the axle or main shaft as to effectually minify or prevent vibration or pounding, which must follow the revolution of an eccentric weight.

There is no material used in the construction of any static machine plate which is perfectly true, or which will remain so if it could be made so, on account of the effects of the physical conditions surrounding it, such as heat, cold, humidity, etc.

If any one should tell you that such or such a machine will generate electrification all the time, and under all conditions, without any qualification, then beware. There is none that will do it.

They are selling machines, we are stating facts. Take your choice. There is no question whatever among machinists about the great advantage which the roller bearings have over the old style ball or spindle bearings, as the difference in the cost is more than made up in the lessened friction and strain, with the consequent decrease in expense of repairs and outlay for power. Get the best.



ROLLER BEARINGS

On account of the ease of operation and generation, the type of machine known as the Tœpler, which is self charging, is the more preferable. Therefore, after twenty years of study of the physics and mechanism, and experiments with nearly all the different makes and materials, and after

noting and consulting with many disinterested students, experimenters and observers, I would advise the selection and purchase of a Tœpler type of self charging machine, with all glass plates and roller bearings, set in a rigid frame case, as nearly air tight as possible, as likely to prove most satisfactory and economical.

In which direction must the plates turn?

The plates of a static machine should revolve from right to left, at the top, or just the reverse of the direction in which the hands of a clock move. Many blunders have been made, by beginners on account of overlooking this simple rule.

How would you restore a lost charge?

If you should not have a self charging machine, or if for any cause the machine will not generate, or has "lost its charge," there are various ways of charging it again.

Thoroughly clean and dry the machine, case and plates.

If the shellac coating on the plates is old and "dead," then remove it, and recoat the plates.

Connect the terminals of the machine in series circuit with another machine or a high tension induction coil, which is generating, and transfer a charge to your plates. Hold a piece of fur, cotton or silk lightly against the front of rear plate, while the same is turning. Warm the plates slightly if they are chilled. Lift up the end of the case and jar it down slightly. Discharge a heavily charged condenser or Leyden jar charge upon the prime terminal of the machine. Run the plates backward for a few minutes, and then reverse, and run forward as they should turn. Renew the brushes if dirty, greasy or worn.

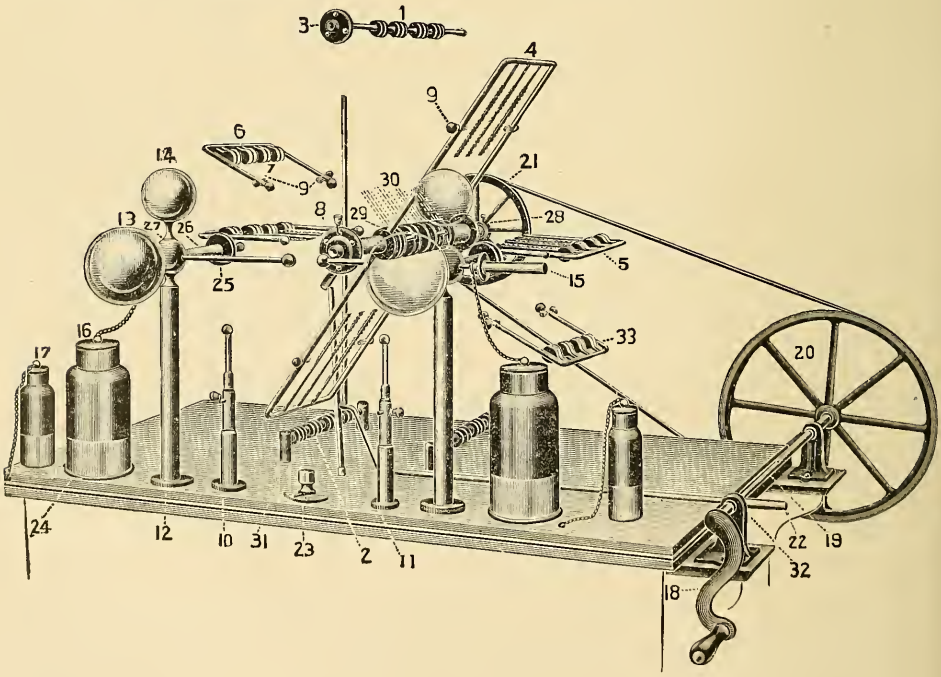
Renew or thoroughly bake the dryer if it is wet. Set the machine in the bright sunlight for a few hours. Remove the machine to another room, or upstairs, or away from an open window, or brick wall, or from over a cellar.

When no spark can be generated, if the wires are all in their places, then it is because the moisture has settled on the plates, and, if you readers or operators will rub your fingers on the revolving and the stationary plates, you will find a gummy substance adhering thereto; so long as that remains no spark can be generated. Another remedy for quick and permanent relief is as follows: Get about four ounces of benzine. A piece of muslin or coarse cheese cloth about 36 inches long and 5 or 6 inches wide.

Saturate the cloth with the benzine, wring out about three-fourths, and then at full length hold the cloth between the plates, while another person slowly revolves them. Work between each plate in the same way, also rub on the back of the stationary plate; afterwards gently rub the iron and painted parts, also the inside of the machine, all over the woodwork. Then for one hour close up the case. Afterwards place in the machine the dry calcium chloride, and within fifteen minutes you may generate a spark of from nine to twelve inches. Occasionally bake the chloride, when the operator finds the spark does not immediately generate. Reversing the machine, say for five or ten minutes (run it backward and forward) will often start the current flowing.

Any one or more of these expedients will sometimes start the "juice" to running from an apparently dead machine.

What are the names of the parts of a static machine?



The cut shows a skeleton of static machine, with the various parts numbered so that by referring to the list of numbers and names, you can

recognize each part by itself. Different machines will all vary in the details of construction, but the above are the main parts of the self charging Tœpler static machine.

No. 1 Uppper cross bar with washers.
No. 2 Lower cross bar with washers.
No. 3 Front support at upper cross bar.
No. 4 Upper arm equalizer and combs.
No. 5 Horizontal arm and combs with ears.
No. 6 Upper left side brush arm.
No. 7 Clamps holding arm to plate.
No. 8 Oil cup to front bearing.
No. 9 Exciter brushes.
No. 10 / No. 11 X-Ray posts for use when there is no multiple spark gap or pole-changer attachment.
No. 12 Hard rubber main post.
No. 13 Large brass ball.
No. 14 Small brass ball
No. 15 Sliding rods with rubber handles
No. 16 Large Leyden jar.
No. 17 Small Leyden jar,
No. 18 Crank handle to hand shaft.
No. 19 Crank shaft.
No. 20 Crank shaft large pulley wheel.
No. 21 Rear axle pulley wheel.
No. 22 Rubber handle and current controller (a nuisance).
No. 23 Rubber switch and current indicator.
No. 24 Base of Leyden jar.
No. 25 Rubber washer on sleeve front glass.
No. 26 Sleeve of hard rubber, threaded for washer.
No. 27 Brass head to main posts.
No. 28 Oil cup to rear bearing.
No. 29 Front hub on main shaft.
No. 30 Glass plates, revolving and stationary.
No. 31 Lower support for stationary plates.
No. 32 Iron bracket for crank shaft.
No. 33 Lower right side brush arm.

THE POLARITY OF A STATIC MACHINE

How do you distinguish static polarity?

To test polarity of direct static current, start the machine, seperate sliding rods a half inch to get a steady purple stream, one end of which, the positive, will have a white spot.

Separate the sliding rods several inches and the white end of the stream of sparks will be on the negative side.

Separate still further, four or five inches, and get a steady continuous flow of sparks. The end having a single stream dividing into several about a half inch from ball, like a tree trunk with branches, will be positive, and have a pink color. The other side, having a number of streams, like tree branches, will be negative with bluish color.

Separate still further, six to ten inches, to get the brush or fox tail discharge, like a paint brush, on one side and a feather duster on the other. The brush side is negative and bluish; the duster side is positive and reddish.

Separate balls on sliding rods two or three inches, with several steady streams of sparks passing between them. Hold the head of a match close to, or in contact with, one ball. If you can concentrate the

streams of sparks into the head of a match, so that there is only one stream, and coax it away from the center of the ball to one side and hold it there till the match burns, it will be the positive pole.

Seperate sliding rods beyond sparking distance, and look through the machine from the end, so as to see between the plates, and on the negative side, the revolving plates will be covered with a violet sheet of light for several inches ahead of the collecting combs.

When the X-ray tube is properly connected with a machine, one half of the tube, opposite the flat electrode, and on the side towards the concave electrode, will have a uniform greenish yellow color.

To tell polarity of high tension induced (faradic) current, attach a Geissler tube to terminals of coil and start vibrator.

The above cut shows a Geissler vacuum tube for testing the polarity of high tension induced currents. A current passed through this makes the positive end glow red and the negative end glow with a bluish light. This test should be made in a darkened room.

Static induced current is tested the same way. The Leyden jar current on positive side will have a negative polarity, and vice versa.

What precautions should be taken with a static machine?

Remember that the man with the static machine always has trouble coming. It may not come to you. I have seen very poor machines generate well under the adverse circumstances, while on the other hand I have seen some of the best makes utterly refuse to work under the most favorable conditions. I groomed a fine beautiful machine carefully for two days, and it did well for three hours and then quit, and I had to tickle it up with a chain from another large machine in the next room every time I wanted to use it, and even then it would sometimes refuse to work. I had it in a dimly lighted, cold room, surrounded by brick walls. Another man took it to the second floor of a frame walled room, under a bright sky light and it has been working well ever since. I took a small homely, cheap rubber plate machine out of the box in which it came, all dusty with excelsior and set it up in a room which was freshly scrubbed and still wet, right by an open window with a rain storm raging outside, and before the case was put on, it gave a fat six inch spark, and did good X-ray work for several months.

It was sent to the mountains of Tennessee and has never done a bit of work since. If you take the proper precautions, with the right kind of a machine, you can expect and get uniformly satisfactory results from it. Keep it clean, free from dust and moisture.

TO PREVENT DISAPPOINTMENT WITH STATIC MACHINES

Owners of static machines must remember that moisture and dust on the outside of a static machine is just as injurious as on the inside. Your machine should be cleaned daily on the outside and when the air is perfectly dry as indicated by the hygrometer, the machine can be opened up to let the ozone out. The machine to render the best service, must have good care just as much as a person. The machine should stand from the wall, so that you can wipe it off clean every morning. It is a good plan to take a chamois skin or piece of cheese-cloth and run over the electrodes and fixtures in front of the machine before seance. The case should be as nearly air-tight as possible by puttying up all openings and then schellacing over the putty on the inside. This should be looked after thoroughly at least once a year. Doors should always close on strips of felt to prevent dust and air from entering. It is a good plan to take the machine apart at least once a year and thoroughly clean the plates and all metal parts in order to get the best results.

If the coating on the glass plates does not show perfect insulation, the old coating should be entirely removed with alcohol and five fresh coats put on, although this is not necessary if the instructions given further on are followed. The necessary material, including camel's hair brush for recoating the plates and work will cost you $3. If your static machine changes polarity when running, it shows it needs cleaning. In order to clean the plates without remvoing them, use a clean woolen cloth slightly dampened with alcohol. But the cloth should not be wet. Great care should be exercised so as not to injure the coating or metal part. All coating on the inside should also be cleaned the same way and with the same amount of care. If the inside fixtures are made of brass and are tarnished with ozone and cannot be cleaned as above directed, they should be removed and put in strong soap suds and heated to the boiling point so that the lacquer will soften and scale off. Add lye to the solution and it will hasten the process. When the old lacquer coating is softened, remove the parts from the water and clean them with a dry cloth quickly when they are hot, then brighten them with common whiting and recoat at once with lacquer.

From June to September, the machine must be kept in first class

condition or it will not work. Every static machine will work if the plates are clean, the brushes in good condition and the air on the inside of the case dry.

Those who have never taken proper care of the static machine by opening up the case on dry days and allowing the ozone to escape, will find a coating has formed over the plates, and for this reason there are many machines which will not do satisfactory work. It is a good plan to use precaution to prevent the machine from discharging, especially in warm weather after using the machine, by removing all portable attachments, as connecting rods and ground chains. Every owner of a static machine should have a hygrometer, which should be hung on the inside of the case to indicate the moisture in the atmosphere. Should you have a hygrometer on the outside of the case or in the room, and it registers 30 or more, it shows you are near the danger point. The best dryer is 30 lbs. of calcium chloride (not lime), placed in glass or enamel trays inside of the static machine. Before placing in the machine, it should be baked in an ordinary cook oven until it is thoroughly dry and takes on the appearance similiar to common salt. After it has been used several times, it will form one solid mass. With a hammer, this should be broken up before placing back in the machine again. Never allow the calcium chloride to remain in the machine with over half an inch of water in the bottom of the dishes, and it is a better plan to remove the calcium at least once a month and bake it thorougly.

Shall I buy a static machine or coil ?

What shall I buy—a static machine or a coil ? This question is asked with unvarying regularity by every man who wants to do electro-therapeutic work. Here is the answer: If you wish to become an X-ray specialist, get a good coil (not less than 12 inch). If you want to do general electro-therapeutic work, including X-ray work, get a static machine. For therapeutic X-ray work the static machine answers as well as a coil. For radiographic work the coil is the thing. For high frequency work the static machine is, other things being equal, superior to the coil. The coil does better radiographic and fluoroscopic work. In all other respects the static machine is preferable. If you want to be perfectly equipped, get a coil *and* a static machine.

HOW TO MAKE YOUR STATIC MACHINE WORK IN MOIST ATMOSPHERE

The man with a static machine, usually, and in fact nearly always, has troubles of his own, especially during the hot, moist weather of the months of July and August, and along rivers, lakes and the coast.

Static machines are variable and fickle, but are governed by certain laws which must be obeyed. Moisture and dust are the greatest troubles to contend with. No matter how tight the case may be, dust and moisture will get into it. Some machines are less susceptible to the atmospheric, conditions than others, and notwithstanding the claims made by makers, there is no machine that can be depended on to generate always, under every circumstance and condition. We may so alter the circumstances and modify the conditions that we can be reasonably sure of our machine working, but never be absolutely certain of it.

Some machines have a smaller machine, or charger, inside the case, in order to start the current and charge the larger plates, but even then they sometimes fail to work. The glass and mica plates should be covered with a coating of shellac. Hard rubber plates are left bare. Various methods have been tried to keep the air inside the case free from moisture, such as lamps, incandescent lights, electric coil heaters, jars of sulphuric acid, common lime and chloride of calcium; but lamps, light and coil heat too much, acid gives off destructive fumes, lime dust flies. The most generally used and probably the most satisfactory, when all else is considered, is fused calcium chloride. This is not the ordinary chloride of lime of the stores, which is chlorinated lime, or bleaching powder, which gives off the fumes of chlorine gas, which will ruin the metal parts, but the fused chloride of calcium, which comes in rough, hard lumps. It should be thoroughly baked, bone-dry, in a deep, flat granite or earthen vessel and kept inside the case, all the time. Being very hygroscopic, it quickly absorbs all the moisture in the case, and keeps the air within quite dry. As it gets wet it becomes soft and sticky, and should be then removed and again thoroughly dried or baked. Do not allow it to get on the stove or metal part, as it will ruin it, but when carefully handled it is safe and reasonably sure. The same calcium can be used over and over indefinitely. Probably the safest, quickest and cheapest way of drying the case is the jar of cracked ice and rock salt. Do not use snow or common salt, or forget the saucer, but use as follows: Take a one-quart glass fruit jar with screw top, fill with a mixture of chopped ice and rock salt, screw down the cover and

wipe the moisture from the outside of the jar; place the jar in a saucer or bowl inside the case of static machine, close the door and set the machine in motion, keeping the plates moving until the machine begins to generate at its best. After, say an hour, when the ice is fairly melted, remove the jar and quickly close the end door, so as to prevent the outside air from getting into the case. This simple remedy will dry the air within the case in from five to twenty minutes. Materials for this experiment are accessible to every physician at all seasons of the year, and the application of this remedy is entirely free from danger of corrosion of the metal parts of the machine and the annoying care and labor of frequent drying and baking of chloride of calcium.

Apply the remedy when next your machine refuses to generate, and it will insure the very best of results in the operation of your machine on any and every day in the year.

Simply holding a pledget of absorbent cotton against the revolving plate, while in motion, will often cause the machine to generate at once, especially the rubber plate machines.

What precautions should be taken in giving static treatments?

In giving static treatments be careful not to approach too close to the patient, for you may accidentally draw to your patient a discharge, in the form of a spark, which will be painful, or at least unpleasant, and which may frighten, or annoy, so that they will not return, and the effect may even be harmful.

Always have female patients remove their hats, and also the pins from their hair, if made of wire or celluloid. Always begin with a short seance, and a mild treatment, to new patients. Avoid sparks as much as possible. Make no spark applications to bony prominences, or to the nails, or to the nipples, or the organs of special sense.

Do not concentrate a series of sparks, or a brush discharge to metal buttons, or to corset stays. You may blister the skin beneath. Have the overhead crown just far enough away to be distinctly, but not unpleasantly felt. Remember that you can do good or harm with a static machine, and

do not make a show, or have fun with it at the expense of the patient, or his friends. Do not abuse a good thing.

The uses of static sparks ought to be discouraged. The static breeze will usually do what sparking can do, and is by far more agreeable.

In what condition is static electrification indicated?

In giving dynamic electrification, we must necessarily make the treatments largely local, whereas we can rarely make a static treatment local. When the patient is on the insulated platform, we may concentrate the most of the effects to some part,or local area, but we cannot prevent the excess from traveling all over the patient, thus giving him a general treatment at the same time.

With a proper diagnosis, and a full realization of the needs of the individual case, and a full knowledge of the techuique of the treatments, the man with the static machine can accomplish wonders, and do it so safely, quickly, and pleasantly, and withal so profitably to himself, that he will no longer resort to the older and slower, and more disagreeable methods of the past, when once he gets started in the new ways.

Do not get the idea that static electrification will do everything, or that it is a cure-all, or that it will take the place of galvanism, or faradism, or drugs, in all cases. If you start out with that idea, you will be disappointed, and are only laying up for yourself trouble. Static electrification has its place in our work, and in many instances it has a place which nothing else can fill. Use it in conjunction or in alternation, with the other modes and get a combination which cannot be excelled.

There are some advantages in giving this treatment over all others. It may be applied, either generally, locally or both, without disrobing, exposure, or the annoyance of delay. For this reason it is popular with the women, who are usually our best patrons. Again the treatments take less time, as there is none lost in preparation before or after the treatment. Then you may treat a number at a time if desired. For instance, the platform is usually large enough for two stools upon it, or a mother may hold her child on her lap. You may treat infants this way, which you could not do with any other method.

In static electrification, we possess one of the most useful agents for the relief of painful and diseased conditions, and when properly applied will usually prove beneficial, and where tissue metabolism is to be stimulated, or elimination and execretion to be hastened, there is probably nothing superior.

As a restorer of the normal electric equilibrium, it probably acts more generally and quickly than anything else. General catalytic or nutritional effects are more quickly produced with static, than with the other modalities.

How does electrification cure diseased conditions?

Electrification cures diseased conditions in three ways. The purely mechanical, by phoresis, by means of which we may force directly into the tissues, drugs or compounds of the metals, thereby getting the local effect of the materials so employed; by electrolysis, which is a purely chemical process, by means of which we are able to break up the tissues of the body, by a chemical process of decomposition, or dissociation of the component parts, with the liberation of the elemental gases, and getting the local polar effect of the acid and alkaline radicals upon the healthy and morbid tissues. Both phoresis and electrolysis are more or less local, and therefore limited in action and effects. By catalysis, which is both direct and reflex in effect, and is both local and general, and is therefore by far the most important effect of electrification in all of its varied modalities. The nutritional effects through the complex vaso-motor nervous system, is at once most important and far reaching of all the results of electro-therapeutic applications, and is the keystone of the whole science.

Electrification appears to effect its curative results first in acting as a general tonic to the entire organism. By stimulating the circulation, the whole vegetative system seems to put on renewed action. Glandular secretions are increased, absorbtion promoted, the waste of the system is carried off with greater rapidity, repair is hastened in still greater proportion. Nutrition is increased, the vital nerve force is endowed with greater strength, and the whole well being of the organism becomes improved to a wonderful extent.

Electrification begins its remedial effect immediately upon being applied, and is much more prompt in its action than are most drugs.

Electrification avoids hemorrhage caused by many operations.

Electrical treatment obviates the necessity of an anæsthetic.

Electrification produces a powerful physiological effect, which in many instances is of great value.

It does nor retard the action of any remedial treatment that may be used, as is frequently the case when different drugs are employed.

The science of electro-therapeutics is one of the most tangible. positive and practical in the domain of medicine and surgery. And the physician

who attempts to ignore or belittle its claims is simply displaying his own ignorance and getting in the way of a power that will speedily convert him or sweep him aside in its onward progress. In the field of surgery its demonstrations are open and undeniable. The electro-cautery and the galvanic currents are positive and palpable in their work on the tissues and morbid growths, in phoresis. The galvanic and faradic currents in general diseases and in diseases of the nervous system are applicable in the widest range of troubles, and yield results that cannot be accomplished by drugs, exercise or massage alone.

To those who are skeptical we do not wish to bring a new doctrine, but would refresh their minds on subjects that are old in this connection. A glance will show that the entire nervous system receives and transmits its impressions and influences purely as an electrical battery, which it is essentially. When we consider that every element in our bodies is either electrically negative or positive, we must see that we are the most thoroughly constructed, sensative and readily affected electrical machine that can be found.

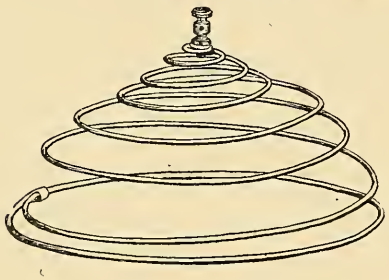
MOLECULES, ATOMS, CORPUSCLES, IONS

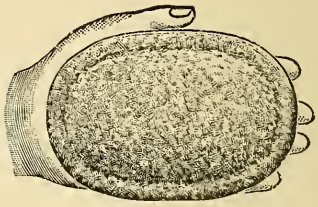
We have been taught in school for years, in the study of physics and chemistry, that the molecule is the smallest particle of matter that can exist in a free state, as matter, partaking of all the properties of the mass, and that a molecule consists of two or more atoms. We are also taught that the *atom* was the smallest divisible particle of matter and that it was supposed to be about one twenty-millionth of an inch in diameter. More recently we have been working on a later theory that even the atom was a complex body, containing one thousand other smaller particles, which are called *corpuscles*. Now we go a step further toward infinitessimalism, and believe that even the corpuscle is a community, consisting of *ions*, which are one five-thousandth of the diameter of a corpuscle. Now, going down through the division of the scale, through the successive stages of imaginative conception, through the different theories, viz.: *molecular*, *atomic*, *corpuscular* to the *ionic*, with our pencil we can figure out the supposed size of the ions. Thus, we find that one hundred quadrillions (100,000,000,000,000,000), or one hundred thousand thousand millions of ions can be placed on the flat point of a needle, which is small enough to go inside the central canal of the finest hair you ever saw. Can imagination go any further? Whether this is correct or not, and it remains yet to be proven or disproven, we only offer it, not as a practical fact, but to further carry out

our statement previously made that each ultimate particle of human tissue is independent and free to move, and is possessed of its own individual polar

affinity, and follows the laws of electrification, that likes repel and unlikes attract. Therefore, if we conceive of such a condition, it will help us to understand how electrification can exert its catalytic effect upon the vaso-motor mechanism, controlling circulation, and also the endosmotic and exosmotic processes, by which nutrition is affected.

What advantage has large dispersing electrodes?





Large dispersing electrodes have the two fold property of, at the same time increaing the diffusion, and lessening the density of electrification, and by means of the proper appliances, we are able to modify our treatments, and effects, as to adapt them to a wide range of usefulness. A thorough understanding of the law of Ohm is essential and easy, both to demonstrate and apply, and it enters into every equation of treatment by electrification.

The resistance of the skin, which is very great, is diminished by enlarging the electrodes, which allows greater diffusion of the current. If the current be too strong and applied too long a time at a given place there appears at the positive an eschar from acid reaction. At the negative, ulceration from alkaline reaction. The electrodes should be moistened with a solution of chloride of sodium, this is a better vehicle than water, for the reason that the positive takes the chlorine and the negative the sodium ions.

What are high frequency currents ?

The consideration of this subject has assumed so much importance recently, that we offer a few items of interest concerning them, with some observations and experiments, and the conclusions deduced, which we hope will be useful to the beginner. While the use of the so-called ultra-violet ray has been extensively exploited but lately, it is by no means new, as there are well known physicians who have been using and experimenting with them for the past twenty-five years.

The so-called high-frequency current is derived from either an ordinary X-ray coil or static machine, and is usually passed through an apparatus consisting of a specially constructed induction coil, arranged in series with Leyden jars, and an adjustable spark gap.

The Ledyen jar plays the part of the condenser in the production of the high-frequency discharge. The current is induced in the outer armature of the jar and thence passes into the high-frequency coil. The primary current passes between the terminals of the sliding roads.

This produces a current with very rapid periods, running up to many hundreds of thousands per second, and a voltage up in the millions. This is, of course, guess work, as we have no way to count or measure such things, but the figures are certainly low enough. The rapidity and pressure is governed by the size and speed and capacity of the generator and apparatus employed. With such great stress, the air is no longer an insulator, and the effect is seen at a distance, with or without conductors. It is not necessary to complete the circuit, and the treatments can be given from either terminal. There is marked difference in the phenomena, effect, and feeling, from different poles. Vacuum tubes placed near either pole will glow, and if connected direct will light up more strongly, and if brought near the body will emit the ultra-violet rays. This demonstrates the passage of the current through space. These rays have considerable penetrating power, and on account of their ease of generation, and safety of application, may be more valuable as a curative agent than the X-rays. They can be applied internally as well as externally. They seem to be analgesic, anæsthetic, and antiseptic. They affect the blood supply through the catalytic action on the vaso-motor nerves increase arterial tension and stimulate absorption, secretion and excretion. Their antiseptic, or bactericidal power is probably due to the great amount of nascent ozone liberated. They are therefore useful in parasitic skin diseases, microbic infections and suppurative conditions. The affections most amenable to the ultra-violet rays are pulmonary consumption, tubercular ulcers, glands and joints;

gleety, gonorrhœal, gynæcologic, and urinary troubles; cutaneous, cancerous, and lupoid diseases; rheumatic, gouty, arthritic, and lithemic states; nervous affections. There are numerous methods of application.

The same rules govern the high frequency treatments, that apply to all the other forms of electrification, as regards the polarity.

What are the methods of high frequency treatment ?

The methods of administering the high frequency treatment, are: by auto-conduction, auto-condensation, resonator, two-pole and single pole.

Auto-Conduction. The part is surrounded by a coil of wire through which is passed the high-frequency current. The body being soaked in the rapidly fluctuating electro-static field, which sets every corpuscle of the body in vibration.

Auto-Condensation. Patient reclines on a couch over a large metal plate, placed beneath, and connected to one pole, the other applied directly to the patient.

Resonator-Treatment. In this a coil is connected to one pole of the apparatus with a spark gap in series. The electrode is attached to a cord connected to a slide contact, which moves over the coil, similar to a wire rheostat. This regulates the current used.

Two-Pole Method. One pole is attached to any ordinary electrode in contact with the patient, the other pole is applied directly to the part to be treated. In the above treatments the ordinary electrodes are used, while the low vacuum glass tube electrodes are used in the

Single Pole Method. This is the one most used, and in which we get, not so much the high-frequency currents, as the ultra-violet rays. The patient is placed on the platform, as in simple static insulation, with the bare feet on the foot plate, which is connected to one pole. The other pole is attached to the vacuum electrode and applied to the body. This is only a modification of the two-pole-method.

The Best Way, however, is to place patient on platform, not connected with either pole. Then attach the vacuum electrode to the positive pole, and ground the negative. Close the spark gap. Approach to the part to be treated with the vacuum electrode, and either touch it lightly, or hold it a short distance from the skin. Then gradually open the spark gap, till you get the desired effect.

There is much ado made about the use of the coil, and it may be necessary in the first four named methods, for using the high-frequency current, but we know from many experiments, that in order to generate the

ultra-violet rays, and use the vacuum electrodes, according to the single pole method, *the coil is not necessary*. With the proper static machine, and the proper technique, the effects can be obtained with much more ease, safety, and simplicity, and a great deal less expense, than with the condenser and coil. In the first place the enormous voltage will overcome any insulation and short circuit a coil, and render it practically useless. The more simple the apparatus the easier to operate, and the better the result. In our experiments we use a twenty-four plate, static machine, thoroughly dry and clean, run as fast as is safe, by a ⅓ H. P. 220 Volt, direct, series, motor and speed controller. Close spark gay between sliding rods of prime conductors, *Remove Jars*, Ground negative pole. Connect glass vacuum electrode to positive pole. Put patient on insulated platform. Bare the part to be treated. Place electrode in position (either internal or external). Start machine. When speeded up enough, then slowly open spark gap between the sliding rods, till you get the desired effect. The glass vacuum electrode when not in contact with patient will glow slightly bluish. Placed in contact with skin or near to it, it glows a bright deep violet, and a shower of fine violet rays flow from electrode to patient. The best distance is about an eighth of an inch away. With the tube in contact a slight warmth is felt. When attached to the positive pole the distal end is most violet, and the proximal end shows a greenish fluorescence. With the negative pole, the proximal end is most violet, and the distal end shows the greenish fluorescence. The positive pole, applied to the inside of the wrist, produces tonic spasm of the flexor muscles, and is most felt in the forearm. The negative pole, applied to the wrist, is most felt in the hand. Applied to the forehead with very short spark gap, either pole causes much drawing and a stinging pain, even with the hand placed between electrode and skin. This application caused intense frontal headache for several hours, so much care must be used in applying to the head, or over superficial nerves. Negative pole applied to nasal mucous membrane caused stinging, and pain in upper teeth, with sneezing and increased secretion. Positive pole to nasal membrane, produced no pain or sneezing, but in a few minutes there was the same sensation as if the nose had been sprayed with cocaine. The secretion stopped and congestion disappeared. There was a strong smell of ozone. The same experiments made with one and both jars on, and with one jar grounded and electrode connected to other jar, produced same effect, but very much less marked. Same tests made off the platform were not satisfactory. The tests applied to the skin produced slight redness only. The violet spray from negative pole was much more disagreeable. The too frequent use of the rays will

cause intense conjunctivitis and irritation of the eyes. Several positive treatments were given an old case of psoriasis on the arms, and the patient said it was soothing and made the patches feel more natural. From these experiments we get the following conclusions:

In generating the ultra-violet rays a coil is not necessary.

A good static machine is sufficient. It should be run fast.

The spark gap should be short.

Both jars should be removed.

The positive pole is richer in ozone and violet rays.

The negative pole is richer in X-rays.

The positive pole is sedative, soothing and astringent.

The negative pole is stimulant, irritating and congestive.

The polarity of ultra-violet therapy follows the same laws, as of static, faradic and galvanic electrification.

The deep effects are greatest when electrodes are in contact with skin, or mucous membrance.

The superficial effects are greatest when electrodes are close to, but not touching the skin, or mucous membrane.

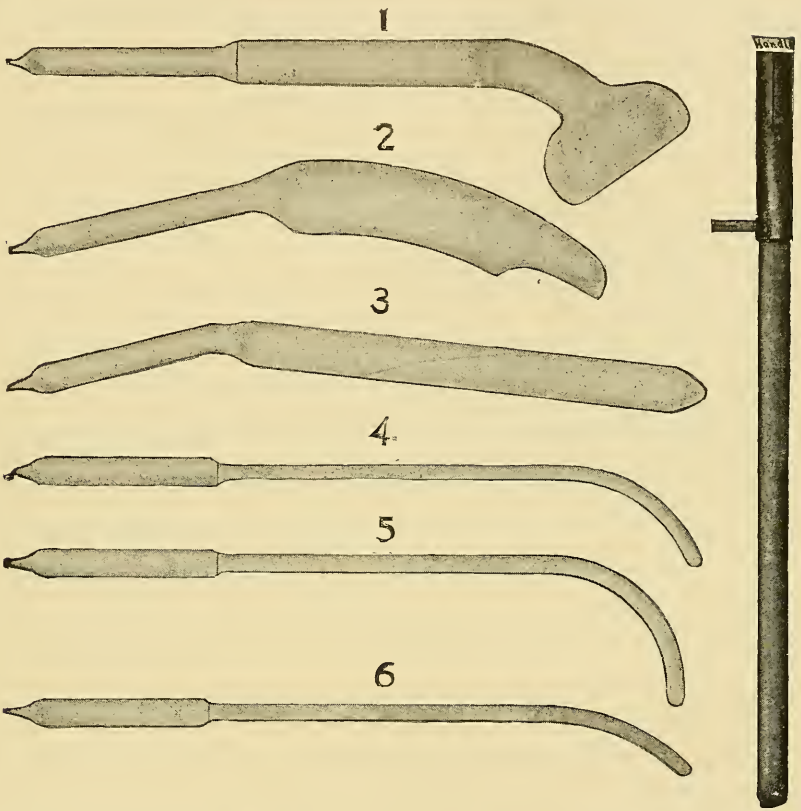
Great care should be used in treating on the head, or over superficial nerves, and especial care should be used to keep the rays from striking the eyes, to avoid irritation.

The rays can be applied, by proper electrodes, in the treatment of diseased conditions, through any of the skin or mucous surfaces, or cavities of the body.

In the ultra-violet rays with glass vacuum electrodes, we have a most valuable adjunct to electro-therapeutics.

ULTRA-VIOLET-RAY VACUUM ELECTRODES.

What are vacuum electrodes?



The cut shows a set of six, at about one-third actual size. Fig. 1, for external treatments. Fig. 2, vaginal, with concavity to fit the cervix. Fig. 3, rectal. Fig. 4, urethral. Fig. 5, fauces and larynx, Fig. 6, flat, for nasal and post-nasal region. The handle shown at the right fits all the tubes, and is of hard rubber and brass, with connection for conducting cord.

The sketch (p. 148) shows the technique of the single pole treatment of frontal and supra-orbital neuralgia by means of the high frequency current. Here the operator holds the surface glass vacuum electrode, or applicator in his hand, and the current passes through his body and is then applied

The "Electric Hand" Application of High Frequency.

to the patient who is either insulated or grounded, according to the effect desired, as shown above.

This is a very simple yet effective method of treatment, and gives good results, and has a profound psychical effect in addition, although the effects will be secured without any suggestion.

Application of High Frequency for Stomach or Bowel Troubles.

The sketch above shows the method of applying the surface electrode

to the abdomen of the infant, where suggestion would not avail. This form of treatment is to be recommended in the sluggish conditions found in infants and small children, requiring muscular stimulation.

What are Roentgen rays?

Rœntgen rays are so named after the man who first put them to a practical use, and are usually called the X-rays, on account of their formerly unknown classification.

The X-rays are not appreciated by any of the senses, and do not produce heat, and therefore belong to the violet end of the spectrum. The X-rays differ materially from the cathode rays, and the ordinary light rays. They travel in straight lines to infinity, and can be neither refracted, reflected, or deflected by a magnet, as may the cathode rays, or by some polished metal, or glass, as are the light rays. They do not produce the sensations of either heat or light. They will pass through substances which are opaque to ordinary light, without heating, and at the same time will not pass through such substances as glass, which is transparent to light.

The X-rays will cause certain substances to fluoresce, or glow in the dark, especially the platino-cyanides of barium and potassium, uranium fluoride, and calcium tungstate. They will decompose the sensative silver salts, producing the same effects as those of light. They have the property of discharging either positively or negatively charged bodies, and as stated before, will penetrate bodies which are ordinarily considered as opaque. The transparency of these bodies to the X-ray is proportional to the atomic weights of the substances. Thus, aluminum is more transparent to the rays than lead, which has a much greater atomic weight, and we may use the lighter metals as a filter to keep back the weaker rays, and allow only the more penetrating rays to pass through.

What are cathode rays and electrons?

Cathode ray is the name applied to the stream of particles known to pass from the negative to the positive electrode inside a vacuum tube, when energized by a current of high voltage electrification. This stream of infinitessimal particles, constituting the cathode ray, and which are assumed to be the ultimate division of matter, is composed of what are termed electrons, and are estimated to travel at the rate of 70,000 miles per minute.

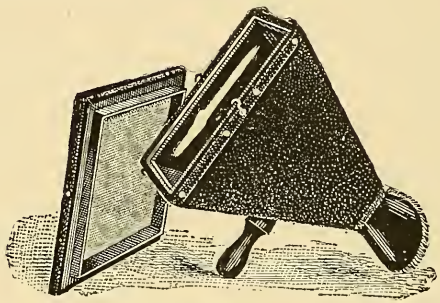
What is meant by the term vacuum?

Vacuum, in electro-physics is that condition of the attenuation of the atmosphere inside of a tube, which is about the one millionth of the density of the outside air, and which is the best condition known for the generation of the X-rays.

What is fluorescence?

Fluorescence is a property possessed by certain crystals of glowing, when acted upon by the X-ray in the absence of light.

What is a fluoroscope, and how used?



A fluoroscope is a funnel or pyramidal shaped box, in the base of which is set a screen of some fluorescent chemical, so that the light is excluded, and the shadows of some object intervened between it and the tube will be projected upon the fluorescent screen, and thus become visible to the operator.

What is meant by anode, cathode, anti-cathode, target, focal point?

The anode is the electrode in a vacuum tube to which is connected the positive pole from the electric generator. It is flat, and usually composed of platinum, and is fixed at an angle of 45 degrees to the long axis of the tube, and is usually the target, or point of impact, on which the stream of the cathode rays are concentrated, at what is known as the focal point, by means of a concave disc of aluminum, which constitutes the cathode, which is the electrode to which the negative pole of the electric generator is connected. Sometimes another electrode is inserted inside the tube, opposite the cathode, which is known as the anti-cathode.

How are the X-rays generated?

When the cathodal stream of electrons is focused at a point on the target, they are deflected at right angles and strike the side of the tube, and the X-rays are generated, on the outside of the tube, by the process of induction, and pass straight off into infinity, starting at right angles to the outer surface of the tube.

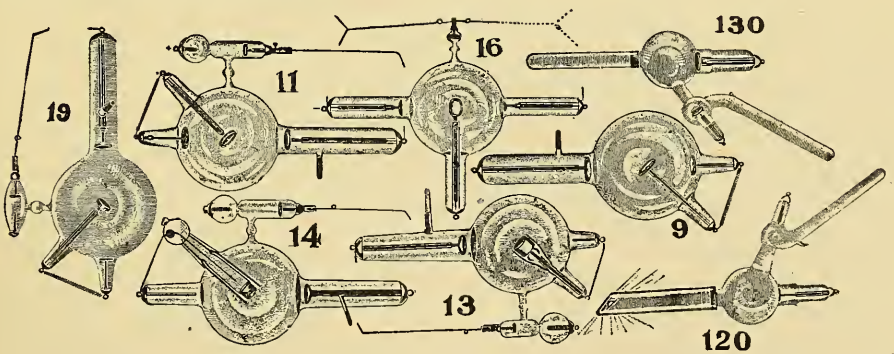
The divergence of the X-rays equal, in all conditions, in every sixteen inches, 13-16 of an inch. The distortions of fluoroscopic views may be mathematically corrected.

The rays travel in straight lines to infinity, and cannot be deflected, reflected, or refracted, or stopped by ordinary opaque substances. The part of the greatest concentration of the X-rays, or rather the field of strongest activity, is opposite the focal point, and in a line at right angles to the surface of the target which is usually the anode.

When is a tube said to "back up a spark"?

When the discharge refuses to pass through a tube it is said to "back up a spark," which may be two, four, or more inches between the terminals. This is the condition in which we experience a great waste of current and the possibility of electric burns. When the resistance in the tube is high, and the X-rays intermittent, the liability to these injuries is apparent.

What are X-ray or Crookes tubes?



X-ray tubes are vacuum tubes of various shapes for use in radiography and radio-therapy. They are made in many shapes, some of which are illustrated herewith. Nos. 120 and 130 are to be used in cavities.

TUBE POINTERS

What points should be remembered about X-ray tubes?

Do not short circuit the tube and run continuously, as too much gas will then be driven off. A very few sparks, sometimes one or two, should lower the vacuum sufficiently for the time being.

When the tube cools off after use the vacuum will probably go up again, and may be brought down as in the first instance. A long run may also raise it somewhat.

The best X-ray results depend upon a nice adjustment of the vacuum, for which some tubes are especially designed. If by chance the vacuum should be lowered too much by using the regulator, prolonged running, or a rest, will raise it again.

We believe that experienced manufacturers of X-ray tubes are now in a position to furnish a proper vacuum and one which will not be materially lowered by use.

The diameter of the plate of a static machine determines greatly the length of the spark. Experience has shown that a plate of thirty inches will excite sufficient length of spark for all purposes. The number of plates determines the quantity and fatness of the spark, and twenty-four plates seems to provide the limit necessity.

When a good tube which has given good service, after a while begins to fail to longer give off the Rœntgen light, it can be restored to usefulness in a few minutes; reverse the discharge through the tube by reversing the connection.

In most instances five to fifteen minutes will restore a tube that has been "worked out." A tube which has too great resistance for X-radiance may be restored to its efficiency by interrupting the negative discharge while properly connected; this will lessen the internal resistance. If the tube is improperly connected, purposely done so for the purpose of reducing resistance, interrupting the positive discharge on its way to the tube will assist the reversed connection in reducing the resistance.

How do you test X-ray tubes?

While the machine is in operation it sometimes occurs that the current is suddenly reversed, or it may be that the tube is improperly connected. If this is the case with a good tube it will present a green striæ, with very faint nebulæ, together almost filling the tube, or in a higher generating apparatus the cathodal end, including one-third of the tube, is bound with a distinct zone with lighter right angle radiations. Bugs or beads may cling

to the tube. This phenomena is quickly dispelled when the current is properly connected. An improperly connected tube will generate but feeble X-radiance.

The simplest method of testing the penetration of X-ray tubes is to examine the shadow cast on the screen of a fluoroscope.

The density of the shadows seen, determines the degrees of penetration of the X-ray from the different tubes, the tubes being denominated "hard," "medium," or "soft," according to the density of the shadows seen.

The density of the human tissues will also act as filters, so that we will get different degrees of shadows or silhouettes on the photographic plates and fluorescent screens, and thus distinguish between the flesh, bones, and foreign metallic bodies. This fact is of great importance to us in surgery, enabling us to detect and correct fractures, dislocations, and abnormalities of the hard parts, and to diagnose diseased conditions, and to locate foreign bodies of metallic nature. Many lives have thus been saved, and operations simplified, and deformities prevented.

When the shadows of the bones of the hand are so dense and black, when seen in the scope, that the joints cannot be distinguished, it shows either a weak current or that the tube is too soft for good fluoroscopy, or radiography, although a fairly good radiograph will result from a long exposure.

Fig. A. Shadow of hand shown with a soft tube.

This condition of the tube will be indicated by the cut above, which shows the shadows cast on the scope screen by a very soft tube. The whole hand shows dark, and the bones run together. Such a tube can be used only for superficial treatments, and prolonged exposures at a short distance, may be given with safety.

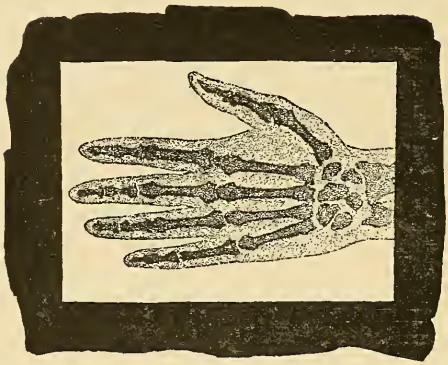


Fig. b.

Fig. B. Shadow of a hand shown with a medium tube.

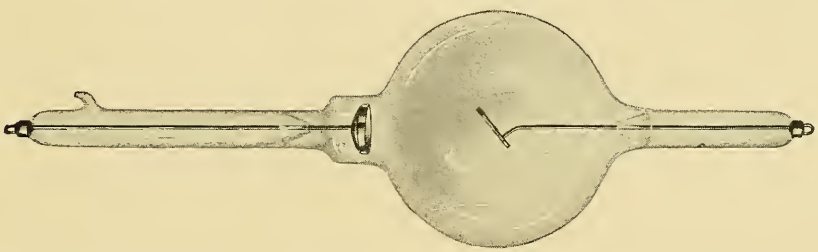
The conditions of the medium tube will be indicated by the cut above, which shows the shadows cast by a medium vacuum tube. The bones of the hand and wrist stand out clear and distinct from each other, and the flesh casts a dim shadow. Such a tube can be used for nearly all fluoroscopic work, especially of the extremities, and all but the thickest and densest parts, and for the more extensive and deeper seated diseases, it will be adapted in therapy.

Fig. c.

Fig. C. Shadow of a hand shown with a hard tube.

The condition of the hard tube is indicated by the cut above, which shows the shadows cast by a hard tube, as seen in the scope. Here the shadow of the flesh is hardly seen, and even the bones cast but a faint shadow, and you notice the texture of the bone, the marrow canal, and the

cells in the cancellus parts. Such a tube is best adopted for all deep fluoroscopic examinations, through thick and dense tissues, and for radiographic work in any part. It is not best to use this tube for treatments, as there is more danger from burn, an account of the penetration and the greater superficial effect. Of course these directions are not arbitrary, because you may be able to so manipulate the various tubes as to get what you desire, in the way of work, from one or two tubes, but for the sake of economy of time, and to get the best results, it is cheaper and better to have several tubes, which you know are best suited for various work. Then if you are unfortunate enough to break or puncture your best tube, you will have another handy, which you can coax to take its place while you get the other repaired; or a new one arrives. The life of a tube will vary with different tubes. I have had tubes break down time after time with little use, with no apparent cause, and then I have had the same tube in use for hours at a time, and for years intermittently, without any trouble. I have found the simple and cheaper American made tubes to be more satisfactory, and economical, and practical, than the complicated and expensive imported



tubes. Some of my best work has been done with a simple non-regulating tube, costing but six dollars, and I have done several hundred dollars worth of cash work with a simple chemical regulating tube costing but twelve dollars. My favorite has stood by me now for about three years, and, with a great deal of use, shows no signs of deterioration. When you get a good tube, stick to it. Learn its habits, as it were, and allow it to work as it seems best adapted, and do not try to do everything with one tool, any more than you would treat every condition with one remedy.

What are the three kinds of interrupters?

There are three kinds of interrupters used in connection with coils for the generation of currents for energizing X-ray tubes, viz: Mercury jet turbine, rotary break, and the electrolytic. Of these the last named is the more preferable, as being most noiseless, economical and convenient.

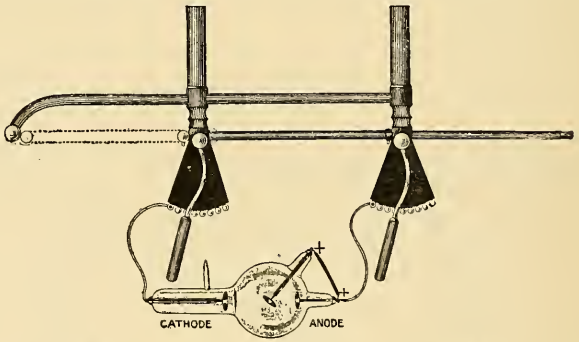
Why use multiple spark gaps?

Multiple spark gaps are an advantage, in that the breaking of the current a number of times while the tube is in circuit, imparts to the current a greater tension, and also gives it an oscillatory character, which greatly increases its generating power. They are usually placed on both sides, with about twice as many on the positive as on the negative side.

What value have pole changers?

Pole changers are an advantage, on account of the easy manipulation of the direction of the current through the tube, without changing the connections between the tube and generator.

A good attachment to have on the static machine is a pole changer, so that if the tube is connected and the polarity of the machine should change, as it will on some of the static machines, then you may reverse the current through the tube, without disconnecting and re-connecting the tube.



Multiple spark gap, pole changer and X-ray tube connections.

This is also very convenient if the vacuum is too low, and you wish to raise it by merely running the current through the tube backwards. A good combination of a pole changer and multiple spark gap combined, and which can easily be attached to any make of machine by any one, is shown above.

What is the technique of X-radiography?

The technique of X-radiography is to bring an energized vacuum tube, and object to be radiographed, and a sensative photographic plate in line, so the part to be graphed will be in direct line with the anodal axis of the tube. The exposure having been made, the plate is developed as an ordinary photographic plate.

How do we compare fluoroscopy with radiography?

The great difference between fluoroscopy and radiography is in the distinctness of the image fixed on the plate, as against the irregular outline and dim shadow seen on the screen. The one is for perfect and accurate record, while the other is for examinations not requiring much exactitude, and often in cases where time is an important factor.

What are high voltage or frequency currents?

High frequency and high voltage currents are those which are derived from a static machine or an inductorium, and have very high potential, so much so that they will overcome great resistance, and leap across spark gaps of considerable distance.

When derived from a static machine they are usually secondary or the induced form. A condenser in the form of a Leyden jar is in series circuit, and one or more spark gaps may be introduced.

This gives a rapid interruption and imparts an oscillatory character to the current which sets up rapid waves or vibrations.

When derived from an inductorium, the currents are the same as the ordinary faradic form, but with a much higher tension.

Sometimes several induction coils are superimposed upon each other, the secondary of the first one being used as the primary of the second, and this second secondary being used to energize the primary coil of a third inductorium, etc. Thus each step up in the process of induction greatly augments the tension or the voltage. This constitutes the method of the generation of the Tesla currents. The same way a number of condensers or Leyden jars may be coupled in series, either with a static machine or with a coil, or both may be used with a coil.

There is no amperage about these currents, which accounts for the immunity from danger in taking or giving treatments with these currents. It is supposed that the beneficial results derived from the use of these high frequency, high voltage, oscillatory currents depend upon the vibrations imparted to the tissues, which stimulates metabolism, thus rearranging the electrons into their normal relations, and stimulating the elimination of the effete matter produced by retrograde metamorphosis. It is a well established fact that great good can be derived from these treatments, especially in nervous functional derangements.

A high tension current may be applied to the patient by passing the derived current through a large coil of wire, which is insulated from the earth, and so arranged that the patient either wholly or in part, is immer-

sed in the field of rapidly oscillated influence which will be created within the coil. The effect may be modified by means of the primary spark gap, so that a thrill either mild or vigorous may be felt, and either a strong or mild stimulation given the patient. Usually only one pair of Leyden jars are connected between the static machine generator and the diasolenic coil.

What is a diasolenic zone?

This field of influence is called the diasolenic zone, and this method of treatment and nomenclature is to be credited to Dr. Otto Juettner, of Cincinnati, who first brought it to our notice.

What is the radio-activity of a tube?

The radio-activity of an X-ray tube is dependent upon the source of energy which acts, and also on the degree of vacuum within the tube. A tube with a low vacuum will not generate X-rays of as great penetrative powers as will a tube of higher vacuum, and vice-versa. Therefore a soft tube should be used for treatments requiring but little penetration, and a hard tube employed for the treatment of deeper seated troubles, or when you wish to make a radiograph through the thicker parts of the body.

What is meant by the anodal axis?

The anodal axis of a tube is that part of a tube which generates the strongest rays, or rather that part of the field in which the rays are most concentrated, and this axis is a plane exactly at a right angle to the plane of the anode or target, within the tube.

In making either fluoroscopic examinations or taking radiographs this anodal axis should be directly over or in line with the part which it is most desired to examine or radiograph.

Of what value are shields and screens?

In either fluoroscopic or radiographic work there should be much care exercised that you do not expose too much healthy surface to the action of the X-rays, therefore it is always advisable and in fact is very essential, that the operator have some means of protection for the surrounding parts. For this purpose some form of metal shield should be used, which will effectually cut off the rays from all but the field, or part which it is wished to ray.

It is also best for the operator to take precautions for his own safety,

so that he will not be influenced by the rays. For this purpose a screen may be used, behind which he may observe the work he is doing, or he may wear an apron of some material which is opaque to the rays. These precautions will greatly add to the safety and satisfaction of the work, and at the same time possibly save him from troublesome complications, and delays, and annoyances, due to accidental irritations, or so-called "burns" or from suits for malpractice. A careful operator will not very likely have any such trouble, especially if he takes the precaution to always warn the patient of the possible danger, but it is always best to be on the safe side. Better to be much too careful than a little too careless.

THE ALLEN X-RAY SHIELD AND TUBE HOLDER

Shield.

The cut (p. 159) shows a good combination of a tube holder and an adjustable protecting screen, which may be used in any position. The shield is made of aluminum, which is partially opaque to the rays, with a central shield made of sheet lead, which is very opaque to the rays. In the lead a hole may be cut of any desired shape or size, for the purpose of irradiating only a limited area, while the parts in the immediate vicinity are completely protected from the more powerful rays, and the parts more remote are also protected from the weaker rays by the larger aluminum shield. The stand of a shield should be of metal, to act as a "ground" to carry off the stray static currents or streamers, which may annoy the patient and cause him to move, which would spoil the result if a radiograph was being made.

MANNER OF ATTACHING X-RAY APPARATUS TO THE STATIC MACHINE

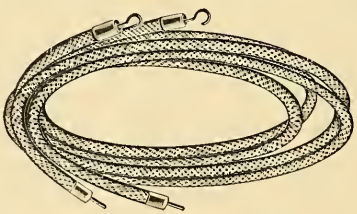
What is the technique of tube connections?

Disconnect or remove the jars.

Ascertain the polarity of the machine.

Place the X-ray tube holder in the desired position.

Affix X-ray tube in tube holder, taking care that the anode will be in the same relative position as the positive pole of the machine, i. e., if the positive pole is indicated on the left hand side of the machine, then the anode of the tube should be on the left, and vice versa.



Connect the heavy insulated X-ray cords to the prime conductor posts and then to the X-ray tube.

Start the machine with the prime conductors closed and then after the desired speed is attained, pull out the prime conductors their full extent, when a green light should appear, forming a hemisphere in front of the anode. If a number of green rings appear back of the anode, this indicates that the polarity of the machine is reversed and that the tube must be disconnected and reversed, or the current direction reversed by means of the pole changer.

The X-ray light radiates from the center of the anode outward, therefore focus the point to be examined directly in front of the center of the anode and about six to ten inches from it.

Press the fluoroscope screen close upon the object so as to reduce the length of the shadow.

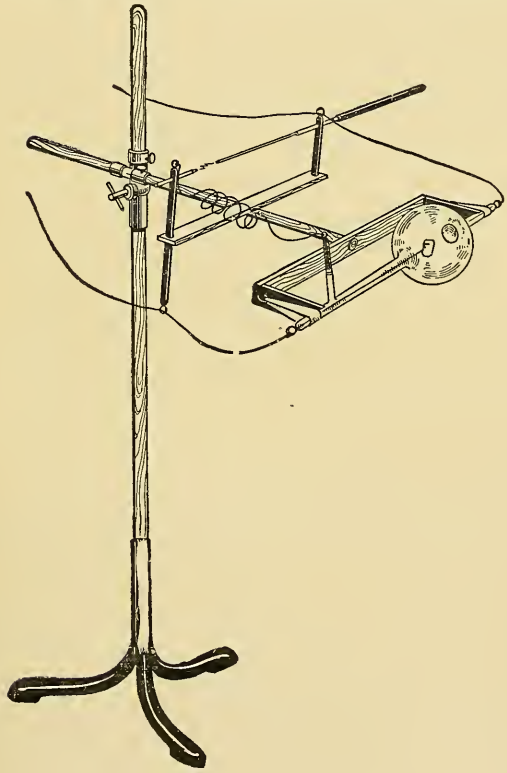
X-rays penetrate all substances according to their density, consequently bone and metal, having greater density than flesh and blood, will be indicated by a more pronounced shadow.

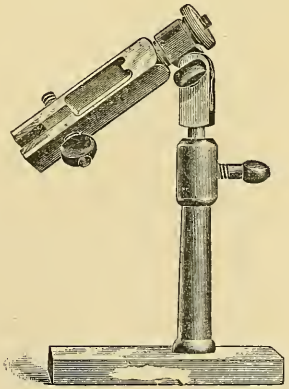
The shorter the distance from the source of light the more definite will be the shadow indicated on the screen.

THE TUBE HOLDER

What is the tube holder?

The tube holder is a stand arranged to hold the tube while in action. A good stand should have a heavy, firm base to insure stability, an arm





that will admit of various positions by the simplest device possible, and it should have a cross bar holding up the conducting cords.

A tube holder should be made of wood, so as to be as nearly a non-conductor as possible. The accompanying cuts show a small tube holder for use on a table, and a large tube holder which stands on the floor.

The large tube holder, at the left (p. 161), shows a simple chemical vacuum tube regulating device by means of which the vacuum of a chemical regulating tube may be kept at any desired degree, indefinitely, automatically. With this device the tube may be short circuited, that is, whenever the vacuum in the tube becomes so high as to back up a spark it will then pass the current around through the chemical and liberate a little gas, which will lower the vacuum again. This process will be repeated every time and thus the vacuum be held wherever you want it, automatically.

With this simple tube, and holder, and regulator, I have held the vacuum at any point desired for an hour at a time, without any attention whatever.

What are the requirements for X-radiography ?

The requirements to successful X-radiography are a good source of energy, which must be constant; a good tube, which may not be either costly or complicated; a sensative plate protected from the light; a knowledge of the anatomy of the parts to be radiographed, so as to avoid distortion of the shadow; a knowledge of the physics and technique of the operation; and someone who can develop the plate after it is exposed.

There are many useful accessories which may be used by the X-ray operator, all tending more or less to make the work easier, safer and better, but these things may be added as they are needed from time to time, or omitted entirely. Good work may be done with very little apparatus, but facilities contribute to success.

What principles and conditions are to be remembered?

The results of radiographic work depend on the care with which the different apparatus is used; the location and density of the part examined; the state of the vacuum in the tube; the length of the exposure; the steadiness of the current generated; the angle at which the tube is placed with reference to the part; and the development of the plate. As there is no perspective or any high lights in a radiograph, nothing but a black and white shadow, a plate is in no danger of being over developed, but should be developed very slowly with a weak developer.

Radiography

The shadowed picture on a photographic plate excels in detail and accuracy the shadow cast upon the fluoroscopic screen. Successful radiography requires a good exciting apparatus, good tubes, a thorough knowledge of both, and skill in the management of the photographic plate. Unless one has some knowledge of photography, he had better let the photographer develop his negative and finish his prints.

For radiographs of the head, hips and abdomen the coil is preferable. For all other parts of the body a static machine may be used. The patient should be stripped of clothing about the part to be examined to avoid confusion from shadows of buttons, pins, etc. Splints, iodoform, and plaster of Paris dressing should also be removed, though the bony shadows will show through them. The recumbent positon is best in most examinations, because there is less liability of movement during the exposure. Common sense and a knowledge of anatomy will direct the operator in posing his patient, always remembering that the nearer the part to be radiographed is to the film side of the negative the sharper will be the shadow.

The higher the vacuum of the tube the more penetrating will be the rays produced. The degree of penetration will be determined largely by the thickness of the part to be radiographed. The bones of the extremities yield the brightest shadows to a tube of comparatively low vacuum; a harder tube will show less contrast between bones and soft structures. The chest requires a medium tube and the head and pelvis a high one.

For the purpose of comparison, it is wise to radiograph both extremities where only one is abnormal. This plan is imperative where pictures are to be introdnced as evidence in a court.

Malignant growths of the bones, also tuberculous bone, show more transparent than the surrounding bony tissue. Malignant growths of the soft parts cannot be positively diagnosed by the ray.

The wrist and hand are the easiest parts of the body to radiograph. Exposing from back to front will show most lesions, but a side view can be taken if necessary.

The elbow should be radiographed through the plane of the condyles if possible.

The shoulder may be taken from front to back, or from back to front. Usually the tube should be placed directly over the glenoid cavity, but if it is desirable to show the acromion, the tube had better be over the point of the shoulder.

The clavicle is best shown by placing the front of the body against the plate and the tube behind the back.

In the foot the metatarsals and phalanges show best in an antero-posterior view.

Injuries of the ankle usually require both the antero-posterior and a lateral view. Potts fracture is readily diagnosed by a front view.

The lateral view of the knee joint is most useful, and unless there are contra-indications it should be taken in a semi-flexed position.

The hip-joint is the most difficult subject of all, except in children. Best have the patient lie upon the back with thighs adducted.

The skull, face and neck show most abnormalities by a lateral view.

The chest shows best if the exposure does not to have to last longer than the patient is able to hold his breath. The respiratory movements cause some blurring.

Stones in the kidneys, ureters and gall-bladder can seldom be located by a static machine. Use a moderately low tube with a long exposure, and if unsuccessful the first time, try again.

The distance of the tube from the plate differs in various parts of the body.

Every operator must learn from experience the time necessary for good results with his particular equipment. With a static machine of 12 revolving plates, 30 inches in diameter, and running at not less than 400 revolutions per minute, the following table may prove helpful to the beginner:

Part	Distance	Time
Hand	12 inches	4 minutes
Foot	12 inches	4 minutes
Shoulder	15 inches	10 to 14 minutes
Chest	20 inches	15 to 30 minutes
Hip		

A 16-inch coil with mercury interrupter requires about as follows:

Hand	12 inches	5 to 10 seconds
Foot	12 inches	10 to 15 seconds
Shoulder	15 inches	45 to 60 seconds
Chest	18 inches	45 to 60 seconds
Hip	20 inches	4 to 7 minutes

The same coil working on an electrolytic interrupter will do this work in about one-fourth the time above specified.

Of what value are intensifiers?

Intensifying screens are for the purpose of lessening the time of exposure. They consist of sheets of celluloid coated with some fluorescing substance, usually tungstate of calcium. One of these placed in contact with the film side of the negative to be exposed reduces the time of exposure to about one-fourth that ordinarily required.

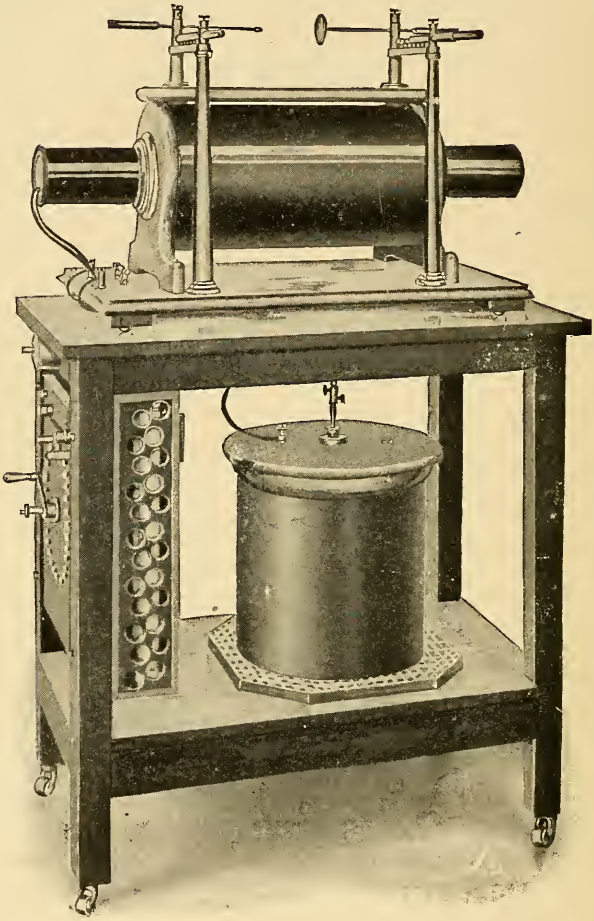
X-RAY PLATES

What X-ray plates are best?

Any rapid photographic plate will answer. Some manufacturers make a special double emulsion coating for this purpose. They come packed six in a box, and accompanying them are envelopes for each negative. The plates should be kept in a dry, dark room, and unless solid or plastered walls intervene between the machine and the dark room, they should be kept in a box lined throughout with lead. When ready to make radiograph close dark room, take plate from the box and place, film side up, in the black envelope and this in turn in the pink envelope. The film side of the negative should always be in contact with the smooth side of the envelope. Place the negative on the the table, film side up. If the table is padded, a board must be placed under the plate to prevent breakage. If the weather is hot and patient is sweaty, lay a piece of blotting paper over the outer envelope. See that your apparatus is in perfect order. Place your patient in the best possible position to bring out the abnormality looked for.

For the development of plates, see the literature accompanying same.

There is much to be learned which cannot be taught, but which will come to you as you go along, as the result of your own observations and experiments.



X-Ray induction coil, with electrolytic interrupter.

The above cut shows a form of high tension X-ray induction coil, with an electrolytic interrupter, for use with the alternated street current. This is one of the best coils for this purpose, and will do almost instantaneous radiographic work.

Magnetisation

What is magnetism and magnetisation?

Magnetism is a *condition* so closely allied to the *condition* of electricity, as to be inseparable, and the phenomena of manifestation of both *conditions* are very similar, and in some ways follow the same laws.

The force manifestation of the *condition* of electricity is known as electrification.

The force manifestation of the *condition* of magnetism is known as magnetisation.

What are magnets?

There are two kinds of magnets, viz: The natural magnet, which is known as the lodestone, found free in nature, and the artificial magnets, in which the peculiar properties of magnetisation are artificially induced.

Further there are two kinds of artificial magnets, viz:

Temporary magnets, which are made of soft iron, and which acquire magnetic properties very readily, and then lose them as readily as acquired, and the permanent magnets, which are made of hardened or cast steel, and which cannot be so highly magnetised, as the soft iron, but which retains magnetisation more or less permanently.

State the properties of magnets.

The presence or existence of the magnetic *condition* in any object is shown by the following phenomena:

1. By its power of attracting iron filings, needles, etc.

2. By its attracting or repelling other magnets.

3. By arranging itself, when freely suspended, so as to parallel the polar axis of the earth.

4. By its power to impart its own magnetic properties to iron or steel.

What is electro-magnetic induction?

We have shown the zones of influence surrounding a primary live wire, and constituting the electric field. If this wire is passed around a magnetic core the strength of the field, is increased, and constitutes an electro-magnetic field.

If a copper wire is immersed in the electro-magnetic field or zone and the free ends connected to a meter, there will be registered a secondary current strength.

This secondary current is generated in the secondary wire or coil by electro-magnetic induction.

LAWS OF MAGNETISATION

What are the laws of magnetisation?

A unit magnetic pole is that which at a unit distance from an equal similar pole, will repel it with unit force, and with this definition the laws of magnetisation may be stated thus:

1. Magnetisation cannot be insulated.

2. Like poles repel, and unlike poles attract.

3. Attraction and repulsion is proportional to the strength of the poles.

4. Attraction and repulsion is inversely proportional to the square of the distance between the poles.

5. The strength of the magnetic field at any point is the force with which the field would act on a positive unit magnetic pole at that point.

6. The lines of magnetic force follow the direction, at every point, of the lines corresponding to the direction of the prime magnetic potential.

The usual insulators or dielectrics, controlling electrification, have no effect upon magnetic induction which will exert its influence right through wood, paper, glass, air, etc., just as if the generator was in actual contact, and this force acts across vacuum, water and all known substances, except across a network of iron or other magnetic material, but these are not insulators, but conductors, so that magnetisation has one property which is distinctively its own, in that it cannot be insulated.

This property makes it especially valuable in therapeutics, on account of its easy application and its great power of penetration.

What is understood by stress?

When a body is immersed in a magnetic field, it is placed in a state of stress, which has a profound effect on the tissues within, and the results of such stress are very apparent to the close student and observer of the phenomena. This stress will disturb the existing state, and the extent of the disturbance will depend on the nature and strength of the magnetic stress operating within the field, and primarily on the inducing current.

A constant uni-directional current will induce a strain with a fixed tension and pressure, A constant current, but with a variable potential, will induce a strain with a pulsatory or intermittent tension, A uni-directional current, but interrupted in character, will induce a strain of a wave-like or undulatory nature, with a consequent rise and fall of pressure. An alternated current will induce a strain of a changeable polarity with an oscillatory tension, the frequency corresponding to the periodicity of the alternations, and the strength varying with the rate of the current reversal.

What effect has stress on living organism?

There is necessarily a wide difference of potential between the extremes of the two polarities with each reversal, which may be likened to the distance from the top of the crest of a wave to the bottom of the next trough of the wave, and we have found that the most apparent physiological response to the magnetic stress in the living organism follows the employment of the sudden and wide difference of potential.

Variations of stress produces a liberation of corpuscular magnets from abnormal relations, and permits of a rearrangement in their normal relations, thus restoring normal conditions, and equilibrium and magneto-tonus, or health.

What is magneto-tonus?

Magneto-tonus is a state or condition of normal magnetic equilibrium, existing in a healthy body or part.

What are the physiologic effects of magnetisation?

Magnetisation stimulates tissue metabolism, increases oxidation, and raises temperature, the execretion of urea is assisted, elimination and as-

similation is quickened. Nutrition and growth is aided. If carried to excess, over stimulation causes deleterious results, and there is loss of weight.

What is the Bennett magnetone?

The magnetone is strictly an original invention, as I never saw or heard of anything like it, and so far, no one who has seen it, has ever seen or heard of anything like it. If there be any such it has not been published, as the writer has obtained nearly every book relating to the science of electro-therapeutics, and also many publications of an electrical nature, along physical and commercial lines without so far meeting with any suggestion leading toward the construction of such a machine or instrument.

Therefore I take a great pleasure, as well as pride, in being able to place before the medical profession at large, and the guild of electro-therapeutists in particular, something which is unique, new and original, and at the same time to be able to state with the positive assurance of experience, just what effects it will produce in certain cases.

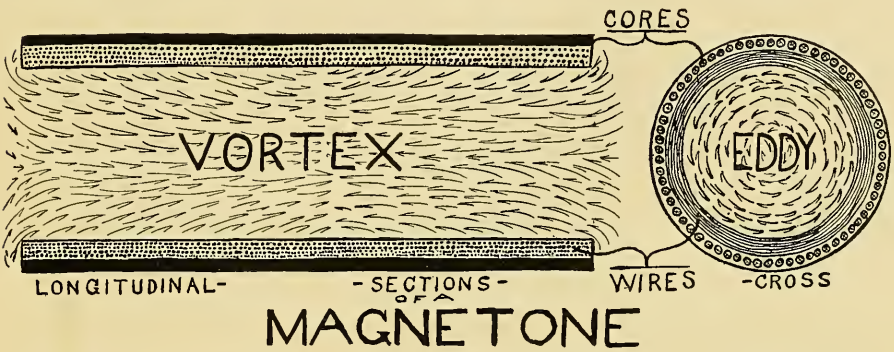
In casting about for a distinctive name for this apparatus, knowing the action of magnetisation upon the organism in restoring the disturbed equilibrium to its normal magneto-tonus, and also having proved to his entire satisfaction that this invention came as near doing it as anything known could do, the inventor decided to call his apparatus a MAGNETONE, and as such it will be spoken of hereafter, to distinguish it from all other electro-magnetic appliances.

The series of experiments and failures, the discouragements, exasperations, expenses, study and labor which preceded the successful completion of the magnetones, are not of interest, expect as proof of the old adage, that "There is no excellence without great labor," and to call to your minds the motto; 'Per aspera ad astra."

Before going on to state the results of the therapeutic applications, I will give a brief description of the method of its gross construction, omitting only, for business reasons, the secret of the cores and method of winding, which make it distinctive, and will surely prevent successful imitation, by unscrupulous substitutors, who might offer you something "just as good." You know how it is with your prescriptions.

The magnetone consists of a great length of insulated magnet wire wound on a heavy pasteboard drum, and surrounded on the outside by a tubular battery of compound electro-magnets, the whole apparatus being

saturated with an insulating material, and then tightly bound together with a layer of heavy express twine, longitudinally inside and out, and again tightly wrapped outside of all with manila post-office twine, which wrappings are also thoroughly saturated with insulation.



MAGNETONE

The cut shows a BENNETT MAGNETONE, roughly in outline, both in longitudinal and cross section.

In the above drawing the heavy black lines on the outside in the long section at the left, represents two of the compound magnetic cores.

These are also indicated in the cross section at the right, by the circle of small rings outside.

In the left hand cut the several rows of dots inside the cores represent the cross sections of the different layers of magnet wire wound round inside the cores.

These are also indicated in the right hand cut by several circular lines in long section, wound inside the circle of the cores.

As stated before, if the coil is energized with an alternated current, the magnetic field will assume the nature of a vortex. This is especially marked in the magnetone. I get the best results when using the alternated commercial lighting current of 110 volts and 60 cycles, and the wires and cores are so evenly balanced that there is nearly complete mutual saturation, both of electrification and magnetisation, so that I get the most energy from the current with the least loss of potential, and the minimum amount of heating of the wire.

The direction of the arrows in the left hand cut indicates the vortecal nature of the magnetisation, from the ends inward toward the center, and this force is manifest to the extent that a heavy iron rod or gas pipe will be sucked into the magnetone from either end toward the middle. Another

iron may be introduced, and the first one will cling to it, so that it cannot be easily shaken off, even with considerable effort. It will follow the second out to the end of the tube, and will then be sucked back again into the maelstrom of magnetic induction.

In the cross section at the right, the circularly pointed arrows pointing in both directions, indicate the alternating character of the parallel field of electrification surrounding the coils of wire. This partakes of the nature of an alternating eddy current, the direction of the eddy being reversed or rotated with every alternation of the primary current.

Thus we will at once see that when we unite these two effects, namely the eddy current or field of rapidly alternated electrification with the vortex current or field of rapidly alternated magnetisation, we have two forces working at right angles, and as neither can be insulated, they must penetrate and thoroughly saturate anything immersed in the field.

If there is anything at all in the theory of the corpuscular magnets in the tissues, then this shaking up will surely set them all at liberty, and allow them to resume their wonted positions, which correspond to the normal.

There is usually no sensation whatever experienced by the operator or patient when the part is immersed in the magnetone, that is, in a healthy subject, and in the diseased subject, the only feeling they appreciate is that of "the pain going away," which is the invariable result.

I tried nearly every size of wire, and many sorts of cores, among them solid and laminated, round, flat, solid sheet, and twisted cable. With some wire and cores the wire would heat and deliver no current. With others the cores would not be saturated, and would dampen the current. Others would choke, and some would buzz like a saw mill. Others would burn out and short circuit, but the end crowned the work.

No effect whatever, either physical or therapeutic is manifest outside the coil. It is all inside where it may be utilized.

The effects are most marked nearest to the sides.

The first magnetone was completed in April, 1902, which one was for the arm and hand. The other two, one for the leg and foot, and the one for the head and neck, were completed soon after, so that all three have been in constant and active service for a number of years, so that the tests are well proven and the results have stood the ordeal of all things, namely the crucible of time.

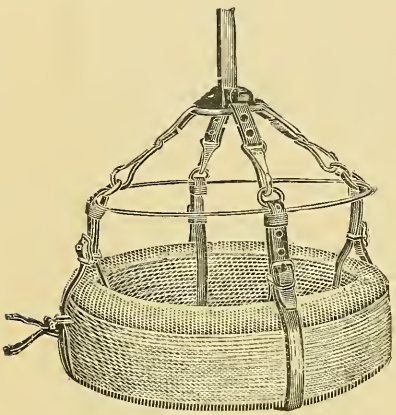
At first all treatments were given entirely empirically, as there was no rule to follow or formula to go by.

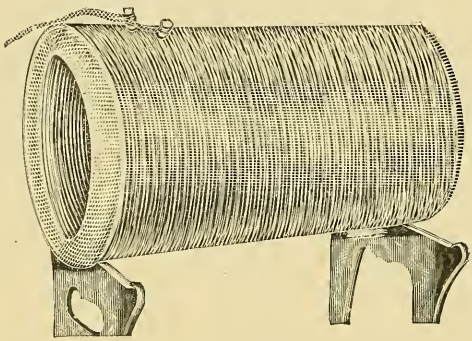
Suffice it to say that everything was fish that came to my net, and everything possible was put into one or the other of these tubes.

Pain is the most universally common sympton complained of, and the results in all forms of painful conditions are simply marvelous. It seems to give prompt relief in nearly every case. I have found out that certain pains are permanently relieved, constituting cures, while other pains are only temporarily benefited.

All of the reflex pains are alleviated, some quickly, some slowly, but all only more or less temporarily, some of them only while in the tube. Of course in these forms the causes operating to produce the pain were still operating, and the same cause would later produce the same effect, so that it is folly to try to cure a pain, due to a torpid liver or an abused stomach, or a diseased uterus, or a carious tooth, till the prime cause is attended to.

But those pains which are not purely reflex, but which are due to functional derangement, are very quickly and invariably entirely cured in but a few treatments.





Without going into details of reports of cases, will say that the magnetone has for me cured the painful conditions resulting from rheumatism, articular, muscular, arthritic, gouty; neuralgia, neuritis, neurosis; old and new fractures, sprains, bruises and cuts; various head pains of doubtful origin, cerebral, anæmia and hyperæmia, insomnia and other neurasthenic symptoms; pain from eye strain, relieving intra-ocular tension; defective circulation in the extremities. In these and many other conditions it was used alone,and in many more it was used in connection with other indicated treatments.

My colleague, Professor J. M. Longcoy, has also had free access to the magnetones with instructions to apply them whenever any opportunity offered in his large practice, and he has availed himself of the permission in many

instances, with uniformly favorable results, especially so in one bad case of synovitis of the knee, which got well without an operation, which had been advised, and no bad results followed. Other acute, inflammatory conditions have been allayed by the magnetones.

The cuts (p. 173) show the two magnetones, for the head at the left, and for the arm at the right. The one for the leg is similar to the one for the arm, but larger in diameter. Both of these are round, while the one for the head is oval, measuring about 7 x 9 inches inside. The head ring is four inches wide and two inches thick, contains a quarter of a mile of wire, and one hundred and ten simple magnet cores, the whole with the hangers weighing just twenty pounds, and is to be suspended over a chair.

The magnetone for the leg is nine inches in diameter inside, an inch and a half thick, and is eighteen inches long, contains a half mile of wire, and seventy simple and compound magnet cores, and rests on a revolving piano stool.

The magnetone for the arm is six inches in diameter inside, is an inch and a half thick, and eighteen inches long, and contains a third of a mile of wire, and fifty-five compound steel magnet cores, and rests in a wooden cradle made to fit it, so as to be easily placed on a table, for convenience of application.

When this arm magnetone is energized with the 110 volt, 60 cycle current, and a piece of common black iron gas pipe eighteen inches long is held within the tube, there is a distinct vibratory thrill felt in the hand, and there is a strong pull exerted upon the pipe, tending to suck it into the tube. If this pipe is let lie in the bottom of the tube, and large nails, keys, etc., placed in contact with the protruding end, they will be suspended and emit a loud buzzing sound, due to the fact of hysteresis going on in the pipe, for with every alternation of the current, the pipe drops and picks up again before they get away from it, the nails or keys, at the rate of 7,200 times a minute.

If the pipe is allowed to remain for thirty seconds, it will be too hot in the middle to be held in the bare hand, and if filled with water, will raise the water to boiling point in a short time, due to the radiated heat from the pipe, no doubt.

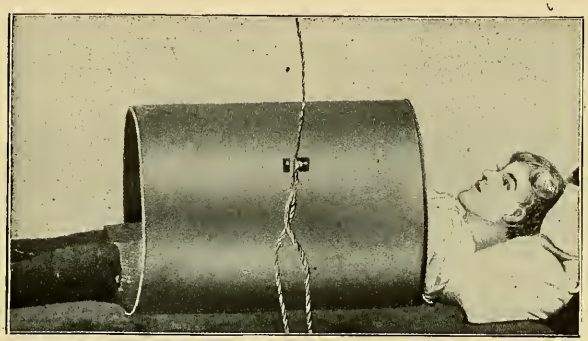
If the magnetones are used continuously for an hour, there will be a slight warmth developed, on account of the resistance of the wire to the current in a short circuit.

My explanation of the heating of the pipe, is that the iron being elastic and soft, allows the particles of iron in it to vibrate, and knock together, and

it is due to this pounding together that the heat is generated, the same as heat is generated by pounding on iron with a hammer.

If the pipe is held in the hand while in the tube, a distinct hum is emitted from the open end of the pipe.

A steel rod held in the same way will not hum, nor will it heat as quickly, on account of the difference in elasticity, and the stronger cohesion of the steel particles.



The body magnetone is eighteen inches in diameter inside, is two inches and a half thick, and is eighteen inches long, contains a mile and a half of wire and two hundred and ten simple and compound magnet cores, and is so arranged as to surround any part of the trunk.

The effects produced, and the results obtained by the therapeutic use of these magnetones are wonderful, and if used for the symptomatic relief of pain alone, they are certainly a wonderful boon to the world. I have tried to be very explicit and full in my description of them, and the explanation of their operation, so as to answer in advance, a flood of questions which are sure to follow the announcement of something new, which is good, as I and many others, personal course students, visitors, friends, patients and bores, will testify from years of observation, experiment and experience.

The exclusive right to manufacture and sell the Bennett magnetones has been reserved by the inventor who has proven himself your friend, and he can, and will make them properly, and will sell them to you cheaper than you could make them. This is his business. He will willingly give you all information concerning them, of a commercial nature. Don't try to make them yourself, for three reasons. *You don't know how. You haven't the time, and you cannot afford it.* They are hard to make and expensive when made singly, as has been found by bitter experience.

Here are a few "Don'ts:"

1. Don't try to use a cell battery current.
2. Don't try to use a transformed direct current.
3. Don't use them on any but the 110 volt, 60 cycle, alternated current.
4. Don't touch the two binding posts, they are alive.
5. Don't fail to have a safety fuse block in series.
6. Don't use the common lamp snap switch. Use a knife switch.
7. Don't expect to cure everything.
8. Don't forget these seven "DON'TS."

MAGNETIC WAVE GENERATORS

Physiologic and Therapeutic Effects.

What are the Bachelet magnetic wave generators?

Magnetisation is the oldest and least understood, and possibly the most valuable form of electrification.

We have discussed the magnetisation of the blood and tissues of the body. The experiments of such eminent authorities, scientists, and physicists, as Von Reichenbach and Cohn, of Berlin, and our own Atkins, of San Francisco, and Bachelet, of New York, have shown the fact that there exists within the human tissues the power of generation of a current of electrification, to such an extent as to be registered by a meter. Bachelet made experiments on lower animals, by means of insulated needles, under anæsthesia, and Atkins corroborated the same with electrodes, introduced into the lungs of sheep, that there was a current of electrification set up with each respiration, which would be shown by a meter attached to the wires from the electrodes used.

Bachelet experimented with nearly every organ of the body, and found that the greatest potential was generated in the lungs, probably on account of the excess of oxygen there, which as we have shown, is very magnetic.

He also showed that no matter how long or how strong a current of electrification was passed through the body, there was none of the energy held or stored, as it were. Consequently there was no increase of electric potential recorded by a meter. On the other hand, Bachelet has shown that when a living organism was immersed a magnetic field, for a variable length of time, and then tested for the electric potential, it was shown to be augumented very much, the degree of augumentation being proportionate to the length of time and the strength of magnetic bath.

This fact undoubtedly goes far to prove the fact of the power of magnetisation of the blood just the same as the magnetisation of a bar of iron, which will retain the charge.

The results of the experiments and investigations of Bachelet, extending over a period of fourteen years, are summarized by him as follows:

1. That by no means which I could use or invent, could I, using the electric current, increase the electrical potential of a living body.

2. That by placing a living body in a magnetic field, and permeating it with magnetic lines of force to the maximum of exposure, I could raise its electric potential as high as thirty-three per cent.

3. That the energy thus imparted to the living body did not depart from it, but transformed into vital energy, and was absorbed by and expended in the conduct of the vital processes.

4. That according to the average established by the series of experiments, the electrical potential of the living body, twenty-four hours after the treatment, showed an augmentation above the normal of twenty-five per cent.

5. That this augmentation, forty-eight hours after treatment, remained on the average, at nineteen per cent.

6. That, upon the average, it was seventy-two hours before the stored energy was finally absorbed and converted, and the body returned to its normal potential.

These records correspond approximately to the periods during which the magnetised oxygen in the blood retained its identity.

The importance of these records can hardly be estimated, and the great value of this form of treatment is apparent to the most casual observer and student.

We know that the dynamic form of electrification, by which we may generate magnetisation, is easily insulated, and we also know by the law of Ohm that the most of our energy is expended or used up or wasted, before it can get through the skin, and even then its effect is such that its time of action is limited, and we also know that magnetisation is not hampered by this drawback, and cannot be insulated, but will permeate every tissue thoroughly and instantly, without loss of power, and when we see by these experiments that there remains long afterward, an effect, we see at once the almost inestimable value and importance of magnetisation as a therapeutic agent.

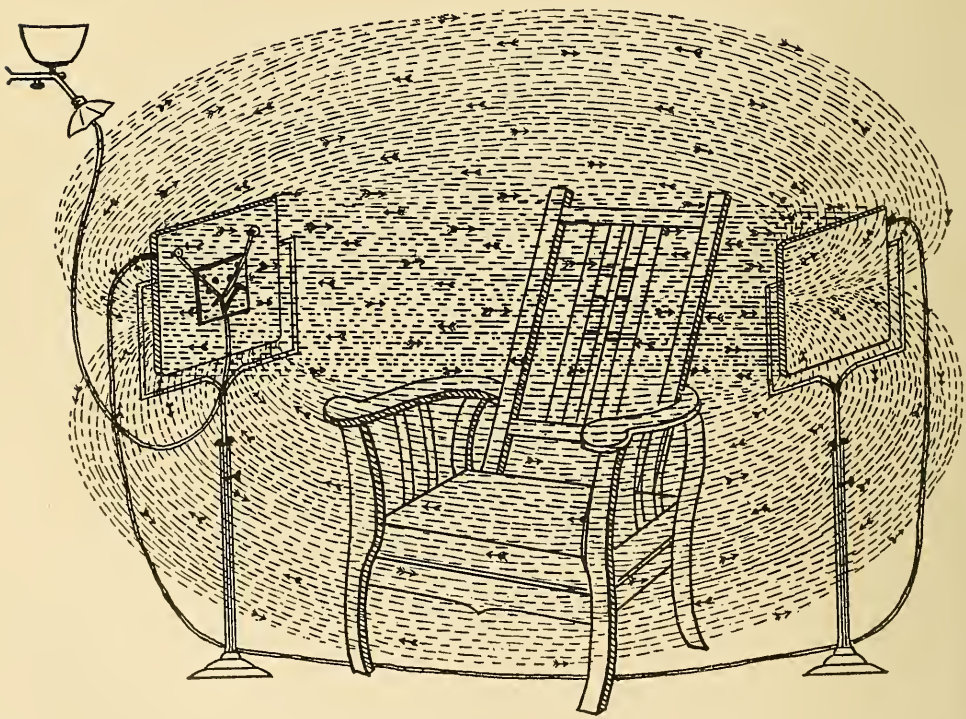
It is evident that a sick or deranged body, or part, when placed in this field of potent influence, will be greatly aided in its endeavor to throw off the disease, and resume the normal state of equilibrium. Of course we

must all accept the axiom, that nature is always trying to regain or keep its balance.

The first invention of Bachelet along the line of magnetic waves, or lines of force, generators, was a clumsy six hundred pound affair, but the perfected instrument weighs but a few pounds, and is easily handled.

It consists of a flat box about ten inches square, and two inches thick, containing several electro-magnets with a switch, to select the one desired, so that the effect may be varied from weak, through the medium, to the strong, according to the nature of the case to be treated, and the results desired.

For convenience in giving prolonged applications, they are arranged in pairs, and the patient or part is placed between them, they being held by supports resting on a substantial base.



The accompanying cut shows the two magnetic wave generators, connected to the source of electrification, and so placed and supported, that the chair, in which the patient sits, is directly within the most active field of

influence, as is indicated by the straight lines of force, while the weaker field is represented by the curved lines of force. There is no appreciable sensation experienced by the person in the field, but that there is an influence being exerted, is demonstrated clinically by the cessation of the pain, and the prompt relief given. It may be more clearly demonstrated by means of a third one, held in the hand of the operator, to which is attached a microphone, similar to a telephone receiver, which the operator holds to his ear. This way the vibrations of the generators may be heard. In a recent test made in the laboratory of the National College of Electro-Therapeutics, the waves were distinctly heard at a distance of six feet in every direction from the generator, and even through eight inches of a brick wall covered with plaster, and when the detecter is held close to the generator, the sound is clearly heard all over the room.

The therapeutic effect of this method of magnetisation is very marked, especially so in acutely painful conditions. I have seen in my own family relief given in a case of acute neuritis with this apparatus, which was more prompt and complete, than would have resulted from a hypodermic of morphine.

This opens up a great field of usefulness in the treatment of rheumatism and allied conditions, neuritis, neuralgia, neurasthenia and all states characterized by pain as a symptom. In all forms of inflammation and congestion as well as weakened and debilitated conditions, it has been shown of great value. In paralysis and mental troubles, as well as kidney and other glandular diseases, and even in tuberculosis, it has given surprising results.

Convalescence is hastened, and the prostration following the strenuous life is combated by magnetisation.

It is not a stimulant, and carries with it no deleterious reaction, but simply supplies the weakened body with the vitality it needs, in such quantities as the condition demands, so that as the cure proceeds the patient needs less strong and frequent treatments.

The action is so direct and immediate, that a too strong or long treatment, in a chronic case, may set up such a decided movement toward the normal as to cause a marked disturbance. Therefore the generators are arranged as to regulate the effect desired.

As in all forms of treatment, frequent and mild applications, so as to get the slow and cumulative effects, are best. The effect on the pulse and temperature is marked, the tendency being to restore the balance in either, whether they be too high or too low, though sometimes in a fever, there is a slight increase of the temperature, before a recession to the normal.

The well known and widely advertised case of spasm of the diaphragm or persistant hiccough, which puzzled and baffled the whole medical fraternity so long, was undoubtedly cured by this method of treatment. This was a case of a fifteen year old girl, who hiccoughed on an average of eighty-nine times every half hour during her waking hours, for a period of over ten months, and which yielded to nothing, until treated by magnetisation.

The accompanying half tone from an actual photograph of the case, shows the hiccough girl being treated, and demonstrates the simplicity of the method.

In all cases the point of sufficiency of the treatment is manifested by a sense of congestion and frontal headache, which is harmless in itself, but is a good index when to stop, as being proof that enough has been given for the present.

These generators are simply connected in parallel, by means of cables, in series with any ordinary lamp socket. A Vetter series current tap, and the alternated current is used. If necessary, for a more decided effect, the generators may be taken from their supports, and placed directly in contact with the part to be treated.

This modality is yet in the formative or experimental stage, and of course the treatments are largely empirical, but that is nothing against the method, because, after thousands of years of the practice of drug medication, medicine is still largely empirical, and guess work. There is a glorious future for electro- and magneto-therapy in conjunction with other physiologic or natural remedies.

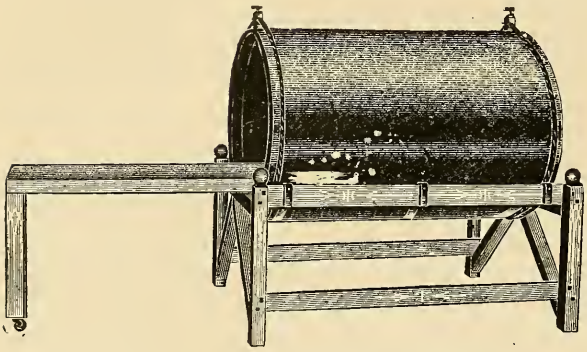
Of what value is magneto-therapeutics?

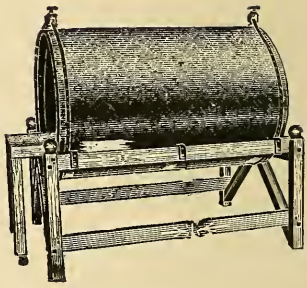
From a total of 50,000 treatments of all sorts, upon all kinds of patients, without any attempt at selection, and with applications sometimes lasting for hours, and though some cases continued for months, the conclusions are, that the applications are in the main beneficial, and that in the hands of a careful, prudent practician, the apparatus is entirely harmless.

Magnetisation is best in conditions of low vitality, with a sub-normal temperature, and insufficient oxidation of the blood, marked by poor circulation, anæmia, and therefore where coldness persists. The results in many cases of rheumatism are most excellent, even in some of the most obstinate forms, and if used for nothing else, would be a great boon to humanity. Among other painful conditions which were relieved were those of floating kidney, chronic cystitis, neuralgias, headaches, dental caries, phthisis, rheumatism, gout, and it was found very useful in hastening convalescence.

The tecnique of the applications is extremely simple, and the apparatus cannot get out of order. All that is necessary is to attach the solenoid to a twin cable with a plug, which is screwed into a lamp socket, and the current turned on, either by the usual thumb snap, or better by a knife switch, and immerse the body or part in the magnetic field.

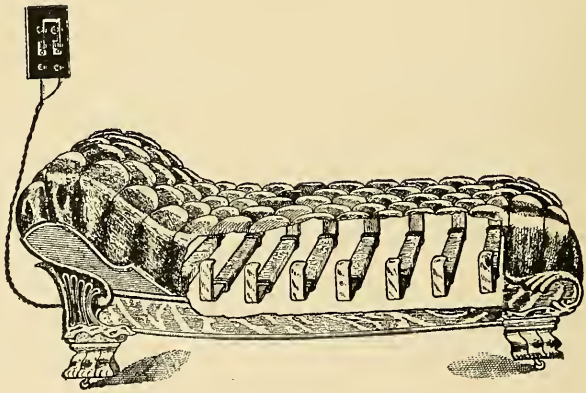
THE BODY MAGNETONE





The above two cuts show the body magnetone for immersion of the trunk in the alternated electro-magnetic field. The platform is pulled out, the patient lies down, and the platform and body is pushed into the tube and saturated with the electro-magnetisation.

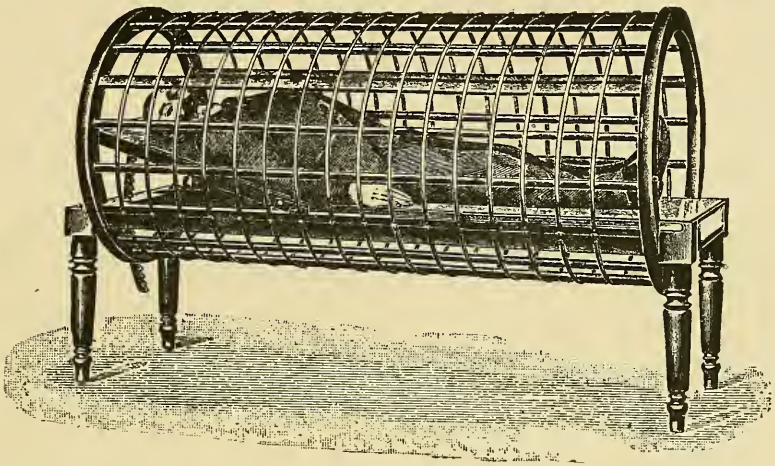
What is the magnetic couch?



The above cut shows another adaptation of the electro-magnetic field for the treatment of disease. This consists of an ordinary tufted leather couch, concealed in which are a number of heavy horse shoe magnets, bent into a wide and shallow curve, and so arranged that when the patient reclines above them, his body sinks down so that when the current is turned on he is traversed laterally by the electro-magnetic fields between the poles of the different electro-magnets in the row. To get the effect longitudinally through

the body or part, it must be placed transversely across the couch. This is an ornamental instrument, as well as useful, and is very refreshing to the patient, after the exertion of a walk or other treatment or operation, which has irritated the nervous system. It will be found especially useful after gynecological operations and treatments.

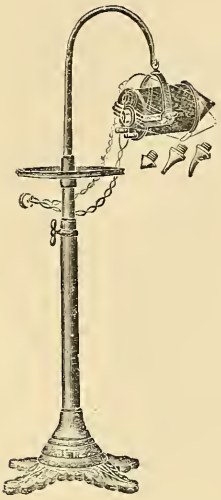
What is the electro-static cage ?



The above cut shows the large high frequency, or alternated current body cage, made after the pattern of D' Arsonval, in which the patient is placed and about him is thrown the oscillatory current field. This method of treatment is especially useful in asthenic conditions dependent on impoverished blood, and has been extensively used on the continent, in the treatment of pulmonary tuberculosis, asthma, pertussis, and various other respiratory and nervous troubles. It may be used with the alternated dynamic current, and results secured, which rival those obtained from the auto-conduction cage, when connected with a high frequency apparatus from a high tension inductorium. This solenoid has no magnets in connection, hence the field is not as strong as the ones with magnets, but on account of the great weight of a magnet coil of this size, it is not advisable. This is to be connected to the alternated current, and will be found especially, beneficial in all forms of general debility, weakened states, and in convalescence from continued fevers, etc.

ELECTRO-MAGNETS FOR EYE WORK

While on the subject of magnets it may be well to call attention to the use of them in eye work, for the removal of particles of magnetic iron or steel from the eye.



The cut at the left shows a reduced illustration of the giant eye magnet, for use in hospitals and by ophthalmic specialists, desiring a very powerful magnet in their work. This exerts an enormous power of attraction, and is capable of sustaining several times its own weight. It is mounted on a heavy base with an adjustable crane, and swings in a universal swivel, which adapts it to any height or angle and while heavy, is easily handled. They have several interchangeable tips, and are wound to suit the different currents.

The accompanying two cuts show a small eye magnet, which may be used in connection with a small acid battery or a few dry cells, and which will develop sufficient power to enable the skillful operator to successfully remove magnetic particles from the chambers and coats of the eye ball. The magnet is small and compact and inexpensive, and will fill a long felt want of the general practician. The large cut will explain the technique of its use. For this purpose a constant current with a steady pull is desired.

Photo-Therapy

What is photo-therapy?

Photo-therapy means the therapeutic application of light from any source, and may be the light of the sun, or the light derived from any artificial source, such as the electric arc, or the common incandescent lamp or the light emitted from the vacuum tube, the X-ray, or the so-called ultra-violet light, or the white light passed through various colored media.

What is the physiology of light?

Physiological experimentation has developed the facts that light has a decided influence on the tissues and processes of the human economy, increasing the oxidation of the cells and augmenting the amount of hæmoglobin in the blood, and stimulating the absorption of waste matter, and hastening the reparative function.

What is the therapy of light?

Therapeutically we may recognize three distinct effects which are due to the activity of one or the other part of the spectrum. Some of the rays produce *heat*, especially those emanating from the red field of the spectrum. Other rays, especially the green, are essentially *light*-producers. There are other effects which are principally due to the activity of the so-called *chemical* field of the spectrum. These are the violet rays and more particularly the invisible rays which lie *beyond* the violet and are, therefore, known as the *ultra-violet* rays. To recapitulate: we speak of heat-rays, light-rays and chemical-rays. Photo-therapeutic methods depend upon the characteristic action of these rays. Some of these methods are dependent upon the capability of certain rays to produce heat, light or certain chemical effects. At times a conjoint effect, combining the action of light and heat, is aimed at.

What is chromo-therapy?

The use of colored lights in therapeutics is called chromo-therapy. For several years past the therapeutics of light and color have been a very interesting department of medical therapeutics. It should be better known to more physicians and a great deal more would be accomplished in the treatment of various conditions, especially sub-acute and chronic diseases.

What physiologic effects have the colored lights?

The red is warming, and especially stimulating to the arterial blood, and desirable in cold, pale or bluish conditions. It is contra-indicated in inflammatory and over excited conditions.

The yellow, aided by some red (yellow-orange), is animating to the nerves, being laxative, diuretic, stimulating to the brain, liver, etc., and especially desirable in constipated, paralytic and stupid conditions. It is contra-indicated in delirium, diarrhœa, etc.

The blue, indigo and violet, being cooling and constricting, are nervine, astringent, refrigerant, antiseptic, febrifuge, anti-inflammatory, narcotic and anti-spasmodic. They are contra-indicated in cold, bluish and chronic conditions, unless considerable excitability is present.

The green is mainly cooling and much like the blue, as strained through ordinary green glass, though the yellow part of green, gives nerve stimulus good for uterine inflammations, etc. The green may often be used to an advantage over the small of the back and lower spine in cases of over sexual warmth and seminal emissions.

The purple combines the blood warming red and the cooling antiseptic blue and is excellent for the lungs, stomach and other parts where animation without irritation is needed. Red purple is good for a dormant stomach, but blue purple is best if stomach is not hot and excitable.

The orange arouses both nerves and blood.

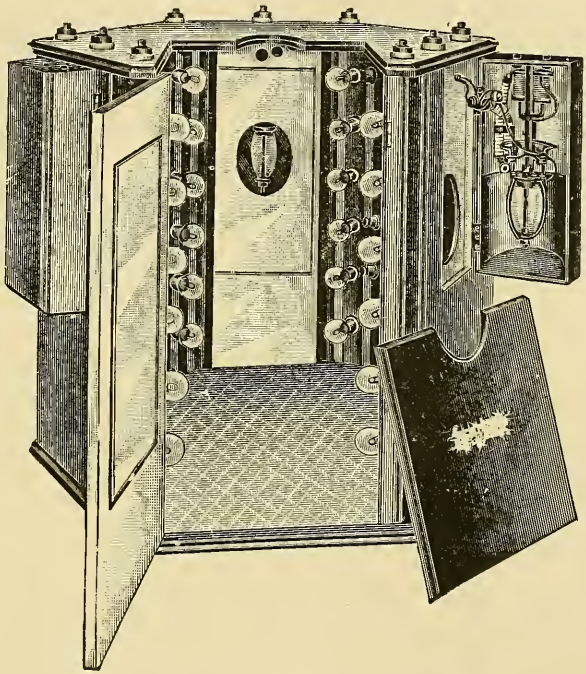
These colors are usually applied externally to the bare body by means of colored panes of glass.

No intelligent physician can dispute the great value of colors in therapeutics. It is a department of therapeutics that is of great value and should receive further attention.

The violet rays of electric light are said by Minin to be anæsthetic and antiseptic at the same time.

What is the technique of the light bath?

The patient is prepared as he should be for an ordinary tub bath, door of cabinet, which is in the side of same, opened, patient seated on a stool in the center of the cabinet, arranged so it may be raised or lowered, to suit the stature of individual. Patient sits or lies facing long axis of cabinet, thus allowing a bombardment of light vibration in all directions. Your door is then closed, and top opening also covered with a crash cloth, which is tucked snugly around the patient's neck permitting only his head to protrude, upon which a towel is placed, which has been previously wrung out of ice water. He remains in the cabinet from twenty (20) to thirty (30) minutes.

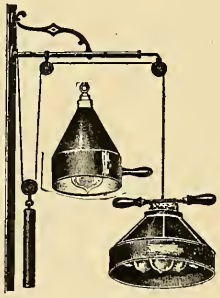


Electric light bath cabinet.

Your patient remains practically cool, yet perspires profusely, which is not at all disagreeable, but on the contrary producing an indescribable glow, which is rather pleasurable than otherwise. By reason of previously stated arrangements of lamp and carbons, which is demonstrated by a thermometer being placed in the interior of the cabinet, in a room whose average temperature is 65 degrees, it is shown that the cabinet is never warmer than

85 degrees, fully establishing the fact that the reaction produced from the vibration of light, acting on cell life, produces untold elimination, one of the prime factors necessary in the treatment of all toxic conditions.

This technique of proceeding with our patient is what I have designated SYSTEMIC treatment. After patient is removed from cabinet he is treated just as he would be if coming from a tub bath, permitted to have a nap, which is usually in demand, and while this is being gone through with, if there is any hepatic engorgement, or any other local condition, which needs attention, with a third lamp, same as ones employed in the cabinet, suspended from ceiling, we proceed to bombard condition demanding our attention. The latter process cannot as a rule be kept up with the liver more than eight or ten days, as the phenomena of bile salts so assert themselves, as to render a day or two of rest imperative. All other conditions may be treated locally until well, without inconvenience.



I might here add that the ceiling lamp used for local treatments has a shield and reflector attached, which intensifies the vibrations.

For what is the electric light bath used?

This form of electrification has given most gratifying results, especially so in the treatment of the following diseases: Eczema, tuberculosis pulmonalis, lupus, acne, psoriasis, rheumatism, all forms, especially acute and gonorrheal types, constipation, arthritis deformans, malaria, hepatic troubles of all forms, stomachic disorders, neurasthenic conditions, very sedative to all forms of functional and valvular disorders, correcting them as far as it is possible for them to be corrected, and syphilis. Experience in the treatment of the last mentioned disease hasn't been sufficient to warrant stating anything absolutely definite, further than the beneficent results or action obtained in other conditions would promise good results in this most formidable disease.

Dr. Crothers, of Hartford, Conn., who has had considerable experience in the use of the electric light bath, as an aid to the treatment of alcoholism and drug addictions, considers that the sudorific effect produced by the electric light bath is superior to that produced by hot air, both as to torpidity of action and duration of effect, and is useful as a remedy for the restoration of deranged metabolism, which is manifest in these cases.

The patients treated by him, like all of their class, suffered from various insanities, along with other disorders among which may be mentioned sclerotic conditions of the heart, liver, kidney and blood vessels—particularly of the smaller arterioles. With these pathologic changes there were also vaso-motor paralyses, muscular paralyses, anæmia and neurasthenia.

Results other than those noted may also be produced. In tobacco heart, so-called, the tachycardia and arrhythmia are both corrected to a great extent, end even in cases of irregularity of heart action due to organic disease improvement is shown by greater regularity and steadiness of action.

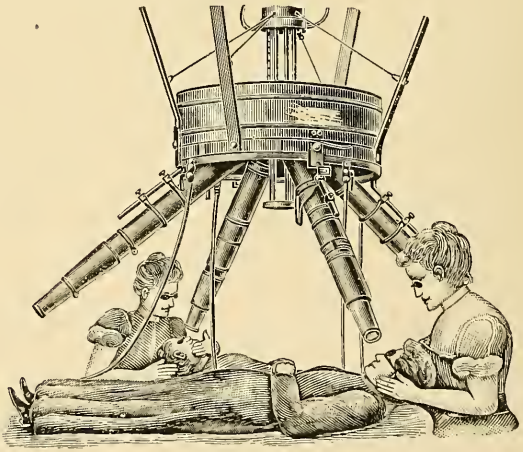
The insomnia usual in cases of the kind under consideration is generally overcome by this treatment. Other conditions found to be improved by it are neuritis, gastritis myalgia, nervous irritation, arterio-sclerosis and sclerosis of the liver and kidneys. There is also noted a marked tendency in those taking the baths to lose their appetites for spirits.

Kellogg summarizes the therapeutic effects and modes of application of the incandescent light bath as follows: 1. General and local revulsive, effects, by dilating the cutaneous vessels. The reddening of the skin begins within a few moments and becomes more and more intense as the application is continued. The permanency of the effect may be increased by a short cold application following the light bath. 2. Sudorific. It induces perspiration more quickly and more vigorously than any other agent, and with the least amount of inconvenience and discomfort. Care must be taken to protect the heart and the the head by means of cold compresses. The patient should be made to drink water very copiously, both to encourage diaphoresis and to maintain the normal bloood volume. 3. Promoting the absorption of exudates. Both general and local applications are valuable. In France the general electric light bath has been used successfully in promoting the absorption of exudates in the cornea of the eye, vitreous opacities and similar pathologic products. Kellogg has used with success in promoting the absorption of exudates from the pleural and peritoneal cavities, and in and about the joints, general applications of the electric light bath, combined with local applications of the light to the

affected parts, and suitable hydriatric measures. A cooling bath is necessary after local applications to the joints, this to be followed by the application of a heating compress. The local application of light should be made at least twice daily, the general application once a day. The heating compress should be changed at least twice daily. Massage and, in some instances, electric applications to the parts, and especially to the adjacent muscles, are important adjuvants. 4. Tonic effects. No other means excels short applications of the incandescent electric light (three to eight minutes). A sensation of well-being, similar to that experienced by one who stands before a glowing fire, is pronounced, and when followed by a proper hydriatric application, the stimulation to nutrition is of the highest possible degree.

What can be done with the Finsen and Dermo light?

The very great popularity of the Finsen treatment is shown by the large number of London hospital lamps and Dermo lamps which have been installed by physicians in all parts of the country. The two Finsen lamps named are without a doubt the best, most convenient and yet most serviceable modifications of the original cumbersome device with which Finsen made his clinical experiments.



The Genuine Finsen light.

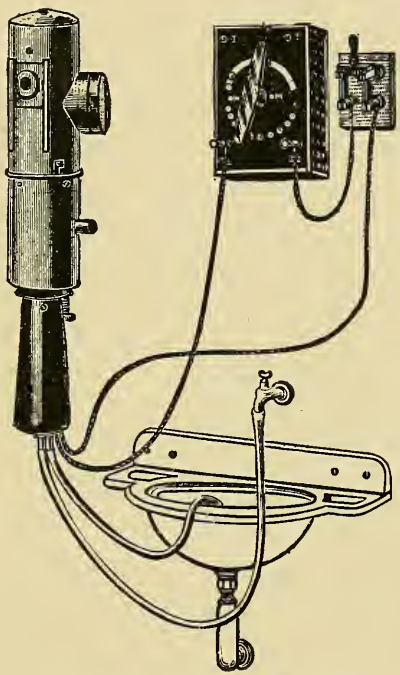
There are a number of modifications of this lamp known as the Scholtz or Triplet, the Bang or Dermo, and the London lamp.

Let it be remembered once for all that the term "ultra-violet" does not refer to any special color. The term designates the location of the rays

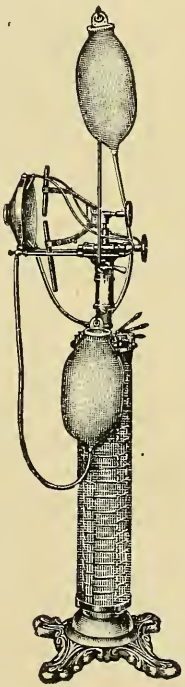
which bear this name. An *ultra-violet* ray is a ray whose spectroscopic location is *beyond* the violet field of the solar or arc-light spectrum. The ultra-violet rays belong to the variety of chemical or actinic rays. They are invisible and, therefore colorless.

Dr. Juettner of Cincinnati, has answered the question and summarizes as follows:

What can be accomplished with a London hospital lamp and the dermo lamp, the two best modifications of Finsen's original device? Both lamps produce a wealth of chemical light, The germ-killing power of this light has been proven beyond a doubt. It has a strong affinity for oxygen. It produces a disintegrating effect upon living tissues. The greater the resist-



The "Dermo" Finsen Arc Light.

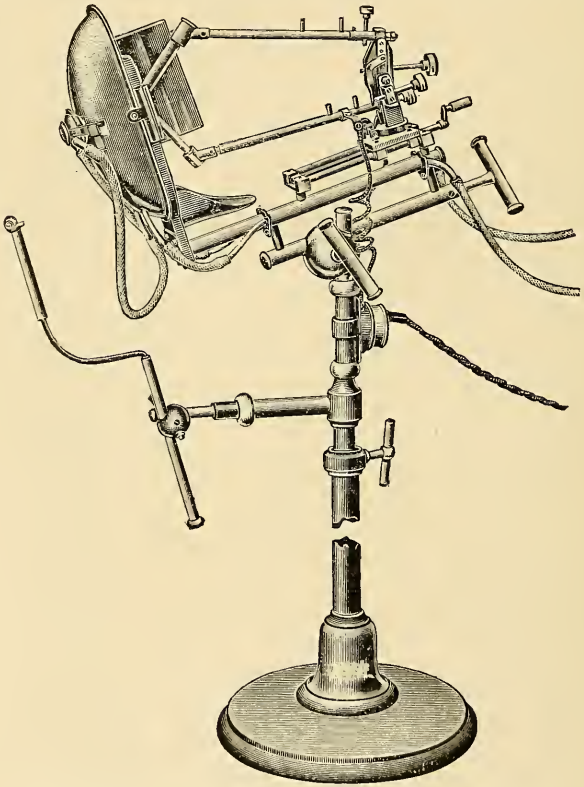


London Hospital Patterm.

ing power of the tissues, the less intense the action of the chemical rays. Since morbid tissues are less viable than normal, the destructive effect of the chemical rays upon the cutaneous tissues wherein tubercle-baccilli or other germs have found lodgment, can be readily understood. Lupus is the classical example of the physiological action of Finsen's rays. Their germ-kill-

ing power strikes at the very essence of the affliction. It stimulates healthy action by attracting oxygen to the part. The morbid tissues of the afflicted portion are disintegrated by the rays. In this way a healthy reaction is set up which tends toward restoration of normal conditions.

Applications should be as close to the affected area as possible and should last ten minutes and longer. The average duration of a treatment is thirty minutes. The light from the Dermo lamp is rathar more concentrated and, therefore, stronger. The conditions in which these lamps can be advantage-



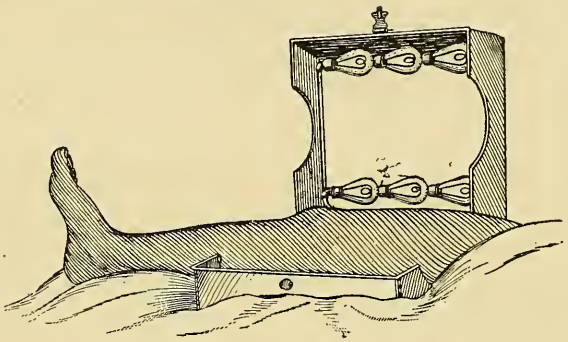
The Scholtz modification, or Triplet Finsen lamp.

ously employed are lupus, acne, herpes, tinea circinata, sycosis, wine-marks and many other skin troubles in which an alterant and germicidal effect is desired.

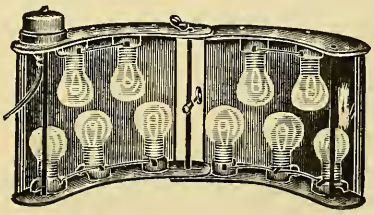
Alternate applications of X-rays and Finsen-rays have been put to several practical tests in the clinic of the "Cincinnati-Post-graduate School of

Physiological Therapeutics," by Dr. Juettner. There can be no doubt about the value of the combined treatment, especially in cases of epithelioma, indolent ulcer, etc. The results are prompter than after the use of either the X-rays or the Finsen-rays alone.

Of what use is the localized light bath?



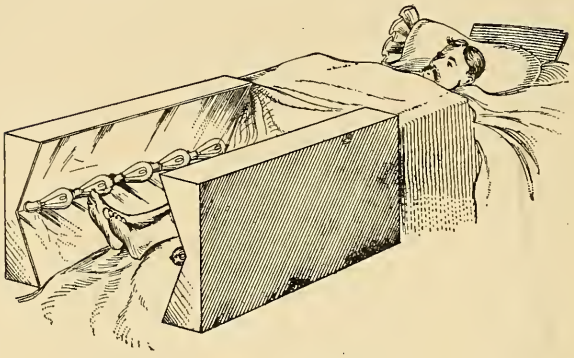
The cut shows a local light bath applied to the leg, the leg resting in the lower half, while the hinged upper part is raised. After the part is in position, the upper half is let down closing in the part to be treated.



The cut shows another form of local light apparatus, intending to be applied to the back, abdomen or other rounded surface. It is made in various sizes, and in two parts hinged together.

With this appliance a radiant heat and light treatment may be given to any surface desired. This may be so placed as to form an arch over a part, as a knee, and is useful in treating sprains, dislocations, fractures, synovitis, and other conditions, where the part must not be moved, without disturbing the part.

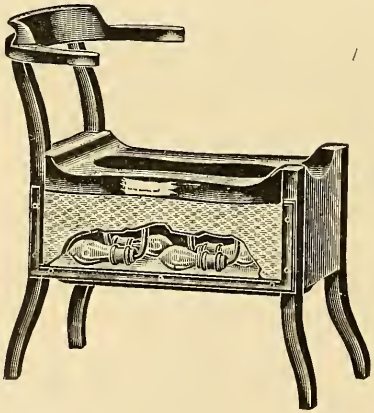
A PORTABLE LIGHT BATH



The cut shows a portable electric light cabinet bath, which may be taken to the bed of the patient, and applied there. The illustration shows the manner of its use, the two sides with the row of lamp bulbs and reflectors being placed on either side, and the whole covered with the bed clothing, so as to retain the heat.

THE BIDET BATH

What are the uses of the bidet sitz light chair?

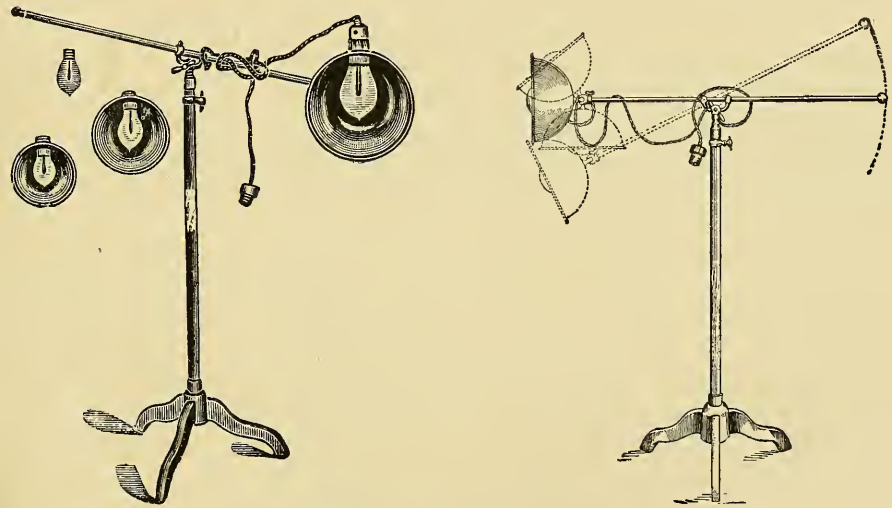


The cut shows the bidet or chair bath, in the form of a box stool, with a back and arms. This is arranged with six lamps, and with mirrors in the floor which gives both a radiated and reflected heat and light application. This form of local bath, is especially good for the treatment of disorders of

menstruation, such as amenorrhœa, dysmenorrhœa, vaginitis, and for ovarian and other gynecologic troubles, also for rectal and genito-urinary affections, in both sexes, and local pruritis and eczematous skin eruptions, characterized by inflammation, pain and exudate. In all of these conditions the local use of the electric bidet bath will greatly assist in the restoration of the normal condition, by equalizing the circulation and relieving the pain and itching, when all other forms of treatment fail.

It is especially adapted to the treatment of scanty or delayed virginal menstruation, where other local examinations, or applications, are for obvious reasons, contra-indicated, or not desirable.

What is the Minin light outfit?



THE MININ OUTFIT

The two cuts show both the front and side view of the violet light outfit as devised and used by Prof. Minin, of St. Petersburg, and as made by an American manfacturer, who has secured from Dr. Minin the exclusive control of it in America.

The outfit which is very simple consists of an upright standard, mounted on a heavy metal tripod, giving it stability. The standard is double, one telescoping the other, thus giving considerable range of height, to the top of which another rod is attached by means of a double clamp and swivel joint.

On one end is a ball and socket universal joint, holding the different reflectors. This arrangement gives any position that may be necessary. There are three parabolic aluminum reflectors polished inside like mirrors, and of different sizes to correspond to the different lamps used. These lamps are of the usual shape of incandescent bulbs, are 16, 32 and 50 candle power respectively. The glass of these three lamps is of a deep violet color, which gives them the name of violet light.

What can be done with the Minin light?

Prof. Minin, of St. Petersburg, after many years of experimenting, has demonstrated theoretically and practically that with the *ultra-violet rays produced by his special apparatus, better results can be obtained in a shorter time than by the Finsen method without any of the unpleasant after effects so common after Finsen treatments.*

We have used it for the the relief of pain in the eyes, head and joints, articular and muscular rheumatism, arthritis deformans, gout, sprains, bruises, fractures, dislocations, ulcers, old sores, neuralgia, neuritis, eczema, psoriasis, pruritis, and in many painful conditions with invariable relief, and usually a permanent result. It is a fact that when the light is held too close it will cause a blister without either the operator or patient realizing it at the time.

One extremely bad case of chronic eczema of the leg completely circling it from the foot to above the knee, and of several years standing, was wonderfully improved with a few treatments, and entirely cured with half hour exposures for two weeks daily, using all three of the lamps, about eighteen inches from the leg, the large one above in the standard, and placing the other two on the floor below, and at either side, with the patient sitting on a chair, resting the foot on a stool. The intolerable itching which kept him awake, and the weeping was soon stopped. One case of arthritic trouble in the hands and fingers where the woman had not been able to write or sew or drive for months, was quickly relieved so that she could do all three in three weeks, with exposures of a half hour three times a week. I was severely jolted in an auto accident, causing an acute neuritis in the entire right brachial plexus causing an intense pain for several months, and the only thing to afford relief, except opiates, and I tried every other form of electrification and vibration, without any but temporary relief, was daily exposures to the strongest Minin light for an hour each night after retiring. After such a treatment I could sleep all night, without it I could not sleep at all. About ten treatments in two months cured the trouble.

What are some nervous diseases benefited by violet light?

Neuritis, neuralgia, sciatica, migraine, tic, zoster, etc.

What are some painful diseases benefited by violet light?

Carbuncle, abcess, sprains, orchitis, burns, fractures, ulcerated teeth, pleurisy, bronchitis, cystitis, rheumatism, etc.

What are some cutaneous diseases benefited by violet light?

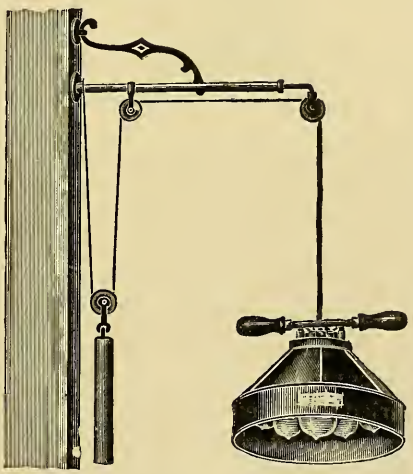
Eczema, chancroid, varicose veins and ulcers, dermatitis, and x-ray burns, boils, and as a local anæsthesia for operations on the surface.

What are some malignant diseases benefited by violet light?

Cancer, epithelioma, lupus, tuberculosis, etc.

Minin, the Russian doctor who introduced the anæsthetic use of the rays, found it unwise to use the rays in hysterical patients as undesirable symptoms sometimes develop.

What is the Russian lamp?

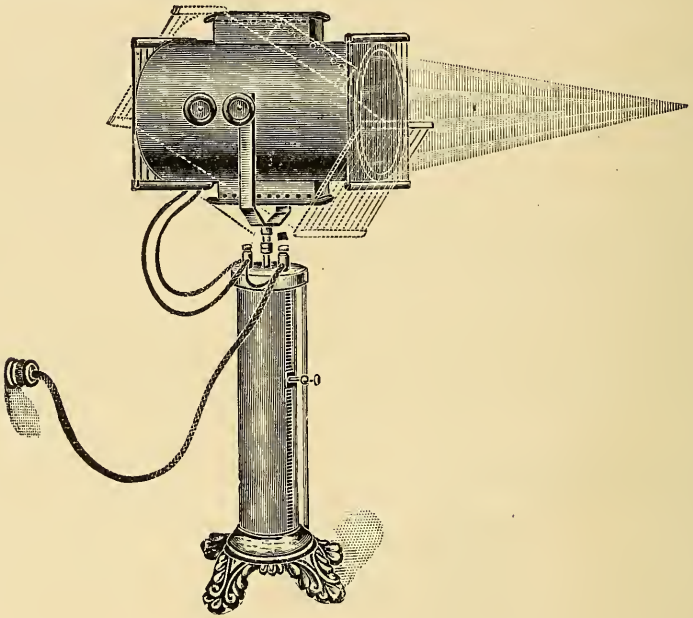


Russian lamp

The Russian lamp is a modified and improved Minin violet light ap-

paratus, which consists of a cluster of seven violet incandescent lamps, with a total of 350 candle power, in front of a powerful reflector, so arranged as to be raised or lowered at will and any number of lamps from one to seven may be lighted, thus giving a varied intensity.

What is the Helios or sun lamp?



The helios lamp is a powerful arc lamp which generates heat, light and chemical rays and so arranged as to be used for treatment with either variety of rays, thus being far superior to the other forms of incandescent lamp outfits.

The helios lamp is mounted on a heavy base, the lamp being on an adjustable swivel permitting the light to be thrown in practically any direction desired. In the base is the powerful rheostat, specially wound, giving the operator complete control over the intensity of the light. This intensity may be varied at will and aggregates many thousand candle power.

The cylinder is furnished either beautifully oxidized or nickel-plated. Inside the cylinder is an especially constructed spun brass nickle-plated parabolic reflector of the most scientific design. Both ruby and violet screens are supplied with the lamp.

The services of an electrican are not required after the proper wiring is done in your building as the lamp comes already set up and ready to attach to your lamp socket.

The helios lamp will operate from either direct or alternating current. You should have, however, at least fifteen or twenty amperes of current. Your lighting company can supply this by running a No. 10 lead wire into your building and providing proper fusing. The cost of operating the lamp is very low when the length of each treatment is taken into consideration averaging about seven to twelve cents per hour.

THERAPEUTIC APPLICATION OF THE HELIOS LAMP

What are the uses of the Helios lamp?

The active rays of the helios therapeutic arc lamp are as nearly identical to the solar rays as it is possible to secure through artificial means. The history of medical practice has demonstrated the importance of the sun's rays in therapeutics as rational and effective, and the new lamp should be considered just as rational and for practical purposes, as effective as solar light. The main value of the chemical or actinic rays is in the decomposing and at the same time reconstructive molecular action on the tissues. The oxidation produced stimulates and increases metabolism and thus increases nature's regenerative processes.

The blue, violet and ultra-violet rays, that is the shorter wave rays of the spectrum, are especially active in the destruction of bacteria which remain almost entirely indifferent to the rays of the other extreme of the spectrum; that is the red and yellow. The bactericidal power of the helios arc lamp, which are strongly marked, are believed by the best scientists, to be due to the presence of "free" oxygen, and these powers are demonstrated especially in such inflammatory conditions of the skin as *acne* or *furunculosis*, where the therapeutic effect is especially prompt and certain.

We hold reports showing remarkable results after brief treatments with the helios lamp in extreme cases of *acne vulgaris* and *carbuncles*, as well as the gravest affections of the skin, the treatments in the cases being given with the blue glass screen interposed, lasting from ten to twenty minutes.

Psorasis, *eczema*, *varicose ulcer*, *pityriasis* and other chronic forms of skin diseases usually yield promptly to daily treatments of from three to ten minutes. *Baldness* and *indolent ulcers* are benefitted by the treatment, application in these cases requiring sufficient strength to produce a slight solar *erythema* or sun burn. This is also true in cases of *phagedenic ulcers*.

Under treatment from the helios lamp the dyspeptic's and the consumptive's anemic, dry and inactive skin soon gains a healthier aspect.

The helios lamp offers one of the most convenient and effective means for the relief of pain. The reports of Rosenburg confirm the fact that the blue, violet and ultra-violet rays can be regarded as a specific against pain such as *rheumatism*, *torticollis*, *pleurodynia* as well as *acute* or *chronic neuritis*. Pain of every description whether peripheral or visceral, when not due to inflammation, including *neuralgia*, *neuritis*, *spinal irritation*, *lumbago*, *sciatica*, *intercostal neuralgia*, *arthropathies and neurasthenia*, yield readily to treatments of from two to ten minutes duration once or twice a day. In severe cases the treatment is continued long enough to produce a decided *erythema*. This produces a counter irritation fully equal to that of the mustard plaster or fly blister, but lacks the unpleasant effects of these measures.

The same applies to *rheumatic gout*, *chronic arthritis*, *synovitis* and *tubercular diseases* of the joints, in which hot applications are indicated as the temperature secured will readily range from 80 degrees F. to 400 degrees F. In application to the spine and trunk in which stimulation is applied to the viscera, the parts should be rubbed with a towel saturated with cold water or with a piece of ice, after treatment.

Local gangrene, *Raynaud's disease* and similar conditions yield to the helios lamp assisted by cold applications and massage. The treatments last ten minutes and are to be of sufficient intensity to produce a solar erythema.

As a curative measure the helios lamp is of the greatest value in *gastritis*, *colitis*, *neuritis*, *chronic appendicitis*, *chronic gall bladder disease* and visceral affections, its peculiar penetrating powers being especially valuable.

The visible chemical rays of the lamp in these cases produce a specific photo-chemical inflammation of the skin causing a capillary dilatation which is detectable for even four or five months after treatment.

In *acute bronchitis* the treatment is peculiarly effective and is also indicated in *cardiac diseases*, *Bright's disease*, *chlorosis* and *malnutrition*.

The helios lamp can also be used in connection with electric light baths, vapor baths or hot air cabinets, as a projector producing general perspiration along the lines indicated in thermo-therapy as well as for its photo-therapeutic effects.

Electro-Diagnosis

Of what value is electro-diagnosis?

Electrification is not only very usefnl in the treatment of diseases, but it is also useful in the diagnosis and prognosis as well, and may be employed as an aid to both in a number of ways.

By means of electro-diagnosis we are able to distinguish between real and apparent death, to decide between genuine and feigned disease, aspracticed by malingerers, to differentiate central from peripheral paralysis, and to detect the presence of foreign metallic bodies, such as bullets, and fragments or iron, etc., in the tissues.

What is the electro-diagnosis of death?

None of the usual tests of death are as reliable and decisive as faradisation, which indicates death with absolute certainty, within several hours after it occurs. The time at which the muscles will not respond to the electric stimulus varies somewhat with condition at the time of death, and nature of the disease, but is a general rule that the shorter the disease, and the death, the sooner the electric excitability of the muscles disappears, so that if within from three to five hours there is no contractions of muscles following faradisation, then you may know with absolute certainty that the subject is dead.

Crimotel, of Paris, after much experimentation in cases of apparent and real death from many causes, has formulated the following conclusions:

1. Death is certain when all the muscles have entirely lost their fraradic contractility. No disease, poisoning or asphyxia, will, during life, abolish electric contractiliy in *all the muscles of the body*.

2. Faradisation is an indispensable test whether life is extinct in all cases of apparent death occuring suddenly. When there are several victims,

as after accidents, it enables the attendants to distinguish the dead from the living, and also the order in which the dead ceased to live.

3. In new born infants, muscular contractility, under the influence of the faradic current, continues fifty to sixty minutes after the heart has ceased to beat. When they have never exhibited signs of life, the faradic test shows whether life is really extinct.

4. In some cases of cholera, electro-muscular contractions cease within half an hour after death.

What is the electro-diagnosis of foreign bodies?

The detection and location of foreign metals in the tissues is entirely mechanical, and is accomplished by means of a flexible probe, made of two spiral wires, insulated from each other, or by a combination of a canula, and trocar, insulated from each other. Both are connected with a weak cell and a meter in a series, and when the probe comes in contact with the metal, there is a circuit formed, which is shown by the meter needle. Some of these probes are attached to a microphone, so that the sound of the impact and the vibration caused by the closing of the circuit may be heard by the operator. However, these things may be so much more easily detected by the X-ray and fluoroscope, and the probes are so fragile and liable to get out of order, that they are seldom used for diagnosis.

What is the electro-diagnosis of malingering?

For the detection of feigned disease in persons who want either sympathy or damages, the deception may be shown by means of faradisation with the wire brush, shown below, the application of which is very painful and harmless, except in cerebral troubles.


1673

In these cases if there is electric muscular contractility after two weeks, you may be sure there is a fraud proposed, but in obscure cases the tests should be made carefully as in diagnosing obscure paralysis.

ELECTRO-DIAGNOSIS IN PARALYSIS

What are the methods of electro-diagnosis of paralysis?

Electrification in the diagnosis and prognosis of paralysis is the most

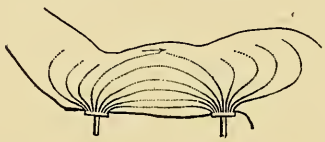
important part of this subject, as on the careful examination will depend, often not only your reputation, but possibly the life, comfort and happiness of your patient.

Both the faradic and galvanic currents are used in diagnosis, and either may be applied in three ways, viz: the direct, indirect and polar.

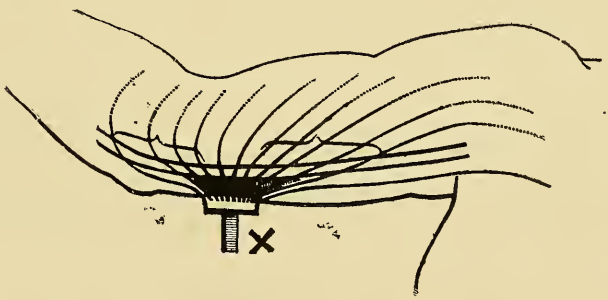
INDIRECT. Place one electrode over the ganglia or nerve trunk, with the other at a distance.

DIRECT. Place the electrode either over the motor point or on the muscle, with the other at a distance.

Both applications may be made with either one or both poles.



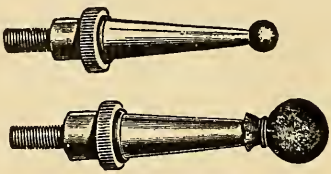
BIPOLAR. Place both electrodes close together, so as to include between them part to be tested.



UNIPOLAR. Place one electrode over the ganglia, nerve or muscle, and the other at a distance.

A number of suitable electrodes are needed either self-retaining or otherwise. The patient must be in an easy position with the muscles to be examined in a relaxed state and bare. The skin must be well wet, as well as the electrodes, which are to be applied to the nerve trunks or centers, the motor points, or to the muscles. Hold firmly in position, and begin with weak currents, gradually increasing as you proceed. A meter while not essential is advisable for precision. An automatic interrupter is also advisable.

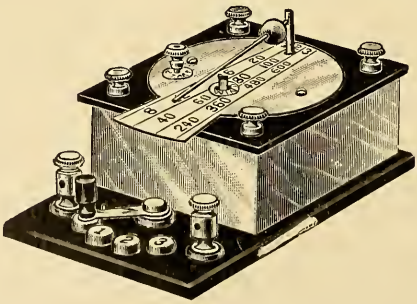
For testing the motor points the Erb electrodes, shown herewith, are used. These are small ball point rods, covered with cotton or wet leather



mounted on wooden or hard rubber handles and held in the hand of the operator.

In making electrical tests upon the arms or neck with the galvanic currents, place the indifferent electrode, which should be of large size, upon the sternum, while the other electrode, which should be small, is placed over the spot to be tested. If the spine is to be tested, place the large sponge at the sacrum, and with the other electrode go over the whole region as required. An automatic interrupter is preferable to an interrupting electrode operated by the hand of the operator. It will be readily understood that with a hand interrupter nice distinctions cannot be made, and sometimes very careful tests are required to decide as to conditions.

Faradism. Rapidly interrupted faradism is the most powerful electric stimulant to a healthy nerve. When passed through a muscle it will cause a quick contraction, followed by a relaxation, but as the periods of the faradic current are so close together, there is no interval, so that the muscles do not have time to relax between shocks, therefore there is a constant contraction or state of tetanus, which will continue while the current is passing. For this reason an automatic rheotome is needed and is shown herewith.



In testing the condition of either the paralyzed muscle or nerves with the faradic current, observe the following:

1. Whether a muscular contraction is produced or not.

2. If one is produced, what is the minimum strength of current required to produce it, and whether the character of the contraction is in any way altered; that is, the intensity of current and the rapidity, whether slow or quick, of the interruptions required to produce the minimum amount of contraction.

GALVANISM. When an interrupted galvanic current is passed through a muscle, there will be contractions caused when the current is made and broken, and we have found that the contractions differ with the make and break. The healthy muscles will contract more strongly with the break than the make, and with the negative more than the positive, which are important points to know, and which will be elaborated later, (p. 206) but the galvanic current does not produce as strong contractions as the faradic.

On the other hand the diseased nerves and muscles will not respond as readily to faradism as they will to galvanism.

With the galvanic current, note:

1. Whether a contraction is produced or not.

2. If one is produced, note (*a*) the order of the polar reactions; (*b*) what is the minimum strength required to produce a contraction; (*c*) the character of the contractions, whether healthy or not; (*d*) the intensity of current required to produce tetanus; (*e*) whether the contractions are more easily excited by slow or quick interruptions of the current.

The contractions in any muscle depends on the nerve supply to it. If there is good enervation, the muscles will respond most quickly to rapid interruptions, but if the nerve supply is poor, the interruptions must be slow to cause the contractions, and the wide range of irritability between the extremes is the field for electro-diagnosis.

PROGNOSIS IN PERIPHERAL PARALYSIS

What is the prognosis in paralysis?

Provided the cause can be removed, as a rule, if there be but little wasting of the muscles and they respond somewhat to the faradic current, a cure may be expected in a comparatively short time. If the muscles are much wasted, the disease has lasted a long time, and the muscles refuse to respond to the application of either kind of current, the case, though possibly curable, requires a guarded prognosis. In case of complete wasting of muscles following paralysis, it is useless to expect improvement.

NORMAL REACTION. FORMULA

What is the normal muscle reaction formula?

As before stated, when we apply a galvanic current to a nerve, and interrupt the same, a contraction takes place in the muscle, differing in intensity with the pole used, the strength of the current, and the condition of the parts. In health, these contractions take place in the following order:

1. When the negative pole is suddenly applied, a contraction takes place, termed Cathodal Closing Contraction, the symbols being, Ca. Cl. C.

2. When the positive pole is suddenly applied, and a contraction takes place, it is called Anodal Closing Contraction, written thus: An. Cl. C.

3. When the positive pole is suddenly withdrawn, the contraction is called the Anodal Opening Contraction, written: An. O. C.

There is a fourth, called the Cathodal Opening Contraction, but it is too painful to produce, and I seldom attempt it. As a rule, it requires only one-fourth the current strength to produce the first, or Ca. Cl, C., as for the last, or Ca. O. C. For practical purposes, therefore, we will drop the latter formula. We may also drop the final letter in all of the formulas for the sake of convenience.

The average current strength required to produce normal contractions, we may tabulate as follows,

1. C. C. (Cathodal closing)..... ....2 to 5 milliamperes.
2. A. C. or A. O. (Anodal closing or anodal opening) 6 to 8 milliamperes.

It will be well to observe that in making such experiments, that after the skin has become well wetted, less current will be required to produce a contraction than when it is dry, and this must be taken into account in diagnosis.

Such tests should be applied whenever possible, so as to become familiar with all the reactions.

The contraction of a muscle, in health, is very quick and short, unless the current is too strong. This applies, of course, to the galvanic current.

REACTION OF DEGENERATION

What is the reaction of degeneration?

Immediately after a muscle has been injured severely enough to destroy a portion of a motor, or mixed nerve, it has been found by Erb that atrophy of the muscular fibers sets in, which may be seen during the second week, and reaches its limit about the fifth or sixth week. At first it ceases to respond to the faradic current, then follows a period when it will

act only to a slowly interrupted galvanic current, and finally ceases to react to any form of electrical stimulation; he termed this the *reaction of degeneration*. It is present in paralysis arising from rheumatism, lead palsy, the paralysis peculiar to writers, telegraph operators, etc. In those difficult cases after railway and other accidents, when persons demand compensation for damages, the existence of the reaction of degeneration would be a fact of vital importance in favor of the applicant, as it would indicate that he was suffering from a serious injury of the nerve. Such a demonstration in a court of justice is more conclusive than any amount of authoritative opinion.

MOTOR POINTS

What is the value of knowing the motor points?

When a nerve center is stimulated by electrification, it will cause a contraction in the muscle or group of muscles, supplied by that nerve. The stimulus may be applied to any part of the trunk of the nerve, either before or after it reaches the muscles, but the most decided response follows the stimulation of the nerve, right at the point where the nerve enters the muscle, and many experimenters have located these points, and they are definitely known, and may be found by all. They will, of course, vary a little in different persons, but it is comparatively easy to find them within a short distance of the usual place, as is shown in the accompanying cuts, shown on pages 208 and 210, made from photographs of the living model.

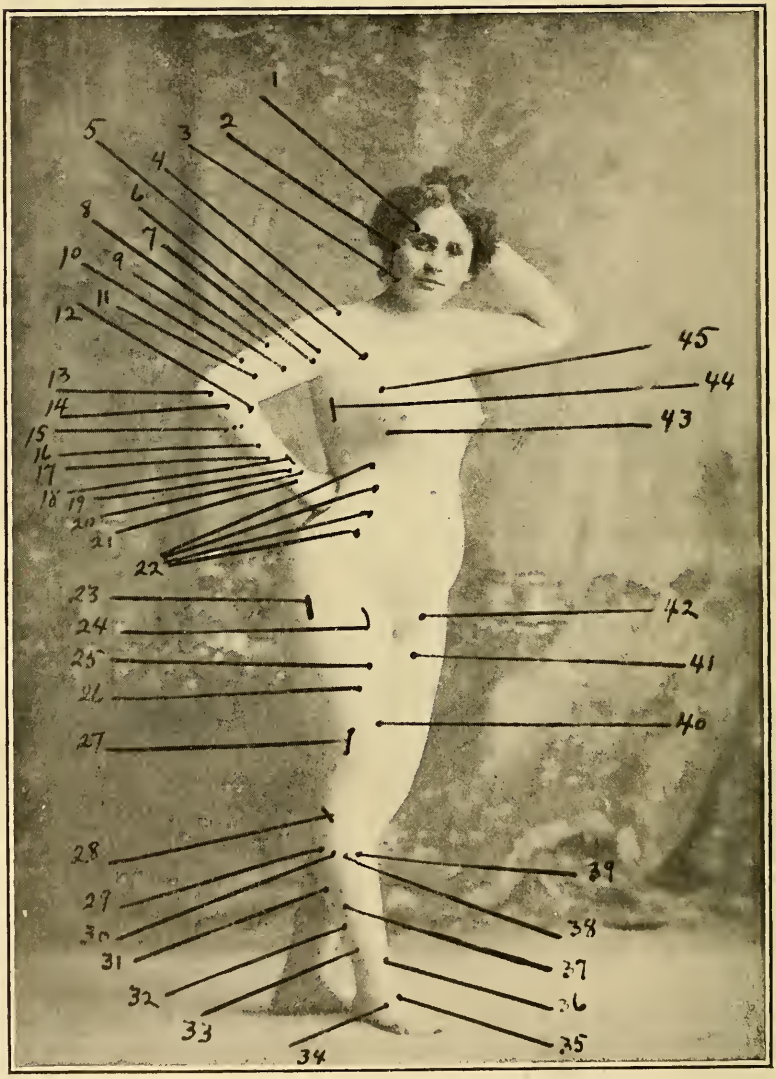
The motor points decrease in irritability as we get further away from the main nerve centers.

The motor points are also influenced by the physique of the person, and are not as marked in the large or fat, as in the small and lean. The muscular development also makes a difference, the larger and coarser the tissues the more current is required.

The state of the health of the subject also makes a difference in the conductivity, and therefore in the muscular excitability. A strong full blooded person will be a better subject than a weak, anæmic, debilitated person.

It has been shown that different nerves will vary in their normal electric excitability, and the following list of ten prominent nerves shows their relative order of excitability:

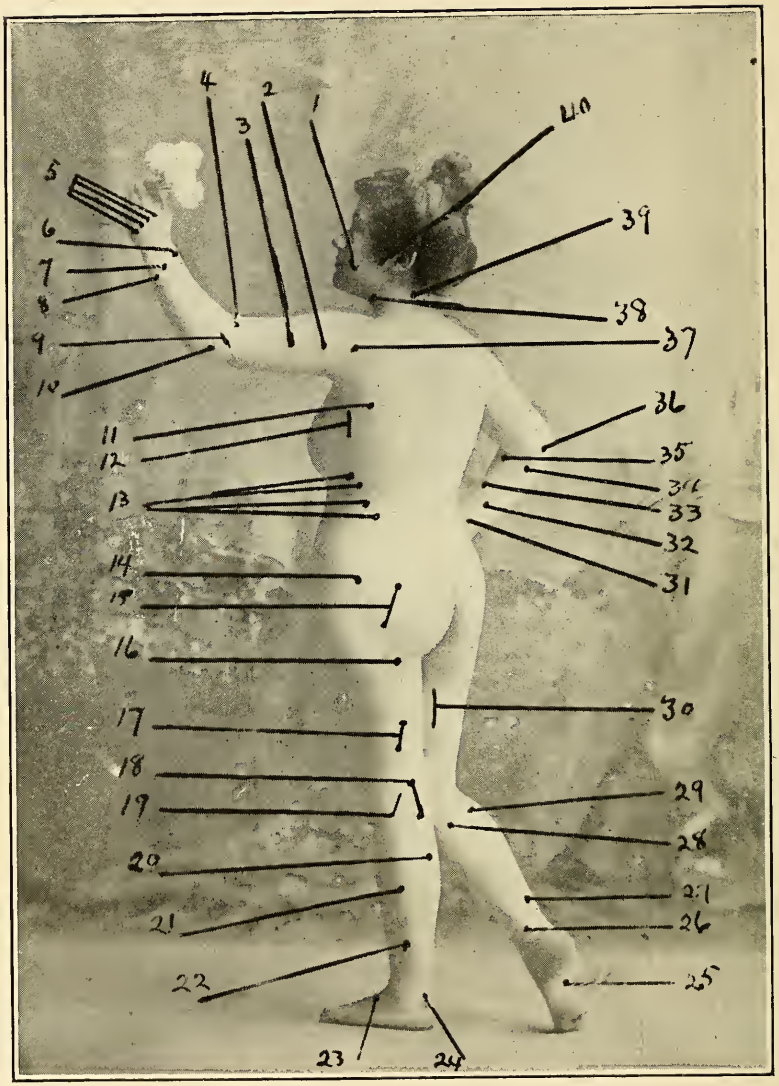
1, Spinal accessory; 2, Branch to levator angulæ scapulæ; 3, Ulnar; 4, Median; 5, Facial; 6, Cervical plexus; 7, Anterior crural; 8, External popliteal; 9, Musculo-spiral; 10, Internal popliteal.


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45

ANTERIOR

SUPERFICIAL NERVES AND MUSCLE MOTOR POINTS

1 Supra orbital nerve.
Corrugator supercilli muscle.
2 Facial nerve, (upper branch).
3 Facial nerve, (lower branch).
4 Deltoid muscle, (middle).
5 Deltoid muscle, (anterior).
6 Musculo-cutaneous nerve.
7 Biceps muscle.
8 Musculo-spiral nerve.
9 Brachialis internus.
10 Triceps muscle.
11 Median nerve.
12 Supinator longus.
13 Exten. carpi ulnaris.
14 Supinator brevis.
15 Exten. digit. communis.
16 Exten. digit. minimi.
17 Extensor indicis. (a).
18 Extensor indicis. (b).
19 Exten. oss metacar. poll.
20 Exten. prim inter. poll.
21 Exten. sec. inter. poll.
22 Rectus abdominus.
23 Tensor vaginæ femoris
24 Crural nerves.
25 Quadriceps. (common point).
26 Rectus femoris muscle.
27 Vastus externus muscle.
28 Peroneal nerve.
29 Gastrocnemius muscle.
30 Peroneus longus.
31 Soleus muscle.
32 Peroneus brevis.
33 Flex. hallucis longus.
34 Interossei dorsales.
35 Exten. digit. commun. brevis.
36 Exten. hallucis longus.
37 Soleus muscle.
38 Extensor digit. longus.
39 Tibialis anticus nerve.
40 Cruralis muscle.
41 Sartorius muscle.
42 Crural nerve.
43 Pectoralis minor muscle.
44 Thoracicus longus nerve.
Serrat. antic. mag. muscle.
45 Pectoralis major muscle.


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40

POSTERIOR

SUPERFICIAL NERVES AND MUSCLE MOTOR POINTS

1 Facial nerve. (middle branch).
2 Triceps muscle.
3 Musculo-spiral nerve.
4 Brachialis internus.
5 Interossei dorsales.
6 Exten. prim. intern. poll.
7 Extensor indicis.
8 Extensor minimi digit.
9 Extensor radii brevis.
10 Ulnar nerve.
11 Latissimus dorsi.
12 Thoracicus longus nerve.
Serrat. anticus magnus muscle.
13 Obliquus abdominus ext.
14 Tensor vaginæ femoris.
15 Gluteus maximus.
16 Great sciatic nerve.
17 Biceps femoris. (long cap).
18 Posterior tibial nerve.
19 Peroneal nerve.
20 Gastrocnemius muscle.
21 Soleus muscle.
22 Flexor hallucis longus.
23 Extensor digit. commun. brev.
24 Posterior tibial nerve. (low).
25 Plantaris muscle.
26 Flexor digit. communis.
27 Tibial nerve.
28 Gastrocnemius, (int. cap).
29 Gastrocnemius, (ext. cap).
30 Ischiaticus nerve.
31 Median nerve.
32 Flexor longus pollicis.
33 Flexor digit. sublimis.
34 Flex. digit. commun. prof.
35 Flexor carpi radialis.
36 Ulnar nerve.
37 Deltoid, (posterior).
38 Hypoglossal nerve.
39 Spinal accessory nerve.
Levator anguli scapulæ muscle.
40 Facial nerve, (middle branch).

ELECTRIFICATION EFFECTS

How should we select the modalities for the various desired effects?

In choosing any special kind of an electric current for the treatment of any given condition, the structure to be treated must suggest the current to be used. If the structure or tissue is coarse (muscle, etc.) we would resort to the faradic current which contracts and relaxes muscle-fibres. If we wish to make an impression on the local nutrition of these parts, the galvanic current would be the current to use. If we wish to alter (augment or diminish the blood-supply) we would use a static current. If it is our desire to act upon the vaso-motor nerves or, in fact, on nerve-cells and nerve-fibers generally we would resort to some form of high-frequency. The high-frequency coil (uni- or bi-polar) is adapted to trophic perversions of the nerves. For the skin (circulation and nerve-supply) we would use the resonator. As a metabolic alterant, locally and constitutionally, the diasolenic high-frequency zone, or the magnetone or wave generator, is unsurpassed. The general rule is: The coarser the structure, the coarser the current to be used; the finer the structure, the finer the current. For electrolysis and phoresis use the galvanic current. The polarity depends upon the effect to be produced. The negative pole relaxes, the positive pole contracts. These rules are the foundation of all scientific electro-therapy.

To sum up, all known effects of an electric current upon and near its conductor are:

(a) Heat,
(b) Magnetisation and induction,
(c) Electrolysis, including phoresis.
    1. Cathode (hyperæmia),
    2. Anode (ischæmia).
(d) Stimulation,
    1. Muscular, (coarse alternation),
    2. Nervous, (fine alternations),
    3. Metabolic, (sinusoidal and high-frequency, X-radiation and magnetisation.)
(e) Psychic or central nervous effects, due to
    1. Sensations,
    2. Suggestions.

With these physio-chemical effects fixed in mind, and with some familiarity with the necessary apparatus, electro-therapeutics is a simple and very valuable addition to the physician's armamentarium.

Heat is of so little use practically as a result of the electric current that

it needs no further mention here. A burn by a heavy current is simply a burn, and is treated as such.

The question as to the application of electrification in any given case is very simple.

(a) Does any part of the body require increased blood supply? (cathode).

(b) Does any part need reduction of its blood supply? (anode).

(c) Do any muscles require stimulation? (coarse faradic or interrupted galvanic).

(d) Do any nerves need stimulation? (fine or rapid faradic).

(e) Is metabolism of any part defective? (sinusoidal, magnetisation).

(f) Are none of these things wanted? Don't use electrification.

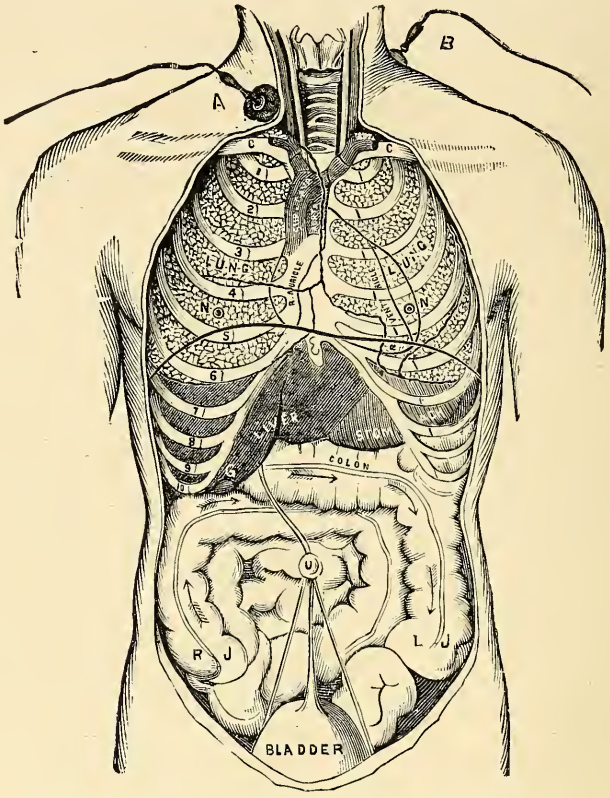
Treatment of warts, tumors, hairs and blemishes, etc., is more nearly surgical.

DIFFERENTIAL POINTS IN GALVANIC POLARITY

What is the difference between positive and negative galvanism?

POSITIVE	NEGATIVE
Is acid	Is alkaline
Hardens	Softens
Denutritive	Nutritive
Promotes a clot	Dissolves and absorbs a clot
Liberates oxygen	Liberates hydrogen
Produces anæmia	Produces hyperæmia
Slows circulation	Quickens circulation
Allays excitability	Increases excitability
Decreases local heat	Increases local heat
Retards hemorrhage	Increases hemorrhage
Repels soluble salts	Attracts soluble salts
Lessens inflammation	Aggravates inflammation
Decreases vascularity	Increases vascularity
Has a drying influence	Has a moistening influence
Lessens nerve irritability	Increases nerve irritability
Is a vaso-motor contractor	Is vaso-motor dilator
Used in acute conditions	Used in chronic conditions
Is coagulating to albumen	Is liquifying to albumen
Intensifies scars and strictures in canals	Dissolves scars and strictures in canals
Decomposes all metals (except gold, platinum and aluminum)	Does not decompose any metals (except aluminum)

ANATOMICAL TOPOGRAPHY IN ELECTRO-THERAPEUTICS



(Cut after Gray. Explanation from Haynes).

This illustration shows the principal landmarks for locating the internal organs with sufficient accuracy for the purposes of electro-therapeutics.

C. C. marks the clavicle.

The ribs are numbered so correspond with the numbers at their spinal termini. It is useful to remember that the sternal end of each rib lies on a lower level than its vertebra. A line drawn horizontally backward from the middle of the third costal cartilage at its junction with the sternum would touch the body, not of the third dorsal but of the sixth dorsal. This varies a little according to the length of the sternum.

The eleventh and twelfth ribs can be felt even in corpulent persons, sloping downward. The head of the last rib is on a level with the spine of the dorsal vertebra.

The nipples (of male) usually lie between the fourth and fifth ribs, about three-fourths of an inch external to their cartilage.

The *right lung*, directly in front, is shown terminating on a level with the sixth rib, and the *left lung*, between the sixth and seventh ribs.

The *heart* is marked by a dark outline. The usual place to locate the electrodes for reaching it is over the sternum (breast bone) just above E, while the other is placed over the cervical ganglia, or at the *right* side of the neck at the point where the electrode A is placed in the cut. An electrode at the same spot on the *left* side of the neck modifies the respiratory movements.

The *lobes* of the *lungs* are outlined by the wavy dark line just above the fourth rib on the right, and between the fifth and sixth on the left.

The diaphragm is marked by the irregular dark line extending across the cut. This shows its attachment in front to the ribs and sternum.

E marks the cartilage ending the sternum (ensiform cartilage).

The stomach may be electrised by placing a large, broad electrode between the false ribs below E and two fingers' breadth above U.

The liver may be reached by pressing one electrode inward and upward just below the tenth rib. When the stomach is empty the liver may also be reached by pressing the electrode located below the sternum a little inward to the right, and upward.

G indicates the location of the gall bladder.

The colon, when treated for torpidity, should have the negative electrode carried over it from R J to L J, in the direction indicated by the arrows.

U is the umbilicus. It is located as a rule above the level of the body of the third lumbar vertebra.

The spleen. Place a broad electrode over the tenth and eleventh ribs on the left.

The bladder may be reached by placing one electrode above the pubic bone and the other over the lumbo-sacral region.

Electrode B marks the location from which a current may be made to reach the brachial plexus of the corresponding side.

Electrode A marks the point at which the current may be made to stimulate the pneumogastrics and cervical sympathetics.

How is electrification used as an anaesthetic?

Sinusoidal alternating electric currents of sufficiently high frequency, and in which the positive and negative phases were nearly equal, possess-

the power of producing local anæsthesia. After the frequency has reached 5000 complete alternations per second the muscular contraction so familiar with medical batteries and other alternating currents, decreases, and at 25,000 alternations per second a current passing from the elbow to the hand completely deadens that portion of the arm, and needles may be passed through the flesh without being felt. When subjected to currents of such high frequency, the sensory nerves appear to lose power of transmitting sensations.

The tetanizing effect of the high tension secondary induced current has been used in dentistry, for the purpose of obtunding pain, incident to the extraction of teeth.

The apparatus used for this purpose consists of an induction coil, wound with a very fine wire and provided with an interrupter which gives 25M vibrations per second, and constitutes the most important part of the apparatus. The patient places himself in an ordinary dental chair, takes the negative electrode in his left hand, and the positive in his right. The current is gradually increased to the limit which the patient is able to endure. Then the forceps, which are connected with the positive electrode, are placed upon the tooth, and it is immediately extracted and the current interrupted. The patient experiences no other sensation than the prickling produced in the hands and forearm by the passage of the current. The secret of the anæsthetic effect produced by the electrical current obtained from this apparatus, seems to reside in the extreme rapidity of the interruption.

Uterine Stenosis set of three tapering tips and universal staff.

Intra-Uterine electrode with copper or aluminum tip. (3 mm. in diameter)

Pain

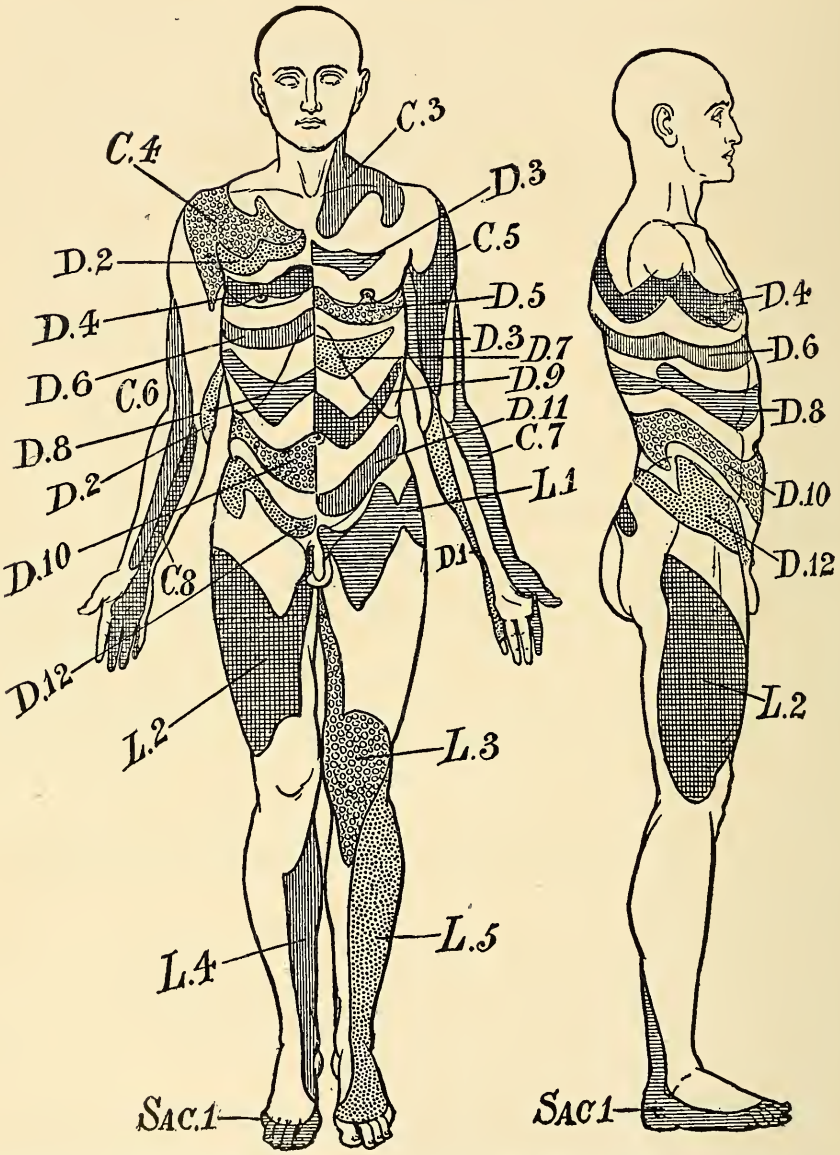
What effect has electrification on pain, and anaesthesia?

The relief of pain is one of the great functions of all forms of electrification when administered properly with the positive pole as the active one. Pain is only a symptom, but is the most constant, annoying and significant symptom in aiding us in our diagnosis, treatment and cures by electrotherapeutics.

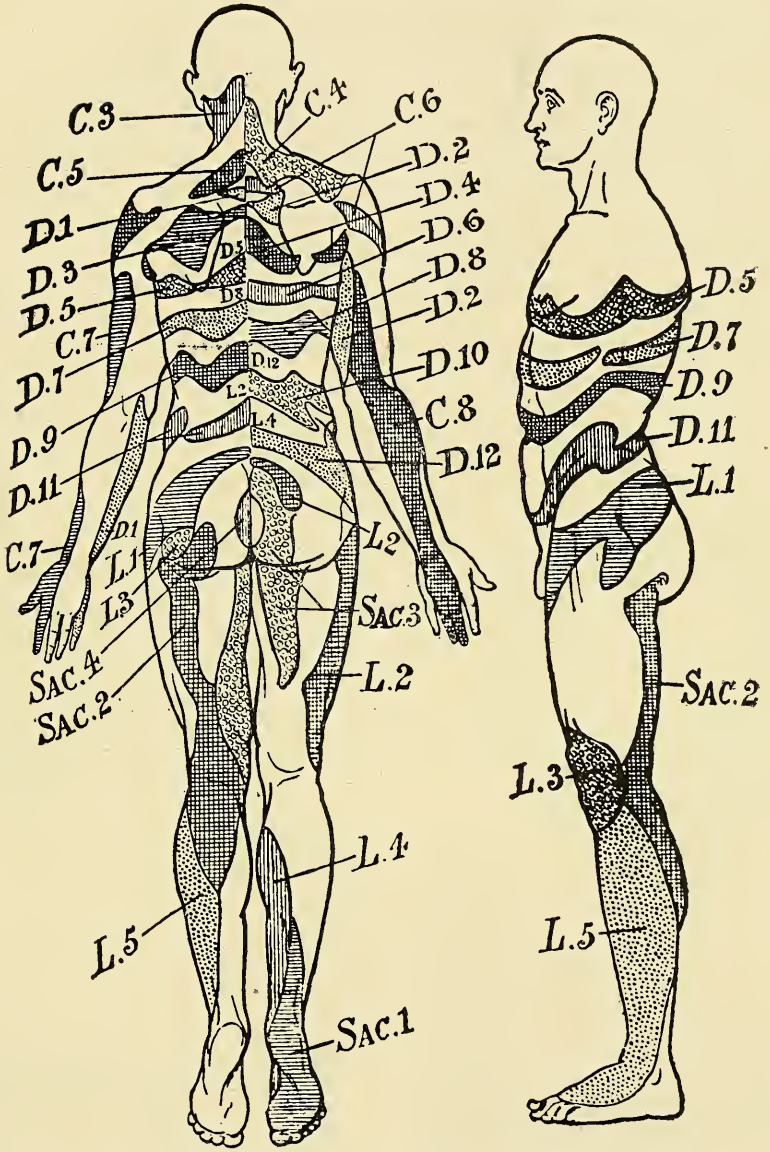
The presence of this symptom is the danger signal and warning to get busy for its relief and for the removal of its cause. The absence of pain, when diseased conditions are known to exist, is also most significant in the prognosis. If there was no pain we should have few patients to treat, and too often as soon as the hurt is stopped the patient thinks he is well, and the treatment is likewise stopped, as well as some other things, such as practice and income.

Pain starts somewhere from some cause, which may be central or peripheral. Peripheral pains are usually local and due to visible causes. Pains of central causation are usually more general, or diffuse and the cause not seen. Reflex pains are harder to locate, and will be more carefully studied under the title of headaches, which are the most frequent reflex pains we are called on to treat electrically.

Pains of central origin are usually due to some spine lesion, and careful experiments by eminent neurologists, such as Head and Gowers, have given us approximately accutate maps of the human body, locating the areas, zones, or lines of pain or absence of pain, which indicate the location of the central spinal lesion. These maps are shown in the accompanying cuts of the full length figures of the man, showing front, back and



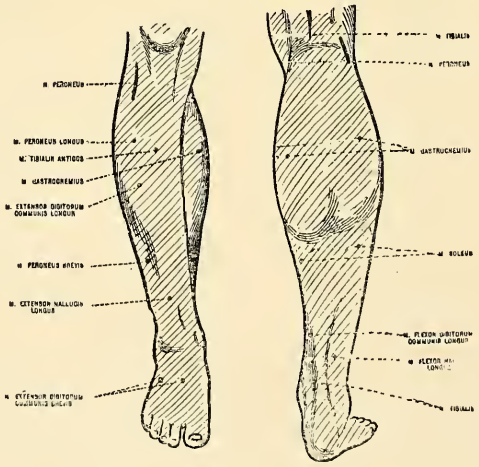
both side views. While these are not claimed to be absolutely accurate, they are approximately so, and are a reasonably reliable guide for us to follow, and a valuable means of diagnosis and assistance in our electro-therapeutic treatment.



The different shaded areas, zones or belts, shown in the accompanying figures (after Gowers) indicate both the peripheral location of the anæsthesia, or hypheræsthesia of the skin, and also the location of that part of the spine which is most probably affected, and indicating the point at which

we should apply our treatment for the relief of and cure of the pain, or paralysis, be it either motor or sensory. Usually the cause of motor or sensory paralysis is at the point in the spine denoted by the figures and letters, while the girdle pain or area of hyperæsthesia is due to irritation of the spine just above the lesion. In these figures the letters C, D, L and S refer to the cervical, dorsal, lumbar, and sacral vertebra, from whence issue the corresponding pairs of spinal nerves, which are distributed to the various shaded areas on the human maps.

For instance I was called on to treat a case of alleged "rheumatism" of the feet, which was characterized by partial paralysis, or loss of motion in the feet, with most persistent pain in the heel and regions of the tendo-achilles, in both legs. The case not responding to any or all of the usually indicated electro-therapeutic and magnetic treatments, I was forced to conclude that there was nothing local the matter, and after long and persistent inquiry, elicited the history of a fall from a low roof, and injury to the lower part of the back, and when attention was directed to the first lumbar articulation, we located the cause of the pain. You will see by referring to the human skin maps that the toes and back and bottom of the foot and heel is marked Sac. 1. I gave an unfavorable prognosis, and he drifted away, but I kept watch over him and found that after going to various baths for his "rheumatism," he got no relief and finally after a couple of years, the pain stopped through degeneration of the nerve, so that it had sensory paralysis, and to-day he has no pain, but has the halting gait, due to partial motor paralysis. Another case similar came for the treatment of a severe



pain in the area shown as marked with the L. 5, the most pain being on t right instep. He also had slid from a roof on to a pile of lumber ve appropriately, injuring the lumbar spine. After a month's careful scienti electro-therapeutic treatment, with not even relief, I diagnosed acute neurit and prognosed ultimate complete degeneration, sudden relief from pain, a then complete motor paralysis in the dorsal foot flexors, presided over by t anterior tibial nerve. He went to an ignorant quack who "guaranteed a cu in a week, or no pay," who collected his pay in advance, and then held t case for two months without any relief whatever, before he was fired. the course of five or six months the pain stopped, and now he walks with cane and drags his toes. A careful study of the human skin maps a examination of the cases along these lines will prove very beneficial in t diagnosis, prognosis and treatment of many obscure spinal lesions chara terized by girdle pains, hyperæsthesia, anæsthesia and motor paralysis.

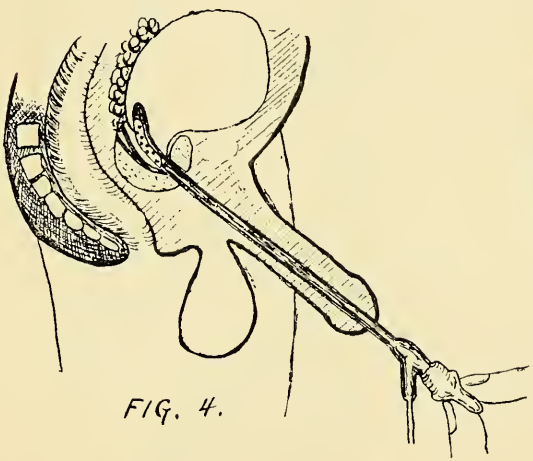


FIG. 4.

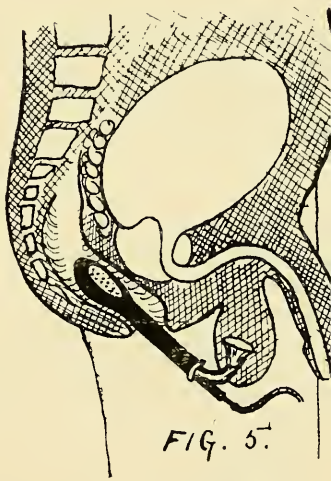


FIG. 5.

Prostatic phoric electrode in bladder.

Prostatic phoric electrode rectum

MUSCLE DISTRIBUTION—ORIGIN OF THE SPINAL NERVES

Cervical

1 and 2, small rotators of head. (2 to 5, sterno-mastoid, upper neck, upper trapezius).
Depressors of hyoid bone. (6 to 8, lower neck, middle trapezius).
3, scaleni, levator angulæ scapulæ.
4, 5, diaphragm, pectoralis, serratus, elbow flexors, deltoid.
6, 7, 8, pronators, triceps, wrist, hand and fingers. Reflex, scapular and pupils.

Dorsal

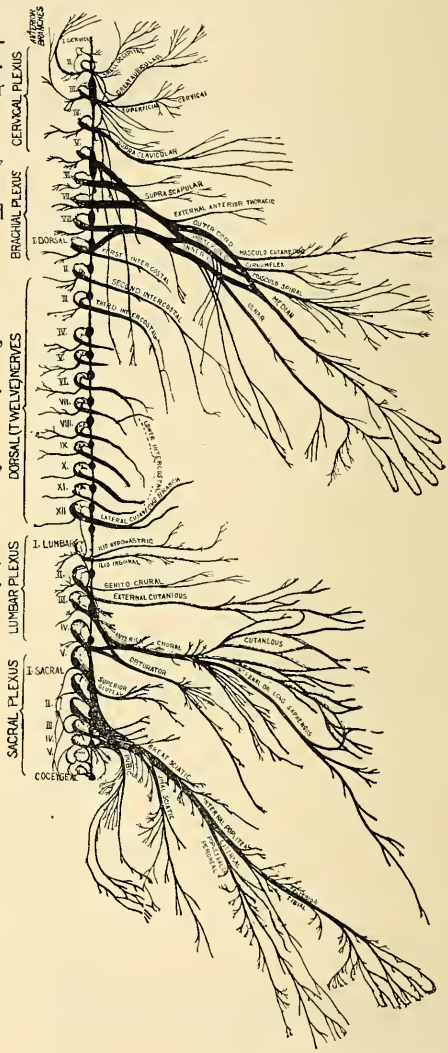
1 to 12, lower trapezius and back muscles.
1 to 10, intercostals. 7 to 12 and 1st lumbar, abdominal muscles and ileo-psoas.
Reflex, 4 to 7, epigastric. 8 to 12, abdominal.

Lumbar

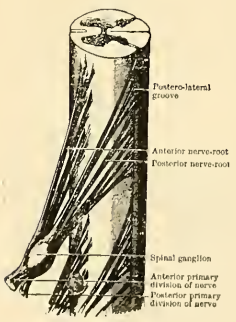
1, ileo-psoas, 2, 3, cremester, hip flexors. 3, 4, knee extensors, hip adductors.
4, 5, hip extensors and adductors.
5 and 1st sacral, knee flexors.
Reflex, 1 to 4, cremasteric. 2 to 4, patellar. 4, 5, gluteal. 5 and 1st sacral, foot clonus.

Sacral

1, 2, intrinsic foot muscles.
3, 4, 5, perineal and anal muscles.
Reflex, 1 and 2, plantar.



Root and Origin of the Seventh Cervical Nerve



Of all the nerves most frequently affected, the seventh cervical is prominent, in all neurasthenic conditions. Pressure at the seventh cervical vertebra is painful, and positive galvanisation gives prompt relief.

Head Pains

In this country, where so many are afflicted with what the Europeans call Americanitis, meaning a condition of sub-acute or chronic nervous unbalance, due to our strenuous manner of life, headache is a still more common symptom than is dyspepsia, but we as physicians, are not called on so much for the relief of this symptom, as we would be if it were not for the patent medicine habit which is so prevalent.

There is, however, a large and ever-increasing proportion of our clientele who are anxious to have us relieve, if not cure this distressing symptom, and if there ever was need of careful diagnosis, it surely is in the determination of the cause of the headache, and then, knowing the cause, we have in some of the electric modalities, very frequently, a safe, sure and quick cure.

There is probably no simpler, yet more spectacular method of impressing the patient with the efficacy of proper electrification, than in the treatment for the relief of some form of headache.

As we have stated before, if it was not for pain, there would not be much call for doctors, in a large proportion of cases.

If a lady patient comes in complaining of a pain in the top of her head, and you tell that she has uterine derangement, and mention a few other symptoms, which go with it, you have impressed her, and when you correct the pelvic trouble, and she has no more headache, then she is your friend and advertiser till the end of the chapter, and then when she tells another friend, with an ache in some other part of the head to take it to you, and you seat her on the static platform, and with a few passes of the static point spray, across her forehead, and down the back of her neck, and

in exactly two minutes she is free from pain, and goes out pleased, she does not forget to tell about it, and usually from the house tops, figuratively speaking. A few such well directed cures of headache will make you "solid" with the community, oftentimes more quickly than any other way.

Now there are headaches and headaches, some of which are easy and other difficult to reach and cure, the result depending in a great degree on the cause.

I have in my office a handsome illuminated pen and ink drawing, the handiwork of a close medical friend, which is framed, and hangs above the mantel, where all may see it, which bears this legend in colors:—

> FIND OUT THE CAUSE OF THIS EFFECT,
> OR RATHER SAY, THE CAUSE OF THIS DEFECT,
> FOR THIS EFFECT DEFECTIVE COMES BY CAUSE.
>
> HAMLET.

I have tried to make this the rule of my work, and with some measure of success. Go thou and do likewise.

The causes operating to produce headache as an effect are many, and may be divided into three general classes, thus:

1. Causes operating within the cranium.
2. Causes operating reflexly from a distance.
3. Causes operating from systemic poison.

The cranial cause may be cerebral anæma or hyperæmia; thrombosis or embolus, in some vessel in the brain; inflammation resulting in cerebritis, meningitis, or cerebral abscess; caries or necrosis of skull bones; tumors of the brain or meninges; hemorrhage or blood clot; effusion, hydrocephalus; concussion or compression; foreign bodies; fractures of the inner or outer table of the bone; gummata or syphillis.

The reflex cause may be from derangement of the stomach, liver, kidneys or glands of the gastro-intestinal tract; some uterine or ovarian disease or displacement; pregnancy; constipation; mental emotions; loss of sleep; overwork; or sexual excesses.

The blood cause may be from fevers, malaria, diphtheria, syphillis, uræmia, cholæmia, pyæmia, septicæmia, anæmia, chlorosis, scurvy, purpura, rheumatism, narcotism, alcoholism, or drug addiction.

From this array of direct and indirect causes, we at once see the great importance of first finding out "the cause of this effect."

I am greatly indebted to the excellent works of Drs. Flower and Benson, for the summarising of the etiology and differentiation of headaches, which while not electro-therapeutic, are essential to know.

DIFFERENTIAL HEAD PAINS

Sympathetic head pain is a reflex symptom, due to some derangement of the gastro-intestinal canal, or the genito-urinary tract, and is usually more severe after a night of rest, being complained of the first thing in the morning.

Constant head pain is due to an excess of urea in the blood; lead poisoning; or from the administration of strychnine, quinine, alcohol, nitro-glycerine, and other stimulants.

Hemicrania or neuralgic head pain is manifested by an acute darting character, usually on one side only, and being increased by pressure.

Rheumatic head pain is usually bilateral, in the region of the occipito-frontalis muscle, the pain being greater on motion of the scalp and neck, and sometimes affects the temporal and masseter muscles, rendering movement of the jaws painful.

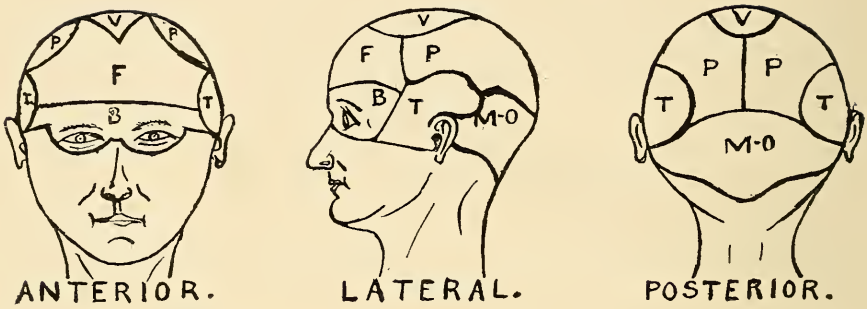
Inflammatory pain in the head is very severe and constant, and is associated with constitutional symptoms, fever, vomiting and delirium.

In abcess, tumors or softening of the brain and other chronic conditions, the head pain is persistent, and is confined to one spot, but not so severe as in the inflammatory kind, and only occasionally is paroxysmal, with mental disturbance and muscular inco-ordination.

Congestive head pain is of a dull aching nature, is made worse by stooping or lying down, and by protracted sleep, or mental or bodily effort, and is attended with flushed face, throbbing carotids and heat in the scalp.

Meningeal head pain is constant and fixed, sometimes sharp and cutting, with frontal and occipital congestion.

Anæmic head pain is severe, but dull and transitory, with much lassitude and scalp tenderness, with no fever, but often there is ocular disturbance, and lack of power for mental concentration.



HEAD PAINS—LOCATIONS AND CAUSES

(Maps modified after Flower and Benson.)

TOPOGRAPHY

(From Benson.)

F. F. FRONTAL. When pain is located in the forehead, from the coronal suture to the superciliary ridges below, and within the temporal ridges on either side, *the large intestines and rectum are congested and overloaded with feces.* Also in gout and malarial diseases.

B. B. BROW-ORBITAL. When pain is located below the superciliary ridges including the orbit, to the external angular process on either side of the forehead, *there is irritation of the stomach and small intestines, or congestion at the base of the brain; or over the orbits; or nasal catarrh; astigmatism or other visual defects; decayed front teeth; but if the pain is located at and around the supra-orbital notch, there is irritation of the sympathetic and vagus nerves of the stomach from reflex causes, as in uterine and ovarian congestion, functional disturbance of the heart, lungs, etc., or congestion of the sheath of the supra-orbital nerve at that point, due to sudden exposure to cold.*

M. O. MASTOID-OCCIPITAL When pain is located between the ears at the occiput, below the lambdoidal sature, *there is congestion at the base of the brain and medulla-oblongata, or defective supply of blood, or anæmia; or spinal irritability from excesses in venery or masturbation.* Also in malarial fever and mental anxiety.

T. T. TEMPORAL. When pain is located in the temporal fossa, from the squamous suture to the zygoma below, and from the temporal

ridge to the mastoid process, *there is congestion of the cerebral meninges, or embolus of the meningeal artery, or inflammation of the internal ear.* Also in typhus and typhoid fever.

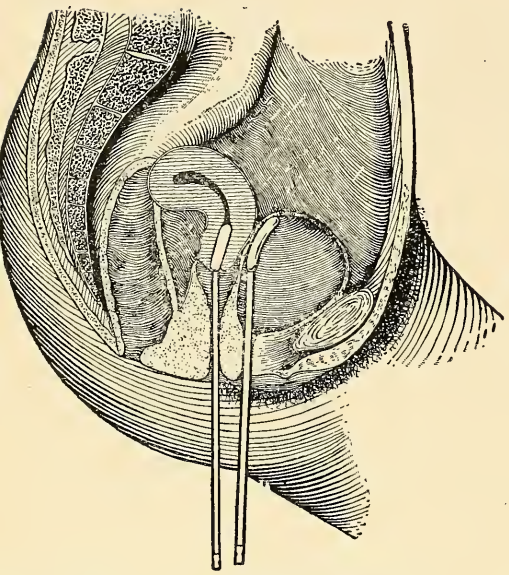
V. V. VERTECAL. When pain is located in the vertex, from the coronal to half the distance of the lambdoidal suture, and on either side of the sagittal suture, to the superior line of the parietal eminence, *there is deficient blood supply to the superior convolutions of the brain, or reflex irritation from the uterus, bladder, rectum or organs of generation, catarrh of the eustachian tube, enlarged or diseased tonsils.* In nervous conditions from debility and exhausting discharges, overlactation, valvular diseases of the heart, hemorrhages, impoverished blood, albuminuria, etc. In hysteria with clavus hystericus, and in sympathetic, organic, and neuralgic states, the pain is confined to one spot. Rheumatic head pain is confined to the occipito-frontalis muscles, *but if the pain is deep seated, sharp, and radiating to the side of the cranium, occurring only at night or before rising in the morning, there is syphilis.*

P. P. PARIETAL. When pain is located in the region of the parietal bones from the coronal to the lambdoidal suture, and from the squamous suture to the superior outline of the parietal eminence, *the liver, duodenum and small intestines are congested and there is constipation.* Also in malarial affections.

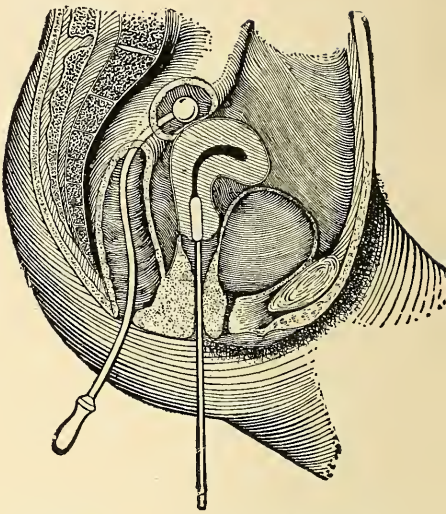
A careful study of the head maps, etiology, differentiation, and topography of headaches, knowing the cause, we can treat it and remove the effect, by means of proper electrification in some form.

Simple frontal congestive headache will disappear in a few minutes under longitudinal galvanisation of the brain, with the positive to the front, and the negative to the back. Either placing the front electrode stabile, or passing it labile from side to side, without lifting it from the skin, will, in a short time, with a few milliamperes, cure the pain, by contracting the capillaries, and relieving the congestion.

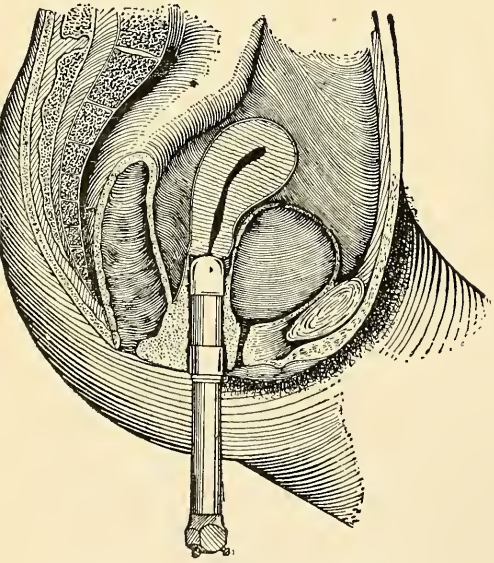
Reflex headache, from excitement, sight-seeing, eye strain, too close application of the eyes, with a poor light, or being too long in a bright light, or on a nervous tension, will be quickly cured by a minute or two on the static insulated stool, with the local point breeze to the forehead, or the overhead crown shower. (See pages 112-115).



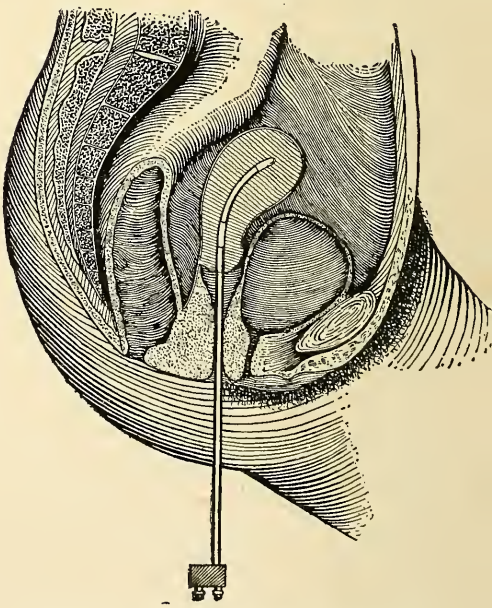
Retro-flexion. Utero-Vesical Faradisation



Ante-flexion. Utero-Rectal Faradisation



Bi-polar Vaginal Faradisation



Bi-polar Intra-Uterine Faradisation

Oxidising the Blood

THROUGH THE AGENCY OF ELECTRIFICATION IN THE TREATMENT OF DISEASE

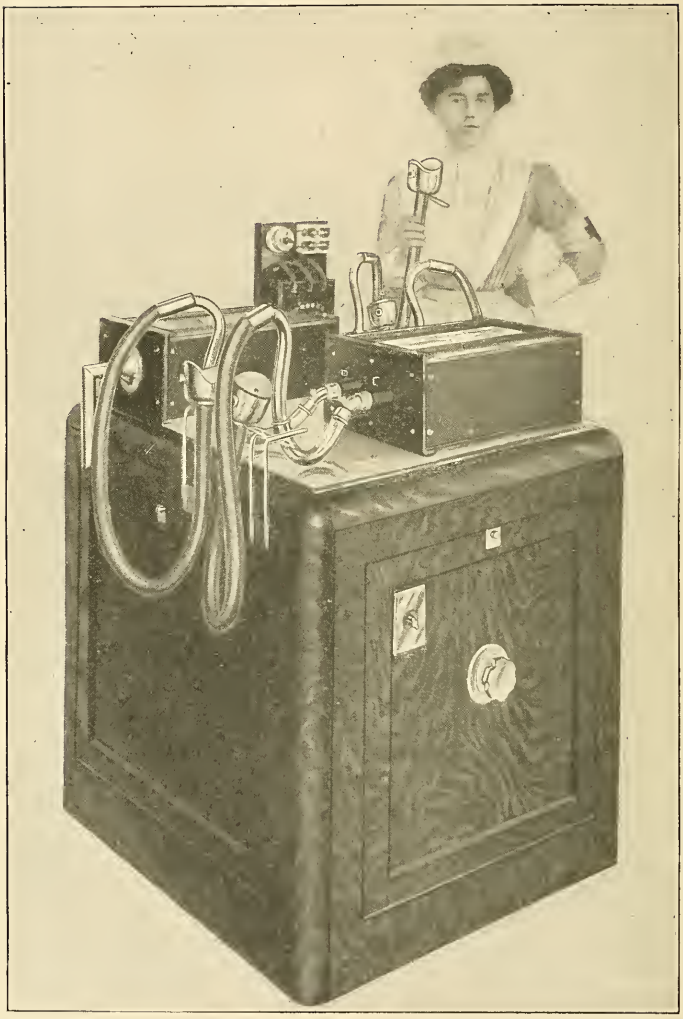
The range of applicability of electrification in the treatment of disease becomes broader and broader as time passes. Wherever electrification is used, directly or indirectly, for the cure of disease, it is to be ranked as an electro-therapeutic agent. Any product of electrification that is used chemically must be classed with electro-therapeutics.

A product of electrification, known as oxyoline, by virtue of its merits is now creating considerable interest in the medical world. The apparatus used in creating oxyoline consists of an electrical ozoniser, operated by an alternating current of high potential power—about twenty thousand volts—but the volume of current used is very small, being less than two amperes.

When the machine is in operation, a decided purple glow is to be seen in the ozonisers and as the air is driven through the electrical discharge, the oxygen is converted into ozone. A pressure blower is connected directly to a motor and after the oxygen is converted into ozone, it passes through the crescent shaped tube, partially filled with a mixture of pinus oils. Here the ozones and oils form a new chemical compound which has been given the name of "Oxyoline."

The identity of the ozone is lost in forming this new compound both as to its irritating properties and odor and also chemical reaction. In producing oxyoline, none of the antiseptic or blood building powers of the ozone are lost. These powers are increased to a marked degree through the agency of the terpenes.

Oxyoline contains no ozone in its free state. While free ozone is a



An oxyoline machine in operation.
The mask is placed over the mouth and nose, and the patient inhales. This shows the simplicity of the treatment.

powerful oxidising agent, those who have experimented with it find that it is too irritating to the respiratory organs to be practical, making it impossible to use sufficient of it to oxidise the blood to any great degree.

The new compound gas is very agreeable to the sense of smell and the ozone is so disguised as to be unrecognizable in the product, oxyoline. The pungency is so modified as to enable persons to inhale a ten times greater quantity of the new compound than it would be possible to take of the free ozone. Consequently, oxyoline has ten to one times greater oxidising powers than ozone.

Oxidising the blood has greater significance in the treatment of disease than the average physician is prepared to believe. In re-calling our lessons in physiology, we are reminded that the normal temperature of the body is produced, and maintained, by the action of the oxygen we breathe upon the fluids of the body, causing combustion. Then, it is natural to conclude that persons, who have a sub-normal temperature, carry on an insufficient amount of combustion.

We have learned empirically that fresh air treatment is a great benefit to run-down persons, but just why such great benefits are to be derived, we have failed to give much thought.

As soon as oxidation to a part is diminished, that part begins to die, and becomes a suitable field of infection.

While much time and energy has been expended in obtaining the active principles of drugs for therapeutic purposes, but little thought has been given, heretofore, to ways and means of rendering the air more active for use as a curative agent. Heretofore, the world has been content to use air as Nature made it.

Dr. Wm. D. Neel, of Chicago, has rendered the profession a great service in inventing the active oxidising agent, oxyoline. This gas is taken directly into the circulation, by inhalation, and produces wonderful effects upon the blood, by increasing the red corpuscles and hæmaglobin, and through its influence, the quality of the blood is very much improved. Its action upon the vaso-motor nervous system, causes all the organs to perform their functions better.

As organic lesions owe their existence to functional perversion, this treatment has a wide field of applicability.

I have, for some time past, been using the oxyoline method and have had it under close observation, and must say frankly that it produces wonderful results. Almost every form of functional disorder can be treated successfully by it, and it differs from the usual form of drugging, in that its

effects are perfectly natural, the nerves being left calmed and pacific, while the muscular system takes on a feeling of buoyancy and exhilaration.

It differs from other nerve sedatives, in that it neither checks the secretions, nor depresses the vaso-motor action. It is very effective in eliminating waste products by all the channels. It increases the appetite and causes natural movements of the bowels, and its effect upon the kidneys is shown in the clearing up of deposits and re-establishing normal specific gravity.

Nervous tension, due to cerebral congestion, with restlessness, insomnia and melancholia is effectually overcome. It establishes a permanency of vigor, and the nerve-wrecked or care-worn persons are made to realize its influence in an incredably short time.

I have witnessed the most phenomenal and unbelieveable results from the inhalations of oxyoline in the treatment of syphilis. Menstrual disorders of a functional nature yield to its influence promptly.

I will admit that I was not prepared to believe that so many persons suffer from disease, due to under-oxidation of the blood, as is evidenced by sub-normal temperature, until I began to make observations with my thermometer. Neither was I prepared to believe that any agency could act so promptly in establishing a normal temperature, and, upon re-establishing a normal temperature, that functional derangements would disappear so quickly.

The conditions that I would mention especially, as being most amenable to this treatment, are such as neurasthenia, melancholia, insomnia, anæmia, asthma, hay-fever, bronchitis, early stages of plumonary consumption, dyspepsia, constipation, headaches, inactive liver or kidneys, menstrual disorders, and syphilis in any stage, and I would say that it is a most valuable adjunct to surgical, electrical and other procedures, for the relief or cure of organic diseases.

This method is most rational. It appeals to both the physician and the patient, and the results produced are almost invariably satisfactory, especially if the disease has not reached a condition of organic disintegration.

I would suggest that the clinical thermometer be used more freely for the purpose of ascertaining the prevalence of sub-normal temperature, Then to study what relation sub-normal temperature bears to functional diseases. As it has been a revelation to me, so will it be to others.

I submit the question of under-oxidation, with reference to its relation to diseases; more particularly those which have a tendency to chronicity.

General Electro-Therapeutics

It has been the aim all through the preceding pages to answer the most important questions concerning the underlying principles, or fundamental facts, concerning the science of electrification, in all the various modalities, or in other words to lay a solid foundation on which to base the system of therapeutic applications, which we are now about to take up more in detail in the special electro-therapeutic index. With the proper care in the preliminary preparation, we will be able to go ahead intelligently, and can show a "reason in our madness," and by applying the known and fixed laws governing the science, we can be reasonably sure of getting satisfactory returns, and a uniformity of results, which will bring both success to us, and relief to our patients.

Some of you have no doubt wondered why we were so slow in getting at the practical therapeutics of the guide, but the experience of years of teaching and practice. when we had no one to teach us except the slow, painful, expensive and valuable school of experience, has shown to us conclusively, that it is far better to go ahead slowly, and be sure, than to "rush in where angels fear to tread," and make mistakes, and fail. If you have thoroughly digested what has gone before, then we could stop right here, and leave you alone with the problem of therapeutics, feeling sure that you could "work out your own salvation," without fear and trembling, but as we are all human, and liable to mistakes and to forget, we have prepared a condensed outline of electro-therapeutics, which takes up the exact details of the technique, of all of the known indications for electrification as a therapeutic agent. This is especially for the busy practician and intended to help his forgettory.

Science is the sum of demonstrated facts, and we have endeavored to place before you, in a simple language, and a clear and concise manner, the series of electric facts which have been demonstrated.

Knowing these facts, and the laws governing the production of the phenomena, the application of them is easy, and the practical technique follows a logical sequence. However, we will now proceed to go more into detail, in the treatment of some of the general constitutional and local diseases, and give special technique in those conditions which will most frequently confront the beginner, and bring the best results.

As this book deals entirely with electro-therapeutics we shall not enter into the etiology of disease, or the pathological conditions, or the medical treatment of the case.

We take it for granted that the physician who reads this book, has carefully studied the course of thirty lessons in electro-therapeutics from the National College of Electro-Therapeutics, Lima, Ohio, to which this guide is but a corollary or supplement, and has correctly diagnosed the case to be treated; that he recognizes the pathological conditions and is familiar with the medical treatment of the case.

It should be understood that no kind of electrical treatment contra-indicates the use of internal or local medication, or the use of such adjuvants as massage, baths, exercise, diet, etc.

It is frequently advisable to combine these methods with electrical treatment.

In outlining a definite line of treatment for each disease, which we shall now do, it should not be necessary to explain in minute detail the method of supplying a certain line of treatment, if the previous pages and the course of thirty lessons have been carefully studied and remembered. For example, if general faradisation or central galvanisation is the treatment recommended, we cannot specify in each individual disease where to hold the positive and where the negative pole, or whether to use the primary or secondary coil.

In each case the physician should understand a sedative or a stimulating effect is desired, and the preceding pages or lessons have told him how to secure either sedation or stimulation, with either general faradisation or central galvanisation.

It should not be necessary for us to state in each disease where the faradic battery is used whether the primary or secondary coil should be used, for we have already explained the difference in effect between the two coils and told where each should be used.

We will, however, at the risk of repetition, "to make assurance doubly sure," state a few facts which will, if remembered, be a sufficient guide for the subsequent pages.

The following facts are important in every case treated; not one of them should be forgotten.

CONDENSED FACTS FOR THE GENERAL PRACTICIAN WHO USES ELECTRIFICATION

P. P. P.—Positive pole for pain.

Electrolysis is chemical, galvanic only.

Phoresis is mechanical, galvanic and static.

Catalysis is physiological, galvanic, faradic, static.

Never use a bare metal electrode on the dry skin.

The faradic has a mechanical and catalytic action.

The galvanic is the only current having a chemical action.

Mild currents only should be applied to sensative parts.

The best method of irritation is by rapid change of polarity.

Use iodine preparations under negative pole in cataphoresis.

Use cocaine and alkaloids under positive pole in anaphoresis.

Both currents and either pole have a great influence upon nutrition.

Do not make long exposures to the X-ray, with tube close to patient.

Never leave a galvanic or faradic battery turned on, or short-circuited.

The battery should be in a condition to run continuously during treatment.

The electrodes should always be in position before the current is turned on.

Don't try experiments on patients. Try them first on yourself and see how it goes.

It must be remembered that for treatment, a low current for a long time is more efficient and agreeable than a high current for a short time.

Frequent interruptions of the current or changes of polarity intensify the effect of the current and are often necessary to relax tense muscles, etc.

The static current is silent, continuous, in same direction, no shock, generated by induction, has low amperage, high voltage, no chemical action.

The static induced is interrupted, but flows in the same direction, but intermittently, is induced, has low amperage, high voltage, no chemical action.

In voluntary muscles, contractions are produced immediately upon ap-

plying current, and at the end of the treatment they return to their normal condition.

The primary coil gives more a current of quantity and produces more violent muscular contractions, but lacks the penetrating power of the secondary current.

Galvanisation of the sympathetic influences the vaso-motor and trophic processes of the brain and spinal cord, the face, eyes, muscles, skin and many parts of the body.

The galvanic current will stimulate the absorbents more powerfully than the faradic current, and is the current to use in removing hypertrophies, morbid growths, effusions, etc.

Don't let female patients take static crown breeze with hats on or with wire or celluloid pins or combs in hair, as the wire is painful and the celluloid may explode and burn the hair.

It is frequently advisable, in addition to treating the diseased part itself, to apply the treatment to adjacent parts, to act upon the circulation and nutrition of the diseased parts.

If your battery or machine don't work, hunt for the trouble till you find it, and see if it is not more your own fault than that of the apparatus. "If at first you don't succeed, try, try again."

The positive pole is acid, liberates oxygen, contracts blood vessels, decreases nutrition, coagulates albumen, corrodes metals, causes dry, white, hard scar, relieves pain and irritation.

The negative pole is alkaline, liberates hydrogen, dilates blood vessels, increases nutrition, does not coagulate albumen or corrode metals, causes no scar, but a moist, red, soft condition, increases pain and irritation.

The galvanic current is constant, flowing in the same direction, and is silent, without shock, generated by chemical action, has high amperage or current strength and low voltage or pressure, has chemical action.

The faradic current is alternated and interrupted, flowing in opposite direction, is noisy, gives shock, generated by induction, has high voltage or pressure and low amperage or current strength, has no chemical action.

The electro-thermal bath is a very excellent method of applying faradisation and may be used in any case where this treatment is to be given. The vapor bath of itself is frequently a valuable auxiliary to the electrical treatment.

Good results cannot be secured with a poor battery or improper methods of application. A faradic battery having a small coil of coarse wire produces a crude, harsh current—lacking power of penetration, and will invariably irritate a nervous patient.

In involuntary muscular fibers, as in the intestines, stomach, œsophagus, contractions are immediately started upon application of the circuit, but the movement when once induced will continue for a considerable time after cessation of the treatment.

The best method of lessening irritability with the faradic current is to begin with a very mild current, gradually increase to the highest point that does not produce pain, and after holding in position for a few moments gradually reduce the strength of current. (Swelling treatment.)

It is not as important in using the faradic current that attention be paid to polarity, yet it is always advisable to use the positive for the active pole when a sedative effect is desired, and the negative for the active pole when a stimulating or irritating effect is desired.

Observations with a fluoroscope should be made only in a well darkened room. The operator will soon find that the same apparatus which gives only faint outlines, in broad daylight, will show every detail at night or in a dark room, after his eyes have become accustomed to the darkness.

The secondary coil produces a greater sedative effect and is a current of greater tension and penetrating power, hence more applicable to nervous and deeply seated diseases than the primary current. The finer and longer the wire in the secondary coil, the greater power of penetration and sedation.

In chronic cases it is necessary occasionally to vary the treatment. Where general faradisation has accomplished all that it will, general galvanisation may produce still further results. Central or general galvanisation may fail in a case where general faradisation would produce results and effect a cure.

The flowing of current electrification from positive (higher), to negative (lower), is due to "difference of potential." (Potential in electrical parlance means level). When the "potential is equalized" the battery is inoperative and is said to have "run down." When deleterious action occurs within the cell it is said to "polarise."

Electrification sets in motion forces that continue to act for hours and even days after treatment, hence treatment should not be given too frequently. Nervous diseases in particular may be aggravated by too frequent treatments. Ordinary chronic cases require three or four treatments weekly. Acute or sub-acute cases may require daily treatment. Nothing will be gained by treating cases more than once daily.

The resistance of the skin, which is very great, is diminished by enlarging the electrodes, which allows greater diffusion of current. If the current be too strong and applied too long a time at a given place there ap-

pears at the positive an eschar from acid reaction. At the negative, ulceration from alkaline reaction. The electrodes should be moistened with a solution of chloride of sodium; this is a better vehicle than water, for the reason that the positive takes the chlorine and the negative takes the sodium corpuscles.

There is scarcely a chronic disease treated with electrification where we cannot trace at least part of the good results of treatment to the effects on nutrition. In the treatment of almost any chronic disease always remember that electrification properly applied will stimulate circulation, and that the increased flow of blood will bring an increased amount of nutrition; that the contraction of muscular tissue produces the same effect as massage or gentle exercise; that nutrition may be effected through a chemical process; that the process of waste and repair may be promoted, and that the nutrition of the entire system may be improved through reflex action as well as by the direct effect of treatment, securing a constitutional, tonic, stimulating effect.

THE SCIENCE OF ELECTRO-THERAPEUTICS

It has been claimed by those whose interests are inimical to advanced therapeutics, that electro-therapeutics is not a science.

Science is the sum of demonstrated facts, and the facts which have been set forth in these pages are capable of demonstration, and, therefore, we make the claim, that *electro-therapeutics is a science.*

This *science* is yet in its swaddling clothes, and it is only a question of time, when it will come forth full fledged and powerful, and be one of the mighty factors in our armamentarium, and an efficient adjunct in treating disease, and in bringing about a restoration of the normal condition of health.

A preliminary knowledge of anatomy, physiology, physics, chemistry and psychology, will make the road of the student of scientific electro-therapeutics much easier to travel, and help him over the rough places and through the short cuts, but as all are not equally fortunate in this respect, we have tried to make up to those who are deficient in these things, in the lessons, and if these have been well mastered, the study of the guide will have been easy.

The careful student who has followed the teachings so far, is just at the commencement of his work, and at the threshold of the great storehouse of knowledge, from which he may take whatever he can apply, and use to advantage in the broad field of therapeutics.

Theories are fine things, and as theories go, any theory is all right as

long as it applies, and is capable of demonstration, but facts are stubborn things, and we are frequently confronted by conditions, not theories, and if things do not always go just as you wish, do not jump at conclusions. Remember that electrification follows fixed laws, and if there is a seeming contradiction, or an apparent paradox, you should set your "thinker" in operation. *There will be a reason somewhere.*

If you leave a switch open, and there is a broken circuit, hunt for the gap and fill it. Do not expect an insensate thing, like a battery, machine or tube, to go contrary to a natural law, because a finite and very fallible operator has made a mistake.

Electrificatlon is a docile and willing servant, when properly handled, but is a stubborn and unyielding master when ordered to act contrary to its fixed rules.

Electrification in its divers manifestations is unexcelled in some things, but it is not as good as other things in many instances, so do not claim that it is a "cure-all." Sometimes it will do what nothing else can, and vice-versa, but it comes as nearly being a universal helper as anything we have at our command.

Judgment, discretion, caution and discrimination must be used both in the selection of the case, and of the choice of the method of application.

Reason, care and prudence will succeed, while hurry, carelessness and guess-work will only bring trouble.

What is worth doing at all, is worth doing well. Be careful of details.

Nothing is too small or unimportant to be neglected or overlooked. Many dismal failures are recorded on the tablets of history, which were due to carelessness or ignorance.

You know the old story, how a nation was lost because of a single little horse-shoe nail.

A slight mistake may cause a shock or a painful sensation, which may frighten or disgust a timid or doubtful patient, and cause them to not only not return, but keep others away, and thus lessen your practice, or ruin your chances of success, while a careful observance of details and wise prevention of the unpleasant things, may start the whole community your way.

It is the little things which make or mar success, and success is by no means a little thing.

Let us all go ahead and make our specialty more perfect, more valuable, more and more needed, more helpful, more respected, more scientific. Let our motto be: "Bonus, Melior, Optimus."

KEY TO ABBREVIATIONS

IN THE OUTLINE OF THE VARIOUS DISEASES, AND CONDITIONS, SET FORTH IN THE FOLLOWING PAGES OF THE ELECTRO-THERAPEUTIC INDEX, THE FOLLOWING ABBREVIATIONS WILL BE USED:

Abd.—Abdomen.
Ana.—Anaphoresis.
Alt.—Alternated current.
Cat.—Cataphoresis.
Con.—Constant current.
C. G.—Central galvanisation.
B. W. G.—Birmingham wire gauge
Diag.—Diagonal,
Elect.—Electrode.
E. O. D.—Every other day.
E. M. F.—Electro-motive force.
F.—Faradic current.
G.—Galvanic current.
G. F.—General faradisation.
G. G.—General galvanisation.
H. F.—High frequency current.
Int.—Interrupted current.
Int.-ut.—Intra-uterine.
Lab.—Labile, or moving application.
Long.—Longitudinal.
Ma.—Milliampere.
N. P.—Negative pole.
P. P.—Positive pole.
P. P. P.—Positive pole for pain.
Prim.—Primary faradic current.
S.—Static current.
Sec.—Secondary faradic current.
Sin.—Sinusoidal current.
S. Ind.—Static induced current.
S. Ins.—Static insulation.
S. S.—Static sparks.
Stab.—Stabile, or stationary application.
Trans.—Transverse.
Vac.—Vacuum.
Vag.—Vaginal application.
Vib.—Vibration.
\+ Plus or positive pole.
— Minus or negative pole.

ELECTRO-THERAPEUTIC INDEX

N. B.—In the Index items, the figures (in parentheses) refer to the pages preceding 240.

SEE KEY OPPOSITE

ABCESS, to abort

G. con., + at lesion, — distant, 15-20 ma., 10 min., daily. Use Bennett phoric, (78), under +, with witch hazel, adrenalin, cocaine or other vaso-motor constrictor, — distant. Copper needle, + at lesion, — distant, 2-6 ma., 5 min., daily. Ultra-violet vac. surface elect., (147), + to lesion, — grounded. Violet Minin, or helios light bath, over lesion, 30 min., daily. (197). S. jet, (114), + locally.

Abcess, old, open. to heal (See Ulcer)

Abcess, mammary, threatened (See Abcess, to abort)

G. con., + at gland, clay pad, — on back, 10-20 ma., 15-25 min., daily.

Abcess, Tubercular (See Abcess, to abort)

Abdominal Pains (See Pain)

"Find out the cause," etc., and apply P. P. P., p. r. n.

Abortion, Habitual (See Displacements, Fibroids, Metritis, Leucorrhœa, Prolapsus, Sub-Involution)

Give uterus a long rest from gestation, and institute a prolonged and regular course of tonic local intra- and extra-uterine treatment, to relieve any organic or functional derangement, with such applications as are indicated, strength and frequency, p. r. n.

Abortion, Threatened, to prevent

F. Sec., (long fine coil, not less than 3000 ft.), from sacrum to feet, very mild, 10–20 min. G. con., + abd., or sacrum, (Bennett disc), (82, 142), — at feet, 10–30 ma., 10–20 min., p. r. n.

Acne

G. con., + to point, ana., (Bennett phoric elect.), (78), with cocaine, or bi-chloride sol., adrenalin or hammemelis, — distant; or potass. iod., under —, 5 ma., 10 min., daily. S. s., (115). Violet light, (198). G. f. and c. g., (97, 101). X-ray, soft tube, short exposure, e. o. d., p. r. n., (188), (192), (199).

Actinomycosis

X-ray soft tube, short exposure, often, p. r. n.

Acute Diseases, Sequelæ (See Sequelæ)

Acute Neuritis (See Neuralgia) (205)

Adhesions, Pelvic

G. con., electric massage, with hand or roller, + over abd., — in vag., 10–30 min., e. o. d. Sin., same way, (82, 142).

Afterpains, to check post-partum hemorrhage

F. sec., (short coarse coil), or g. alt., or sin., from int.-ut., to abd., (Bennett disc), (82, 142), swelling current, (52), (75).

Afterpains

F. sec., (long fine coil), from back to abd., or g. con., + abd., Bennett disc, (52), (81), (142), — back, 10–20 ma., 15–30 min.

Agitans, Paralysis (See Paralysis)

Alcoholism

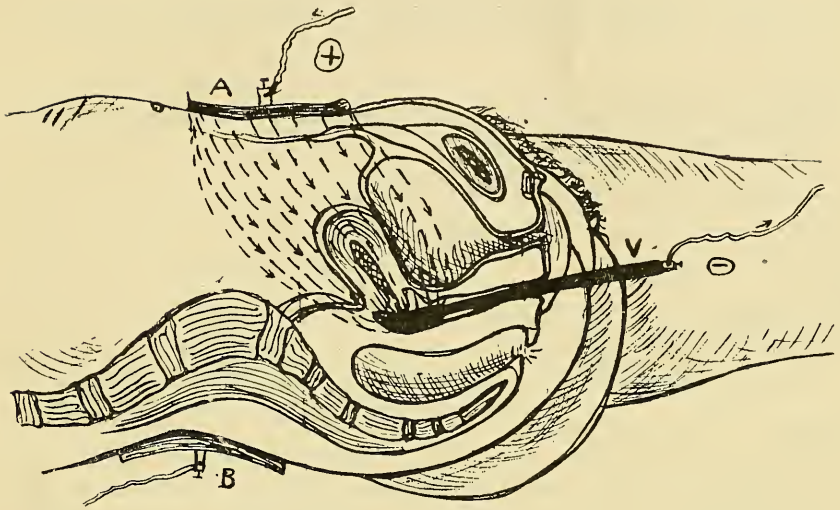
Electro-vapor baths, (92). Electric light baths, (187). Violet light baths, (189).

Alopecia

G. con., lab., — scalp, 5 ma., 10 min., e. o. d. S. shower, (113), to head, —, 15 min., daily. (199).

Amenorrhœa

G. con., — sacrum or abd., (Bennett disc, 82, 142), + feet, e. o. d., or g. con., — int.-ut., or vag., + back or abd., (See cut), 25 ma., 20 min., e. o. d. F. prim., same way, or sin., same way, (52, 75), or f. prim., bipolar int.-ut. G. f., and c. g., e. o. d., (97, 101). Bidet light bath, (194).



Anal Diseases (See Rectal Diseases)

Analgesia, to produce

G. con., + to part, — distant, 5–20 ma., 12–20 min. Sin., locally. F. sec., (long fine coil), high tension. Violet light, (186). Bennett magnetone, (170). Bachelet wave generator, (176). Helios light, (198).

Anæmia, Cerebral (See Brain) (173)

Anæmia, General (See Debility, General, Marasmus)

Anæsthesia, Local, to produce

G. con., + to part, ana., 10 ma,, 10 min., — distant. Bennett phoric, (78). Violet light, (197), 30 min. F. sec., (long fine coil). S. vib., Bennett method, (123).

Anæsthesia, to remove

G. con., — lab., 10 ma., 20 min.. daily. F. wire brush locally, lab., S. s., (112, 115).

Anchylosis (See Synovitis)

G. con., if inflamed, + to part, — distant; if not painful, — to part, + distant; or + and— on opp. sides with frequent reversals. Bennett magnetone, (170).

Aneurism (See Hemorrhoids)

G. puncture, platinum needle, or coil of wire, + 20 ma., till clot

forms, — distant. Reverse polarity till needles loosen, 5–6 ma., 2–3 min.

Angina

G. con., + over heart, — nucha, 5–10 ma., 2–5 min. C. g., (101). S. ins., (112). Helios violet light, (198), 20 min.

Ante-Flexion, Uterine (See Displacements), (228)

Ante-Version, Uterine (See Displacements), (228)

Anthrax (See Carbuncle)

Anus, Fissure of (See Ulcer)

G. con., + copper elect., lab., in fissure, — stab., near, 5 ma., 5 min., e. o. d., (87).

Aphasia (See Paralysis)

If acute: G. con., + over Brocha's center, — behind opp. ear, 3-5 ma., 5 min., daily. S. spray and shower, (113, 114), 10 min., daily. If chronic: G. con., + at nucha, — over Brocha's center, large elect., both stab.; then — at sub-aural region, + nucha, 3-6-10 ma., 3-6-10 min., daily. Bennett head magnetone, (170), 10-40 min., daily.

Aphonia (See Paralysis)

F. prim.; or g. con.; or g. int., — to throat, external; or s. ind. Electric massage with hand, (148), + in hand of patient, or down spine, lab. S. ins., 15 min daily, (112).

Apoplexy

G. con., to brain, (67, 70, 102), — lab., 1-3 ma., 10 min., daily, (only after 3rd wk.). S. ins., and crown, (112, 114), 15 min., daily. F. sec., (long fine coil), nucha, and spine, to affected muscles, or over motor points, (207). Mild lab. massage, 10 min., daily. C. g., and g. f., (97, 101).

Appendicitis, Threatened

G. con., + Bennett disc, (82 142), over appendix, — back, (81), 10-15 ma., 30-60 min., daily, or oftener, p. r. n., (200).

Arthritis (See Rheumatic Arthritis)

Acute: G. con., + to joint, 5-15 ma., 20 min., daily. G. massage with hand, — feet. S. spray, (114). S. vib., (123), + to joint. Violet light, (198), 15-30 min., daily.

Chronic: If part can be immersed in a water bath, (96), of strong lithia sol., — g. con., to elect. in bath, + distant, outside bath, 15-30 ma,, 15-20 min., daily.

If helpless apply portable light bath, (194), general, or (193), local, 20 min., daily, (196, 200). Bennett magnetone, (170).

Arthritis Deformans (See Arthritis)

If not painful: G. con., cat., potass. iod., on — to joints, with Bennett phoric, (78), 20 ma., 10 min., daily. S. s., mild local, (200).

Articular Inflammation (See Arthritis, Rheumatism)

Artificial Respiration (See Respiration)

Aspermatism (See Sterility)

Asphyxia (See Respiration)

F. prim.; or sec., (short coarse coil), from left side neck, stab., to epigastrium, (214), lab., strong current, int., 15-20 times per min., to keep up artificial respiration, p. r. n.

Asthenopia (See Eye Diseases)

G. con., to eye cup, (80), — nucha, or temple, 2-3 ma., 5 min., daily. F. sec., mild, (long fine coil), same way. S. ins., + spray, (114), to eye, daily, 10 min. C. g., (101).

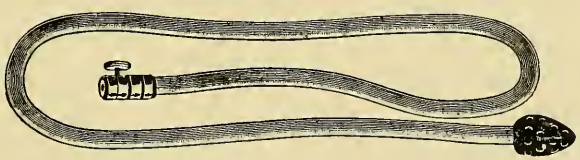
Asthma (See Bronchitis)

G. con., + behind left ear, — epigastrium, 10 ma., 10 min. daily. G. con., to spine, (39), + nucha, — sacrum, stab., 15 ma., 20 min., daily. C. g., (101). Sin., stab., to sympathetic in neck, (214). S. ins., (112), 20 min., daily. Violet light on neck and chest, (200), 20 min., daily. Oxyoline inhalations, (229), 20-40 min., daily.

Astraphobia

Calls for a course of electrification as a general tonic. G. f., and c. g., (97, 101). Vapor baths, (92). S. ins., (112). S. cage, (183). Magnetisation, bath and waves, (170, 176).

Ataxia, Locomotor (See Locomotor Ataxia)



Atony of Stomach (See Dyspepsia)

F. sec., (coarse coil), deglutable elect. in stomach, (See cut), other pole, lab., over epigastrium, (214), 10-15 min., daily. C. g., (101). F., front to back, (38, 81, 82).

Atrophy and Non-Development (See Bust Development)
Bust and penil developer elect., used with g. con., int.; or alt.; or sin.; or f. sec., or prim., moderate vac., and mild currents, e. o. d. (See Lesson No. 20, page 5).

Atrophy, Muscular, Simple
G. con., — lab., to parts, + distant, 10-20 ma., 15-20 min., daily. F. sec., (coarse coil), electric massage to wasted muscles, (102).

Atrophy, Optic (See Eye Diseases)

Atrophy, Progressive Muscular
F. sec., (coarse coil), local massage, large electrodes, (172). G. con., — lab., to part, (142), + distant. G. con., to spine, (39). S. s., or roller, (115, 116). Duration and frequency, p. r. n.

BACKACHE (See Pain)

Baldness (See Alopecia)

Birth Marks (See Nævus)

Bladder, Irritable (See Cystitis)
F. sec., (long fine coil), from bladder, or sac., to abd. G. con., + abd., or sac., — feet. G. con., + to soluble bladder elect., (91), — back, or abd., Bennett disc, (82, 142), 15 ma., 15 min., daily. Sin., from back to abd., mild.
In girls and children, g. con., + over pubes, — back, 5-10 ma., 10-15 min., daily, (181).

Blastomycosis (See Actinomycosis)

Blemishes (See Nævus, Hairs, Moles) (86)

Blindness (See Eye Diseases)

Boils, Open (See Ulcer)
G. con., + copper tip, to lesion,— distant, 5-10 ma., 5-10 min., daily, (88). (199).

Boils, to abort (See Abcess)

Brachial Neuritis (See Neuralgia, Pain)
G. con., + to part, — distant, 5-15 ma., 10-20 min., daily. S. spray, (114), to part. Violet light bath, and helios lamp light, (200), 20 min., daily.

Brain Troubles (See Head Pains, Insanity)

Various brain conditions should be met with the indicated g. con., polarity, thus:

ANÆMIA: G. con., — lab., to forehead, + nucha, stab., 2-4 ma., 2-6 min., daily.

HYPERÆMIA: Just the reverse polarities.

NEURASTHENIA: G. con., long., trans., or diag., p. r. n., with g. f., and c. g., (97, 101), weak currents, brief sittings, daily. S. crown, (113), and Bennett head magnetone, (170), 15 min., daily. Oxyoline inhalations, (229), 20-40 min., daily.

HEMORRHAGE AND SOFTENING: No treatment under 3 weeks, or till all active inflammation subsides.

If painful: G. con., + to part, — distant, long., trans., or diag., p. r. n., according to the symptoms, and location of the clot. G. con., + to relieve pain, (See Pain), and check hemorrhage, and to contract and harden the tissues, (213).

If no pain or hemiplegia: G. con., — over lesion, to dilate and cause absorption of extravasation, and relieve the pressure, 2-6 ma., 2-6 min., daily. Bennett head magnetone, (170), 5-15 min., daily, to influence tissue metabolism, (173).

Breast, Cancer (See Carcinoma) (86).

Breasts, to develop (See Bust Development)

Bright's Disease

S. ins., (112), 30 min., daily, + to feet, bare, or to crown, — wet sponge, (81), on bare skin over kidneys; surging, (122), or s. vib., Bennett method, (123), 30 min., daily. S. shower, (113), 5 min., daily. S. s., spine, mild, daily. S. cage, (183). Bennett magnetone, (175, 182). Oxyoline inhalations, 20-40 min., daily, (229). (206).

Bronchitis (See Asthma, Consumption)

G. con., to pneumogastric nerve, (215), + in fossa under left ear, — top sternum, 5 ma., 10 min., daily. Oxyoline inhalations, 20-40 min., daily. (229). (197).

Bulbar Paralysis (See Paralysis, Bulbar)

Bunions (See Chilblains)

S. s., and roller, (115, 116), short, 10 min., daily. G. con., Bennett phoric, (78), cocaine, + to joint, — distant, 5-15 ma., 5-15 min., daily. S. spray, (114), local. Violet light, (200), 20 min., daily. Bennett magnetone, (170).

Burns

G. con., + to lesion, 5 ma., 10 min., daily. Bennett phoric, ana., (78). Violet light, 20 min., daily. (197). (199).

Burns, X-Ray, to prevent

Follow every X-radiation with the same or longer exposure to the violet light, (199).

Bust Development

Elect.-vac.-massage, local. Bell over breast. G. con., — to bell, + on abd., Bennett disc, (82, 142), or + in vag., carbon elect., 5-10 ma., 10-15 min., daily, or e. o. d. Sin., or f. sec., from breast to breast, or from one breast to opp. hand. Mild current, and moderate vac., not to be painful. Elect. hand, lab., stroke from periphery, to nipple. (See cut.)

CANCER (See Carcinoma)

Carbuncle, to abort (See Abcess, Boils, Ulcer)

G. con., + to part, — distant, 10-20 ma., 10 min., daily.

SUPPURATIVE: G. con., + to copper needle or elect., in lesion, — distant, 5 ma., 5-10 min.

If open, treat same as an ulcer. (197).

Carcinoma (See Lupus)

G. con., local anæsthesia, by injection, (79), or Bennett phoric, (78), + to part. G. con., — with needles, in Bennett needle holder, (120), in base of growth, (if small), 10-25 ma., 10 min., withdraw, and re-insert needles at right angles and repeat. One seance usually enough. If large, use a number of separate long needles, (see cut page 86), inserted at different angles. In very large growths, both poles may be inserted. with platinum or gold + needles, (86). General anæsthesia, with Massey gold, zinc-mercury elects., (see lesson No. 29), on + pole in growth, with very strong currents, 500-1500 ma., 30-90 min. Parsons method: G, alt., 300-400 ma. X-ray often used to advantage, soft tube, 5-10 in. distant, 5-20 min., daily, or e. o. d. Protect surrounding healthy parts with Allen shield, (159). Follow every radiation with a bath in the violet light, (197).

Caruncle (See Warts)

Cataract (See Eye Diseases)

Catarrh

Nasal: G. con., + copper or zinc-mercury elect., to nose, lab., 2-10 ma., 5 min., e. o. d. H. f., nasal vac. elect., (147), + to nose, 5 min., daily.

Uterine. (See Leucorrhœa)

Summer. (See Fever, Hay.)

Central Galvanisation (See page 101)

Cephalalgia (See Headaches)

Cerebral Affections (See Brain Troubles)

Anæmia: (See Brain Troubles)

Congestion: (See Brain Troubles)

Hyperæmia: (See Brain Troubles)

Cervical Erosions (See Erosions, Ulcers)

Cervical Lacerations (See Erosions, Scars)

Chalazia (See Eye Diseases, Hair, Acne)

Chancroids

G. con., copper or zinc elect., lab., + to part, — distant, 5 ma., 5 min., daily, (88). (197).

Chilblains

G. con., + lab., to part. S. spray, (114), or mild s. s., (115), 5 min., daily, G. con., + copper elect., to part, 10 ma., 10 min., e. o. d. Violet light, (198), Bennett magnetone, (170).

Chloasma (See Liver Spots)

G. con., — lab., electric massage, 10 ma., 10 min., daily.

Chlorosis (See Debility, General, Marasmus)

Chorea

G. con., + to forehead, and down spine, — feet, 3-10 ma., 5-10 min., daily. G. con., spine to epigastrium, (39), 10-15 ma., 10 min., daily. S. shower, (113). S. ins., (112), 15 min., daily. G. con., + over parietals, — hands, 3-5 ma., 3-5 min., daily. (N. B,—Always examine for, and correct, genital abnormalities), (102), (107), (108).

Choroiditis (See Eye Diseases.)

Cicatrix

White scars: G. con., — lab., 5-10 min., 5-10 ma., daily.

Vascular: G. con., + Bennett phoric, (78), with witch hazel, stab., 5-10 ma., 10 min., daily.

Very vascular: G. con., — needles in Bennett needle holder, (120), under surface of skin, 5 ma., 10 min., weekly.

Coccygodynia (See Neuralgia).

G. con., + to coccyx, Bennett phoric, (78), — distant, 5-10 ma., 10 min., daily. S. vib., Bennett method, (123), + coccyx, — feet, 5-15 ma., daily.

Coldness of Extremities

G. con., lab., — to parts, + distant, 5-10 ma., 10 min., daily. F. sec., lab., (coarse coil), to parts. G. f., (97). S. s., (115), to parts. S. roller, (116), same, 15 min., daily. S. vib., Bennett method, (123), — feet, 10 min., daily.

Colon, Scales in the (See Constipation)

Comedones

G. con., — needle in part, 3-5 ma., 15-30 seconds. Follow with g. con., + Bennett phoric, (78), with witch hazel or antiseptics, lab., 5 ma., 5 min., daily.

Condyloma (See Warts)

Conjunctivitis (See Eye Diseases)

Constipation

Either current, + abd., lab., hand, sponge or roller, (89), — back, stab. In chronic cases, use — rectal elect. G. alt., or int., 2-10 ma., 15 min., daily. S. ind., 1-2 in. spark, abd., and back, (81, 82). S. vib., + back, — abd., Bennett method, (123), frequently causes prompt stool. G. f., and c. g., (97, 101), daily, (102), (107).

Consumption, Pulmonary

S. ins., 15 min., daily, (112). H. f., diasolenic zone, or electric cage, (183), 20 min., daily. H. f., surface vac. elect., over lungs, (145). Oxyoline inhalations, (229), 30-40 min., daily. Helios violet light, (198), bath, 35 min., daily. Electric massage over abd., (See Massage). C. g., and g. f., (97, 101), (188).

Consumption, Various (See Tuberculosis)

Contractions

F. con., — lab., to part, + distant, 5-15 ma., 10-15 ma., daily. Dupuytren's contraction of the palmar fascia, has been relaxed this way.

Convalescence, Delayed (See Marasmus)

Corns

G. con., + to corn, or local ana., with Bennett phoric, (78), with cocaine, 5 ma., 10 min., daily. Mild s. s., or local s., + spray, (114), or wood ball, (115), 5 min., daily.

Corneal Opacity (See Eye Diseases)

Corneal Ulcer (See Eye Diseases)

Coughs (See Asthma, Bronchitis, Consumption)

Cramp, Writers' (See Writers' Cramp)

Cystitis (See Bladder, Irritable)

G. con., + copper soluble hydro-elect., bladder tip No. 6, (91), — abd., Bennett disc, (82, 142), 5-15 ma., 10-25 min., daily. Sin., abd., back, mild, 15 min., daily, (151), (197).

DEAFNESS

When due to paralysis or chronic thickening of the tympanum: G. con., —hydro-elect., (80, 91), in external ear, + opp., on mastoid, 1-5 ma., 3-5 min., daily.

If nervous: G. con., + in front of ear, over tragus, — distant, 3-5 ma., 5-10 min., daily.

If there be tinnitus: H.f. insulated glass vac. elect., in external ear,

mild treatments, daily, (147). H.f., surface elect., to mastoid process, mild, often, (147).

Catarrhal: G. con., — over spine, + solar plexus, 5 ma., 10 min., daily. Electro-vapor bath, (92).

Telephone ear, neurotic: S. spray, (114), over ear, 10 min., daily.

Debility, General (See Marasmus)

G. f., sec., med. strength, 15 min. C.g., (97, 101), 10 min., alt., e. o. d. S. ins., daily, 15 min. Electro-vapor baths, (92), p. r. n. Magnetisation, (179), (100), (108), (181).

Degeneration, Reaction of (See Paralysis)

See formula on page 206.

Delayed Convalescence (See Marasmus) (179)

Depilation (See Hairs, Superfluous)

Dermatitis, X-Ray

Violet light, with Russian or helios lamp, (198), p. r. n., 10-30 min., 30-40 in. away, daily. (197)

Development, Bust (See Atrophy, Bust Development)

Diabetes (See Bright's Disease)

S. ins., + at feet, — crown, (113). S. surge, alt., + feet, — over kidneys, bifurcated sponge elect., (81), to bare skin, 25 min., daily. Bennett method of s. vib., (123), same way, 25 min., daily. S. s., to entire spine. G. f., & c. g., (97, 101).

Diagnosis, Electro– (See page 201)

Diaphragm, Spasm of (See Hiccough)

Diarrhœa (See Constipation)

G. f., (97). G. con., abd., to back, (81, 82), lab., roller or hand, (98) + abd., — back, or rectum, 20 min., daily.

Diplopia (See Eye Diseases)

Dislocations

Detected by the electric probe, (202), or the X-ray, fluoroscope, (150), or radiograph, (164). Pain relieved by Bennett magnetone, (170).

Displacements, Uterine (See page 228)

Prolapsus: (See Prolapsus Uteri.)

Ante-flexion: } For the various flexions and versions apply bi-polar
Ante-version: } f., either int.-ut., or ut.-vesical, or ut.-rectal, so as to
Retro-flexion: } stimulate to contraction, the weakened muscles in
Retro-version: } the flexed walls, or in the ligaments, if verted, p. r. n. G. int., or alt., from int.-ut., to abd., or sacrum, with Bennett disc, (82, 142). S. vib., Bennett method, (123), excellent. Sin., is splendid. All treatments should be mild, (g. con., 20-40 ma.,) and

often, over a long time, till uterus is normal. "Find out the cause." Select the current indicated to counteract it, and treat persistently, p. r. n.

Distichiasis (See Hairs, Superfluous)

Dizziness (See Brain Troubles)

Drug Addictions (See Alcoholism)

Dysentery (See Diarrhœa)

G. con., + hydro-elect., rectal soluble, (91), in rectum, with water, — feet, 10-15 ma., 10-15 min., daily.

Dysmenorrhœa

Membranous: G. con., — int.-ut., + abd.; 20-50 ma., 15 min., twice a wk., between periods. F. sec., (long fine coil), vag., abd., e. o. d. Obstructive: (See Stenosis, Stricture). S. ins., and breeze. S. s., to spine, daily. (112, 114). C. g., (101).

Virginal: G. con., + abd., and sacrum, — feet, 25 ma., 30 min., daily. G. con., carbon or copper elect,, cotton covered, + vag., — feet, abd., or sacrum, with Bennett disc, (82, 142). S. ins., (112). S. spray, (114), to back, 15 min., daily, Bidet violet light chair, (194), local, 30 min., daily. Body magnetone, (175, 157), 30 min., daily.

Dyspepsia, Atonic

G. con., to pneumogastric, thus: + to fossa under left ear, — top sternum, 5 ma., 10 min., daily. S. ins., (112), and shower, (113), daily. C. g., and g. f., (97, 101), sec., (long fine coil), 10 min., daily. F., stomach elect., swallowed, to pad over epigastrium, (fine coil), 5 min., daily, or front to back, (38).

Dyspnœa

G. con., + in fossa under left ear, — top sternum, 5 ma., 10 min. G. con., + to sympathetic nerves in neck, — at 7th cervical vertebra, 2-5 ma., 10 min., daily. G. con., to spine, (39). C. g., and g. f., (97, 101). S. ins., (112), 15 min., daily. Oxyoline inhalations, (229), 20-40 min., daily.

EAR-ACHE. (See Deafness).

G. con., + in ear on wet cotton, or hydro-elect., (80, 91), 3-5 ma., 2-4 min., repeat, p. r. n. S. spray, (114), over ear, 5 min. Violet light, (195), over ear, 15 min.

Eczema (See Lupus, Carcinoma).

G. con., + to parts. C. g., (101). S. s. and s. spray, (114, 115), 5 min., daily. Violet light, (198), 15-30 min., daily. X-ray, soft tube, 10 in. away, 5-10 min., daily, or e. o. d., p. r. n. (188). (197).

Electric Hand (See Massage, Electric)

Electric Injections (See Constipation, Impaction)

Electro-Diagnosis (See page 201)

Emissions, Seminal (See Neurasthenia)

G. f., and c. g., (98, 101, 39). Vapor baths, (92). S., ins,, (112). S. s., (115), spine. If excessive: G. con., urethral elect., (See Stricture), — internally, + distant, 2-5 ma., 2-5 min., daily. S. vib., Bennett method, (123), + perineum, — nucha, mild vib., 5-15 min., daily. Violet helios light to spine, (198). Bidet local bath, (194), 20 min., daily. Oxyoline (229) inhalations, 20-40 min., daily.

Endometritis (See Metritis, Leucorrhœa)

G. con., — int.-ut., + abd., 10-60 ma., 10-30 min., once or twice a wk., between periods.

Hemorrhagic: (See Hemorrhage). G. con., + int.-ut., copper tip, (88), — abd., Bennett disc, (82, 142), 10-15 ma., 5-10 min., e. o. d. Reverse poles a few min,, to loosen elect.

Virginal: (See Dysmenorrhœa, Virginal.)

Enlarged Lympathics (See Glands, Enlarged, Goiter)

Enlarged Prostate

G. con., — prostatic phoric, (89), or No. 6 soluble tip, (91), hydro-elect., with potass. iod., in — tube, + back, (81), 2-8 ma., 3-10 min., e. o. d., or reverse poles to get local interstitial copper ana., (73, 88).

Epididymitis (See Orchitis)

Epilation (See Hairs, Superfluous)

Epilepsy (See Hystero-Epilepsy)

G. con., + forehead, — nucha, 3 ma., 5 min., daily. G. con., + lab., spine, — feet, 15 ma., 10 min., daily. C. g., and g. f., (97, 101). S. crown, (113), 20 min., daily. Violet light, (197), 15 min., daily, (102).

Epistaxis

G. con., + copper elect., (88), — nucha, 3-10 ma., 5-10 min., repeat p. r. n. Reverse poles at finish for 1-3 min., to loosen tip. G. con., sponge elect., or Bennett phoric, (78), + over nose, — nucha, 5 ma., 10 min.

Epithelioma (See Carcinoma, Lupus)

G. con., — in Bennett needle holder, (86, 120), under base, + distant, 5-20 ma., 10 min., remove and reinsert needles at right angles to 1st insertion, and repeat. Only one operation needed. Use local anæsthesia first, with injections, (97), or with Bennett phoric, (78), 5-10 ma., 10 min. Dress with HgO_2, ungt, till growths drop off, then with ordinary antiseptics. (197).

Erosions, Cervical (See Ulcer)

G. con., + copper or zinc tip, lab., to os, (88), — abd, Bennett disc, (82, 142), 5-20 ma., 10 min., e. o. d., (90).

Erysipelas

G. con., + Bennett phoric, (78) with witch hazel, or antiseptics, — distant, 3-8 ma., 5-10 min., daily. Russian or helios violet light bath, (198), 10-30 min., daily.

Erythema (See Hives)

Excoriations (See Erosions, Ulcers)

Exophthalmus (See Goiter)

Eye Diseases, Various (See Asthenopia, Diplopia)

CATARACT: G. con., sponge or eye cup, (80), to eye, other pole to cheek. Turn on to 2-5 ma., 1-2 min., then off slowly, reverse poles, repeat several times, for 5-18 min., daily. Close with — on eye. Result slow but sure in soft forms. S. vib., Bennett method, (123), — to eye if painful, + if not, very mild, 2-3 min., daily.

CONJUNCTIVITIS: G. con., + eye cup, (80), — distant, 2-4 ma., 3 min., daily.

CORNEAL OPACITY: G. con., — eye cup, (80), + cheek, 1-2 ma., 2 min., daily.

CORNEAL ULCER: G. con., + copper tip to ulcer, lab., ½-1 ma., 1 min., e. o. d. S. spray, (114), +, 5 min., daily.

EXOPHTHALMIC GOITER, (SEE GOITER): G. con., + neck, — back, 5-10 ma., 20 min., e. o. d. S. spray, (114), local over eye. S. crown, (113), 15 min., daily. H. f., elect. hand, (148), 5 min., daily.

Foreign Bodies, (metal): Use eye magnet, (184).

Glaucoma: G. con., + cervical sympathetic, lab., whole length of neck, — at 7th cervical vertebra, 5-10 ma., 10-15 min., e. o. d., also use same treatment as for cataract. H. f., electric hand, (148), + locally, 5 min., daily.

Iritis: G. con., + eye cup, (80), — cheek, 2-5 ma., 5-10 min., e. o. d. S. spray, (114), locally, 10 min., daily. H. f., electric hand, (148), + locally, 5 min., daily.

Nerve Atrophy: G. con., + nucha, — forehead and upper cervical ganglia, 5 ma., 5 min., daily. S. vib., Bennett method, (123), locally, 5 min., daily.

Optic Atrophy: G. con., + nucha, — forehead or eye cup, (80) alt., every minute, swelling app, (75), close with — on eye (see Cataract), 2-5 ma., 10 min., daily. S. spray, (114), locally, 5 min., daily. S. vib., Bennett method, (123), very mild, 5 min., daily.

Pterygium: G. con., platinum needle, + ½ ma., or eye cup, (80), 2-5 ma., 15 min., e. o. d., — nucha, daily.

Retino-Choroiditis: (See Iritis.)

Strabismus: G. int., or f. prim., + to eye cup, (80), — on temple, toward weaker muscles, 1-3 ma., 5-10 min., e. o. d. S. spray, (114), 5 min., daily.

Trachoma: G. con., + copper tip, (88), lab., to granulations, — in hand, (cocaine), 3 ma., 2-3 min., wkly.; or — needle into each granule, + in hand, 2 ma., wkly. X ray, to eyes, soft tube, 10-15 in. away, 5 min., e. o. d.

Trichiasis and Distichiasis: (See Hairs, Superfluous).

FACE WRINKLES (See Wrinkles)

Facial Blemishes (See Nævus, Hairs, Moles, and Lesson No. 25)

Facial Paralysis (See Paralysis)

G. con., + lab., to affected muscles, — over exit of facial nerve, 3-10 ma., 5-10 min., daily. S. vib., Bennett method, (123), — over affected area, + nucha, or distant, 5 min., daily.

Facial Spasm

G. con., + above or in front of ear, — nucha, 5 ma., 5 min., daily.

Faradisation, General (See page 97)

F. sec., from coccyx, or feet, stab., to hand pad, (142), all over body, lab., (See Electro-vapor baths), (92).

Fainting (See Brain Troubles)

Falling of the Womb (See Prolapsus, Displacements)

Favus

X-ray, soft tube, short exposure, often, carried to point of depilation and mild dermatitis. If extensive, go very slowly, follow with violet light, helios or Russian, (198), 15 min., daily. S. crown, (113). 15 min., daily.

Fecal Impaction (See Impaction, Fecal)

Fever, Convalescence (See Sequelæ, Marasmus)

S. ins., (112), s. shower, (113), 20 min., daily. S. surge, (122). G. f., and c. g., (97, 101), e. o. d., p. r. n.

Fever, Hay

G. con., + copper tip, (88), to nose, lab,, — hand or cheek, stab., 2-5 ma., 4-6 min., daily. S. ins., (112), and oxyoline inhalations, (229), 20-40 min., daily. H. f., vac., (147), nasal elect., + in nares, 5 min., daily.

Fibroids, Uterine (See Hemorrhage, Menorrhagia)

G. con., + abd., or sacrum, Bennett disc, (82, 142), — int.-ut., 20-200 ma., 10-30 min., wkly. If hemorrhagic, + int.-ut., (88), copper or zinc tip, — abd., reversing poles at close to loosen tips, for 1-3 min. Repeat p. r. n.

Fissure, Anal (See Anus, Fissure of)

G. con., + copper or zinc tips, (88), lab., — abd., or back, (82, 142), 5 ma., till tissues color green, weekly.

Fissure, Nipples (See Fissure Anal)

Fistula

G. con., same as for fissure and ulcer.

Flexions, Uterine (See Displacements)

Foreign Bodies

Metallic substances are easily detected by the electric probe, (202), or the X-ray, with fluoroscope, (150), and radiograph, (163).

Frequent Micturition (See Cystitis, Bladder, Irritable)

Fractures

Detected by the X-ray, with fluoroscope, (150), and radiograph, (163). Pain relieved by Bennett magnetone, (170), (173), (197).

Freckles (See Hairs, Superfluous, Blemishes)

G. con., — needle under spot. Technique same as for the removal of superfluous hairs.

Frost-bite (See Chilblains)

Functional Impotence (See Impotence, Emissions)

Functional Nervous Diseases

S. ins., (112), 15-20 min., daily. Vapor baths, (92). C, g.. and g. f,, (97, 101). Oxyoline inhalations, (229), 20-40 min., daily.

Furuncle (See Boils) (199)

GALACTORRHŒA (See Bust Development)

To Diminish: G. con., + with concave clay or cotton pad elect., or Bennett disc, (82, 142), over towel, over breasts, — back, 10-20 ma., 15-30 min., daily.

To Increase: F., (coarse coil), sponge elect., lab., to breasts, electric massage. G. con., wet sponge pad, (142), — to breasts, + spine. 10-15 ma., 20-30 min., daily, Vac. elect., with either current, — to breasts, + back pad, (81). (68).

Galvanisation, General, and Central (See pages 97, 101)

Gastralgia

G. con.. to pneumogastric nerve, + in fossa below left ear, — top sternum, 5-10 ma., 10-15 min., gradually increase and decrease, swelling current, (75). G. con., + over stomach, — seat or feet, 10-20 ma., 5-20 min., daily. F., sec., (fine coil, rapid vibrator), over stomach, to back, (81, 82). S. ins,, and shower, (112, 113). Violet light, (198), 20 min., daily. Oxyoline inhalations. (229), 20-40 min., daily.

Gastritis (See Gastralgia, Atony of Stomach)

Gestation, Ectopic (See Fibroids)

G. int., — in rectum, or vag., nearest to sac, + Bennett disc. abd., (82, 142), slow int., 20-80 ma., 10-20 min., daily. G. alt., same way. F., sec., (coarse coil. slow vib.), same way. After growth is checked, treat same as a fibroid.

Glands, Enlarged (See Tuberculous Glands, Goiter)

G. con., — over gland, with or without cat., of potass. iod.. Bennett, phoric, (78), + opp. G. alt., same way, 10-20 ma., 10-20 min.,

daily, or e. o. d. S. s., or spray, (112, 114). Helios violet light, (198), 15 min., daily. Oxyoline, (229), 20-40 min., daily.

Glandular Development (See Bust Development, Penil)

Glaucoma (See Eye Diseases, Glaucoma)

Gleet (See Strictures)

G. con., bare urethral or stricture tip, same as strictures, or g. con., + copper tip, lab., in urethra, — thigh pad, 3-10 ma., 3-6 min., e. o. d. G. con., with prostatic phoric elect., (89), + for copper effect, — potass. iod. effect. If any inflammation, use soluble hydro-electric set, with copper and warm water, (91), + in urethra, — on leg, (81).

Goiter, Exophthalmic (See Eye Diseases)

G. con., — to hydro-elect., eye cup, (80), + nucha, 2-3 ma., 3-8 min., daily, or e. o. d. S. spray, (114), to eye and neck, 10 min., daily.

The Bennett Phoric Electrode

Goiter (See Glands, Enlarged)

G. con.. —sat. sol. potass. iod., with Bennett phoric elect., (78), + opp., 10 20 ma., 10-20 min., daily, treat same as enlarged tuberculous glands. G. con., puncture may be used but is dangerous, and is only mentioned to be condemned. H. f., surface elect., over gland, (147). Helios violet light, (198), 15 min., daily.

Gonorrhœa (See Gleet)

Gonorrhœal Rheumatism (See Rheumatism)

G. con., + to pain, — distant, 5-15ma., 5-15 min., daily. Electro-vapor baths, (92), daily, or e. o. d. S. vib., Bennett method, (123), + to painful parts, 5-10 min., daily. Helios violet light, (198), 15 min., daily. Bennett magnetone, (170), 10-20 min., daily. Oxyoline, (229), 20-30 min., daily.

Gout (See Arthritis, Rheumatism)

G. con., ana., + to joint, Bennett phoric, (78), — in hands, 5-10 ma., 15-20 min., daily. G. con., cat., potass. iod., or lithia iod., sat. sol., — to lesion, + near by, 10-20 ma., 10-20 min., daily, or e. o. d. S. s., mild., (115), to joint, S. ins., and spray, (112, 114), 10-15 min., daily. Helios violet light. 20 min., daily. (198). Bennett magne-

tone, (170), 10-20 min,, daily. Oxyoline, (229), 30 min., daily. Hydro-elect. baths, (96), p. r. n., (181).

Granulated Eye-lids (See Eye Diseases, Trachoma)

Growths, Small (See Blemishes, Epithelioma, Moles, Nævus, Warts)

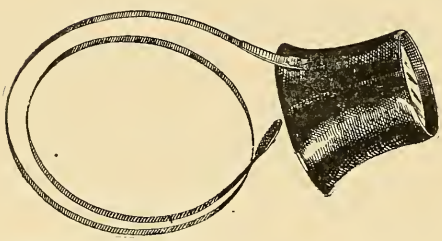
Habitual Abortion (See Abortion, Habitual)

Hæmatocele, Pelvic (See Hemorrhage)

G. con., + carbon elect., in vag., near lesion, — Bennett disc, (82, 142), 25-100 ma., 5-20 min., e. o. d., p. r. n.

Epilation Forceps

Single Hair Needle Holder



Self-holding spring magnifying glass

Head-band Eye-glass

Needle in hair follicle

Hair, Superfluous (See Blemishes)

G. con., — fine steel needles, blunt, + in hand, (142), mild, 4-8 ma., ½-1 min. Insert needle beside hair in follicle down to papilla, then patient completes circuit by placing other hand on wet + pad, (142). Needle is first inserted, using a slight rotary motion. Use only round blunt needles, held in a single holder, (see cut), when a froth appears, gently pull on hair with forceps, (see cut), and hair lifts out, without force. A self retaining magnifying eye glass, is essential, and rests the eye, (see cut). Do not take out hairs too close together. Never use the + pole to needle. Apply some local anæsthetic, (79), to skin before, and bleach, with witch hazel afterwards. X-ray, soft tube. (153), short seance, frequent. Just short of producing dermatitis, till hairs fall out. They will return, but paler and weaker. Repeat ray-

ing, and continue every 3 or 4 mos., till none return. The fine lanugo hairs, if dark, may be bleached white with peroxide of hydrogen.

Hay Fever (See Fever, Hay) (See page 257)

Headache (See Pain, Brain Troubles, Head-pains)

G. con., + over pain, — opp., sponge pad, 2-4 ma., 3-10 min., till relieved. S. ins., and spray, (112, 114), local over pain, 2-10 min. Russian violet light, (197), 5-10 min. Bennett magetone, (170), 2-5 min. H. f., elect., hand, (148), 5 min. If anæmic: Place poles just reverse of above. Operators hand may be used as an elect., (148), passing it over wet skin, lab., current passing through his body. S. spray, or shower, (112, 114), 15-20 min., daily. Bennett head magnetone, (170). Oxyoline, (229), to improve the blood. If hyperæmic: G. con., + to forehead, — nucha. Electro-vapor baths, (92). G. f., (97). S. ins., and + shower, (112, 113), 10 min., daily. (173, 223).

Hemicrania (See Headache)

Hemiplegia (See Paralysis, Apoplexy)

Hemorrhage, Cerebral (See Apoplexy)

No treatment before the third wk., or till all active inflammation subsides. Then if painful: G. con,, + over lesion, — opp., long., trans., or diag., 3-6 ma., 3-6 min., daily. Later, if no pain: G. con., — over lesion, large sponge pad, + nucha, 3-10 ma., 3-10-15 min., daily. Bennett head magnetone, (170), 10-40 min., daily.

Hemorrhage, Post-Partum (See Obstetrics, Uterine Inertia)

F., (coarse coil), one pole int.-ut., other to Bennett disc, (82, 142). Continue p. r. n.

Hemorrhage, Uterine (See Menorrhagia, Metrorrhagia, Obstetrics)

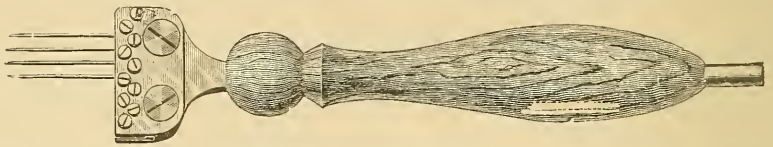
G. con., copper tip, (88, 216),+ int.-ut., — abd., Bennett disc, (82, 142), 20-40 ma., 20-40 min., e. o. d. Reverse poles, 5 min., to loosen tip at finish.

Hemorrhoids (See Growths, Small)

G. con., + copper elect., (88), either bare, or preferably covered with cloth, cotton or leather, wet, to pile, — abd., Bennett disc, (82, 142), 5-12 ma., 5-10 min., e. o. d.

BLEEDING: Bare copper or zinc tip, (88), g. con., + to pile. May be applied per specula, lab., — to abd., (82, 142).

Hard External: Best treated by steel needles in Bennett holder, (86, 120). G. con., — to needles in pile, + back or abd., (81, 82, 142), 10-20 ma., 10-20 min., p. r. n. One seance usually enough.



Bennett 1-10 Needle Holder

Herpes Zoster

G. con., — to lesion, + opp., 5-10 ma., 10-20 min., daily. G. con., cat., Bennett phoric, (78), with potass. iod., local, + opp. S. s., or spray, (114, 115), local, daily. Helios violet light, (198), 15 min., daily.

Hiccough (See Spasm of Diaphragm)

G. con., to pneumogastric nerve, + in fossa under left ear, — top sternum, 5-10 ma., 5-10 min., hourly till checked. Magnetic wave generators, (See photo of case, 180).

Hives (See Hyperæsthesia of Skin)

G. con., — plain wet sponge elect., or Bennett phoric, (78), ana., cocaine, to lesion, — distant, 5-10 ma., 10-20 min., till relieved. S. ins., or spray, (112, 114), + to lesion, — feet, 10-20 min., or till relieved, daily. Electro-vapor baths, (92). Helios violet light, (198), 15 min., daily.

Hydrocele (See Varicocele)

G. con., — to fibroid spear, driven into the fluid sac., + on thigh, 5-10 ma., 5-10 min., or withdraw a little fluid, and inject same amt., sol., potass. iod., (10-20%), and treat as above, or can apply scrotal clamp elect., (81), to — pole, same as for varicocele.

Hyperæmia, Cerebral (See Brain Troubles)

Hyperæsthesia of Skin

Hydro-electric bath, (96). G. con., + elect., in water, — to part above water, 5-10 ma., 10-20 min., daily. Helios violet light, (198), 15 min., daily. G. f., (97). S. ins., and roller, (112, 116), 15 min., daily.

Hyperæsthesia of Stomach

G. con., + over stomach, — back, (81), 10-15 ma., 10-15 min., daily. F., (long fine coil), sec., same way. Hydro-electric method, stomach elect., swallowed, and stomach filled with water, (see cut, page 245).

Hyperæsthesia, Urethral (See Urethra Hyperæsthesia)

Hyperidrosis

G. con., + to water foot bath, in sol. antiseptics, — in hands, 5-15 ma., 10-15 min,, daily. Electro-vapor baths, (92), daily. Helios white light, (198), 10 min., daily. X-ray, over feet or axillæ, soft tube, (153), often, short exposure, p. r. n., e. o. d.

Hyperplasia (See Sub-Involution), (82)

Hypertrichosis (See Hairs, Superfluous)

Hypertrophy, Turbinate

G. con., + platinum or gold needles, puncture, in lesion, both poles close together, 5-20 ma., (cocaine), 5-10 min., wkly. G. con., — steel needle, single, (see cut over Hairs), puncture in lesion, + in hand, cocaine local anæsthesia, (79), 5-10 ma:, 5-10 min., wkly. Galvano-cautery knife, (35), direct to lesion, wkly., p. r. n.

Hypertrophy, Prostatic (See Enlargement of Prostate)

Hypochondria (See Neurasthenia)

G. f., and c. g., and g. g.,(97, 101), e. o. d. G. con., lab.,+ spine, — feet, 10-15 ma., 10-20 min., daily. S. ins., (112). S. s., (115), spine. S. shower, (113). S. roller, spine, (116), 15 min.,' daily. Red helios light to spine, 15 min., daily. Oxyoline, (229), 20-40 min., daily. (107).

Hysteria (See Neurasthenia, Displacements)

Treat same way as hypochondria, but particularly examine for, and properly treat any uterine derangements, p. r. n., (102), (107), (228).

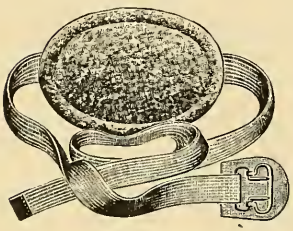
Hystero-Epilepsy (See Epilepsy, Hypochondria, Melancholia, Displacements)

G. con., + on long spinal pad, (2 x 12), — abd., Bennett disc, (82, 142), or feet, 20-30 ma., 20-25 min., daily. Same with s. ind., (116). Carefully examine clitoris and whole genito-urinary tract for derangements, which properly treat, p. r. n.

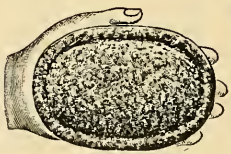
ICTERUS (See Jaundice, Liver Cirrhosis)

Impaction, Fecal

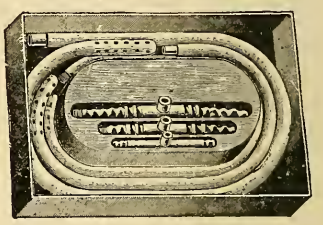
G. int., or alt., patient in knee-chest posture, fill bowel with water, insert a long colon tube elect., (see cut), high up, attach to one pole, other to abd., or back pad, (81, 82), 20-80 ma., slowly, int., or alt., 15-20 times per min., for 5-10 min., daily, Usually first sitting enough. Local roller or hand pad, (see cut), massage, (142), lab., over colon, (215). S. ind., or f. prim., or sec., (coarse coil), from back, (81), to abd.,(82), 10-15 min., daily, or same stab., front to back, (see cut), (81, 82), daily.



Back Pad



Hand Pad



Colon Irrigating Set

Impotence (See Spermatorrhœa, Orchitis, Hemorrhoids, Ataxia, Debility)

As this trouble is but a symptom, the cause must be found and removed, and the conditions treated, p. r. n. C. g., and g, f,, (97, 101). Electro-vapor baths, (92). Oxyoline, (229), 30 min., daily, to improve the blood.

Incontinence of Urine (See Urine Incontinence, Bladder Irritable)

G. con., + spine, — feet or perineum, 10-15 ma., 5-10 min., daily. F., in urethra or bladder or rectum, or above pubes, (228), or perineum, and other pad on sacrum, (81), mild current, (med. coil), 10-15 min., daily. S. s., to sacrum, (115), and spine, 5 min., daily,

Indigestion (See Atony of Stomach, Dyspepsia)

Inertia, Uterine (See Hemorrhage, Post-partum)

F., (coarse coil), sec., or prim., bipolar, int.-ut., (228), or one pole int.-ut., other vag., or abd., (82, 142), 5-10 min., swelling current, (75), hourly. Repeat, p. r. n.

Infantile Paralysis (See Paralysis)

Inflammation (See Pain, Appendicitis, Sprains)

G. con., + to lesion, stab., — opp., mild current, short treatment, often, p. r. n. S. spray, (114), local, p. r. n. Helios violet light, (198), 20 min., daily.

Injections, Electric (See Impaction, Fecal)

Insanity (See Brain Troubles, Headache, Hypochondria, Hysteria)
C. g., mild, g.f., daily, p. r. n. If maniacal: treat same as for hyperæmic headache. If melancholic: treat same as for anæmic headache. S. ins., (112), and spray. (114). S. s., (115), to spine, 10-15 min., daily. Electric light general bath, (187, 194). Russian violet light, (197). Bennett head magnetone, (170), 20-30 min., daily.

Insomnia (See Brain Troubles)
G. con., + to forehead, — nucha, 2-3 ma., 10-15 min., daily, in eve.; or + nucha, — epigastrium, (214), c. g., (101), 5-10 ma., 5-10 min., daily; or + to 7th cervical vertebra, — coccyx, (39), 10-15 ma., 10-15 min., daily. S. vib., Bennett method, (123), hand pad, (142), + to spine, or nucha, — feet, (especially good for cold feet), 10 min., daily. (173).

Insulation for Needles
Coat all but points with shellac. Dry till hard, and use in Bennett needle holder, (86, 120), (262).

Intercostal Neuralgia (See Neuralgia)

Interstitial Diffusion, Metallic (See page 88)

Intestinal Diseases (See Constipation, Diarrhœa, Impaction, Obstruction)

Intestinal Obstruction (See Impaction, Obstruction)

Iritis (See Eye Diseases, Iritis)

Irritation, Spinal (See Spinal Meningitis, Neurasthenia, Sexual)
G. con., + nucha, — sacrum, (39), or feet, 10 15 ma., 10-15 min. daily. C. g., (101). S. vib., Bennett method, (123), + spine, (2 x 12 pad), — feet, 10-15 min., mild, daily. Helios violet light, to spine, 15 min., daily, (198).

JAUNDICE (See Liver Cirrhosis)
G. f. G. int., lab., massage roller, or sponge pad, (142), — over liver, + feet, 10-20 ma., 15-30 min., e. o. d. S. vib., Bennett method, (123), + feet, — abd., (82, 142), 15 min., daily. Oxyoline, (229), 30 min., daily.

Joints Enlarged (See Arthritis Deformans)
If painful: G. con., + to joint, — distant. If not painful: — to joint, + opp. G. con., potass. iod., sat. sol., — on Bennett phoric, (78), + opp., cat., 10-20 ma., 10-20 min., daily. Helios violet light, 15

min., daily, (198). Bennett magetone, (170), 30 min., daily. S. vib., Bennett method, (123), + to joint, if pain, — if not, other pole distant, 5-15 min., daily.

KELOID

X-ray, med. tube, (154), 8 10 in. away, 5-10 min., daily. With a soft tube, (153), must produce slight vesiculation, sometimes repeated. Prognosis good.

Keratitis (See Trachoma)

X-ray, soft tube, (153). Treat same as trachoma. Slight stimulation only needed. If over treated, makes worse. Ray, p. r. n.

Keratosis

X-ray, soft tube, (153), mild. just enough to get slight dermatitis only required. Prognosis good, especially senile form.

Kidney Diseases (See Bright's Disease, Diabetes)

F., sec., mild, int., 60 per min., back to abd., (81, 82), 30 min., daily. Oxyoline, (229), 30 min., daily.

LACERATIONS, CERVICAL (See Erosions, Scar)

Lachrymal Duct, Stricture of (See Strictures)

Lactation, Deficient (See Galactorrhœa, to produce)

Lactation, Excessive (See Galactorrhœa, to decrease)

Lateral Sclerosis (See Paralysis, Hyperæsthesia of Skin)

Hydro-electric baths, (96). G. con., 15-20 ma., 10-20 min., e. o. d. C. g., daily, 10-15 ma. G. con., — spine pad, (2 x 12 in.), + feet, 18-20 ma., 10-20 min., e. o. d. Helios violet light to spine, 15 min., daily, (198).

Lead Paralysis (See Paralysis)

Leprosy

X-ray, med. tube, (154), 5-10 in. away, 5-10 min., daily, follow with helios violet light, (198), 15 min.

Leucorrhœa, Uterine (See Metritis, Displacements, Sub-Involution)

G. con., + bare copper tip, int.-ut., (216), — abd., Bennett disc, (82, 142), 15-25 ma , 10-20 min., e. o. d., reverse poles, 1-2 min., to loosen tip. G. con., nickel or aluminum tip, (216), — int.-ut., + abd., (82), 10-20 ma., 10-20 min., e. o. d. Hydro-electric douche, with soluble elect., (91), daily. "Find out the cause," (224), and correct, (228).

Leucorrhœa, Vaginal

G. con., + copper tip covered, vag., — abd., Bennett disc, (82, 142), 15-20 ma., 15-20 min., e. o. d. G. con., — nickel tip, bare lab., vag., + abd., as above. Hydro-electric douche, soluble elect., (91), p. r. n.

Leukemia

X-ray, med. tube, (154), over spleen and long bones, 10-15 min., daily. Oxyoline, (229), 30 min., daily.

Lipoma

X-ray, med. tube, (154), 5-10 in. away, 5-10 min., daily or e. o. d., p. r. n.

Liver Cirrhosis (See Jaundice)

G. f. G. int., lab., — over liver. + back, stab., (81, 142), 10-20 ma., 10-20 min., daily, slow int. S. vib., Bennett method, (123), — abd., (82), + feet or back, (81). Oxyoline, (229), 30 min., daily.

Liver Diseases (See Liver Cirrhosis, Jaundice)

Liver Spots (See Cholasma)

G. con., — sponge to spots, lab., + in hand, 5-10 ma., 5-10 min., daily. Oxyoline, (229), 30 min., daily. Electro-vapor baths, (92), e. o. d., p. r. n.

Local Anæsthetic (See pages 79, 215)

Locomotor Ataxia (See Lateral Sclerosis, Hyperæsthesia of Skin)

G. con., — to spine pad, (2 x 12 in.), + feet, 10-20 ma., 20-30 min., e. o. d. Hydro-electric bath, (96). Electro-vapor baths, (92), e. o. d. S. s., to spine, mild, 5 min., daily, (115). S. spray, (114), and roller, (116), 5 min., daily. Few, if any, cases will be cured, but the pains of many will be relieved. (107).

Lumbago (See Rheumatism, Muscular)

G. con., + sponge pad, (142), lab., or stab., (81), to back over pain, — in front on abd., (82, 142), 10-20., ma., 5-15 min., daily, often one seance is a cure. Helios violet light over back, 15-20 min., daily. (107).

Lupus (See Tuberculosis)

G. con., + bare copper tip to lesion, lab., — near, stab., 5-10 ma., till surface turns green. Dip tip into brine, to hasten effect, by forming an oxy-chloride of copper, ana. X-ray, with Allen shield, (159, 161), to protect healthy parts. Ray daily, or e. o. d., p. r. n., 5-10

in. away, 3-10 min., soft tube, (153), till gray exudate appears, then less often, p. r. n. Continue 1-6 mos, or till cured. Follow each radiation with the helios or Russian, (197, 198), violet light, 15-20 min., to hasten effect, and prevent burn. (188), (192), (197).

Lymphatics, Enlarged (See Glands, Enlarged)

MALINGERING (See page 202)

Mammary Cancer See Carcinoma)

Mania (See Brain Troubles, Insanity)

Marasmus (See Debility, General)

G. g., g. f., and c. g., (97, 101). S. ins., (112). S. s., spine, (115). S. roller, (116). Med. currents, 10-20 min., daily. General tonic treatments. Electro-vapor baths, (92), Electric light baths, (187), (194). S. cage, (183). Magnetic couch, (182). Body magnetone, (175), (182). Magnetic wave, (178). Stimulate catalysis, (16, 67), and tissue metabolism. (100), (108), (179).

Massage, Electric

Bipolar roller may be used local, or one pole to body of patient, stab., (81), other to roller, or sponge pad, (142), and applied by operator, lab.; or operator may hold other pole in his left hand, and apply his right hand as an elect., with maasage, called "The electric hand." (148).

Mastitis (See Abcess, Mammary, Galactorrhœa, to diminish)

Melancholia (See Headache, Hypochondria, Insanity)

G. con., — nucha, + spine or feet, 10-15 ma., 10-20 min., e, o. d. G. f., (97). S. s., spine, (115). S. spray and roller, (114, 116), 20 min., daily. Helios red light bath, (198). Electro-vapor baths, (92) daily. Oxyoline, (229), 30 min., daily.

Meningitis (See Brain Troubles, Spinal Meningitis)

G. con., + parietal, — under ear, 1-3 ma., 2-5 min., daily, or — sternum, + back, (38), 5-10 ma., 10-15 min., daily. S. ins., (112). S. shower, (113), 15 min., daily. Russian violet light to nucha and spine, (197). Bennett head magnetone, (170). Magnetic wave (176). 15 min., daily.

Menopause, Disorders (See Neurasthenia)

G. con., —int.-ut., + abd., (82, 142), 20-40 ma., 20-25 min., wkly. F. sec., same way. S. ins., (112). S. shower, (113). S. s., spine,

(115). S. surge, (122). S. vib., (123), Bennett method, + abd., (82), or feet, 10-15 min., daily. Magnetic wave, (176), 30 min., daily. Oxyoline, (229), 30 min., daily. (108).

Menorrhagia (See Hemorrhage, Post-Partum, Uterine)
G. con., + copper, tin or zinc tip, bare, (88, 216), int.-ut., — abd., (82), 20-200 ma., 5-20 min., e. o. d. Reverse poles to loosen tip. Repeat, p. r. n.

Metritis (See Displacements, Leucorrhœa, Sub-Involution)
G. con., + bare copper or zinc tip, (88, 216), int.-ut., — abd., Bennett disc, (82, 142), 20-100 ma., 10-20 min., e. o. d. G, con., — int.-ut., (216), + abd,, (82), or sacrum, 15-30 ma., 10-20 min., e. o. d. (228).

Metritis, Peri- and Para-, Acute
F. sec., (long fine coil), bi-polar, int.-ut., (228), and vag., 15 min., daily. Sin., same way. G. con., + abd., (82), — sacrum, (81), 20 min., daily.

Metritis, Sub-Acute, and Chronic (See Metritis)

Metrorrhagia (See Menorrhagia)

Micturition, Frequent (See Bladder, Irritable, Urine, Incontinence)

Migraine (See Neuralgia) (107) (197)

Miscarriage (See Abortion, Hemorrhage, Post-Partum, Obstetrics)

Moles (See Growths, Small, Carcinoma, Epithelioma, Warts)
G. con., steel needles, Bennett holder, (120), — under base, + in hand, (142), 5-10 ma., 5-10 min., p. r. n. Reinsert needles at right angles, and repeat. One sitting enough.

Moles, Hairy See Hairs, Superfluous, Nævus)
Remove hairs first, then treat same as a simple mole. If small, often the removal of the hairs alone will remove the mole.

Muscular Atrophy (See Atrophy, Muscular, Massage)
F. sec., massage, electric hand, or roller. G. con., spine, (39). G. g. and g. f., (97, 101). (102).

Muscular Contractions and Cicatrices (See Contractions, Scars)
G. con.. — over lesion, lab., + opp., stab., 10-15 ma., 10-20 min., daily. Electric massage, p. r. n.

Myalgia (See Rheumatism, Muscular, Lumbago)

Mycosis, Fungoides

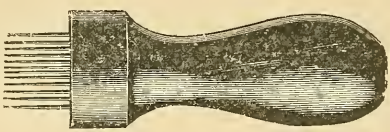
X-ray, soft tube, (153), moderate radiation. Almost a specific. Helios violet light, (198), 15 min., daily.

Myelitis

G. con., + nucha., — lumbar spine, (39), 5-15 ma., 10-20 min., daily. G. alt., spine to sternum, (38). S. s., to spine, (115). Helios violet light, to spine, (198), 15 min., daily. Body magnetone, (175, 182) 30 min., daily. Magnetic wave (176), 30 min., daily. Oxyoline, (229), 20-30 min., daily.

NÆVUS, Hairy (See Moles, Hairs)

Usually fine and brown. Remove hairs, singly, and if mark remains, treat same as port wine mark, or mole. X-ray may also be used, but is very slow.



Nævus, Port Wine Marks (See Blemishes)

G. con., — steel needles, in nævus elect., (see cut), needles driven into mark vertically, + near, 2-5 ma., 2-5 min. Move needles around to different places. Several seances best, if extensive. Allow one spot to heal before treating again near it. G. con., ana., 5-10 ma., 5-10 min., with Bennett phoric, cocaine, (78), preferably used first. Chromethylate sodium, may be applied afterward to hasten effect. (See note). Nævus needles leave numerous minute punctate scars, which are not as much a blemish as nævus, and which gradually disappear, in a year or two.

Nævus, Vascular

G. con., — steel needles, Bennett holder, (120), from 1-10 needles introduced, under base, and parallel to surface, + near, 5-10 ma., 5-10 min., p. r. n. Remove needles, and reinsert them, at right angles to 1st insertion, and repeat dose. One seance usually enough. First use cocaine, ana., local, with Bennett phoric, (78), to prevent pain, 5-10 ma., 5-10 min. G. con.,+ small cotton or sponge elect., (204), to mark, wet with chromethylate sodium, — near, 5-10 ma., 5-10 min. In small children, can use sodium alone. Apply lightly to surface, being careful not to touch surrounding skin. Allow to dry. Surface blackens and peels off. Then repeat, p. r. n., till cured. In any

treatment do not allow the scab to be picked off. Keep it soft with yellow oxide of mercury ointment. When it falls off it leaves a healthy granulating surface, which treat with ordinary antiseptics, and Minin violet light, 15 min., daily, (195). White scar results, which gradually turns red, then fades to natural color in from six mos. to a yr. If large, treat but a part at a time, p. r. n.

NOTE:—Chromethylate of sodium is prepared as follows: Take equal parts of crystals of chromic acid, and ethylate of sodium, and mix in a salt mouth bottle, with a few drops of water. Heat generates, so keep in a cool place, when cool, and deliquesced, it is like thick dark molasses. Keep stoppered, and thin as needed, and apply with a match or toothpick. It takes several days to prepare, and the older it is the better it works.

Nasal Spurs

G. con., + and — needles, platinum, close together, puncture, (after cocaine), 5-10 ma., 3-5 min., e. o. d. G, cautery, p. r. n. (34, 35, 42, 63).

Nasal Stricture (See Strictures)

G. con., — wkly, same as for stricture elsewhere, p. r. n.

Nasal Hypertrophy (See Hypertrophy, Turbinate)

G., same as above, or linear galvano-cautery, (34, 35).

Nervous Diseases, Functional (See Functional Nervous Diseases)

Nettle Rash (See Urticaria, Hives)

Neuralgia (See Pain, Head Pains) (217, 223)

G. con., + to pain, lab., or stab., — distant. On head: 3-5 ma., 10 min., daily. On body: 10-30 ma., 10-20 min., daily. F. sec., (very long fine coil), or sin., same as above. S. shower, (113), or spray, (114), 10-15 min., daily. S. ins., (112), 15 min., daily. G. con., ana., + Bennett phoric, (78), cocaine, chloroform, or aconite, local, 5-10 ma., 5-10 min., p. r. n. Bennett magnetone, (170), 5-20 min., daily. Magnetic wave, (176), 15 min., daily. (38), (107), (173), (181), (197).

Neuralgia, Hysterical (See Hysteria)

Neuralgia, Trigeminal

G. con., + to pain, — nucha, 3-5 ma., 5-10 min., hourly, till relieved. Ana., Bennett phoric, (78), cocaine or aconite, over pain, 3-5 ma., 5-10 min., — in hands, S. spray, (114), local, 10 min., daily.

Helios violet light, (198), 15 min., daily. Bennett head magnetone, (170). Magnetic wave, (176), 15 min., daily.

Neurasthenia Cerebral (See Brain Troubles, Hypochondria, Headache)
G. con., + to forehead, — nucha, 2-5 ma., 3-10 min,, daily. Treat same as for anæmic headache.

Neurasthenia, General
G. con., + to head, neck or spine, p. r. n., — coccyx or feet. C. g., g. f., (97, 101). S. shower, (113). S. ins., (112), 20 min., daily. S. s., and roller, (115, 116), to spine, mild, 5 min., daily. S. surge, (122). S. vib., Bennett method, (123), e. o. d., or daily, p. r. n. Electro-vapor baths, (92). Electric light baths, (187). Bennett magnetone, (170, 175, 182). S. cage, (183). Magnetic wave, (176). Oxyoline, (229), 30 min., daily. (102), (107), (173), (188).

Neurasthenia, Sexual (See Hypochondria)
G, con., — to steel sound in urethra, + sacrum, (81), 5-8 ma., e. o. d. G. con., + spine, lab., — feet, 10-20 ma., 10-20 min., daily. S. surge, (122). S. vib., (123). Bennett method, + to spine, or perinæum, — feet, or crown, 10-15 min., daily. Begin with short vib., and slowly lengthen. (102), (107), (173).

Neuritis (See Neuralgia, Brachial Neuritis)

Neuroses (See Functional Nervous Diseases, Writers' Cramp)

Non-Development (See Atrophy, Bust and Penil Development)

OBESITY
Electro-vapor baths, with electric massage, daily. Local vapor bath, (95). S. surge, (122), to abd., (82). Sin., and f. sec., (coarse coil), lab., over abd., 15 min., daily. G. f., (97). S. cage, (183). Electric light baths, (187). C. g., (101).

Obstetrics, Uterine Inertia (See Hemorrhage, Post-Partum)
F. sec., int.-ut., and abd., (32), (short coarse coil) swelling current, (75), once per min., till contractions occur. Repeat hourly, as needed, p. r. n. F. sec., bipolar, int.-ut., (228).

Obstetrics, Post-Partum Hemorrhage (See Hemorrhage, Post-Partum)
Treatment same as above.

Obstetrics, Retained Placenta, or Fœtus
Treatment same as above.

Obstruction of the Bowels (See Impaction, Fecal) (91)

Occulsion, Intestinal (See Impaction, Fecal)

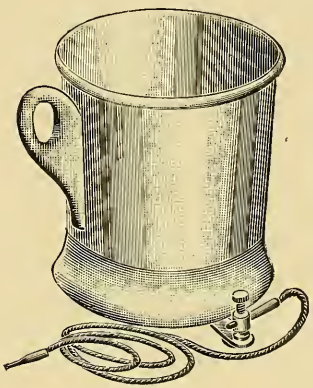
Occupation Neuroses (See Writers' Cramp)

Ocular Injures (See Eye Diseases)

Œsophagus, Paralysis (See Paralysis)

Œsophagus, Stricture (See Stricture)

Optic Nerve Atrophy (See Eye Diseases, Optic Atrophy)



Orchitis

ACUTE OR THREATENED: G. con., + in mug water elect., (see cut), in which scrotum is immersed, — sacrum or feet, 5-10 ma., 10-15 min., daily. Helios violet light, (198), or bidet chair bath, (194), 15 min., daily.

CHRONIC: G. con., — to mug bath, with sol. potass. iod., cat., + back, (81), 5-10 ma., 5-10 min., daily.

Ovaralgia (See Neuralgia, Pain)

G. con., + over ovary, or in vag., — back, stab., 10-20 ma., 15-30 min., daily. F. sec., (long fine coil), or sin., front to back, abd., (82), 10-15 min daily. Magnetic wave, (176), front to back, 30 min., daily.

Ovaritis (See Ovaralgia, Pain)

PAIN

P. P. P. Always remember, g. con., + to pain, (203, 213). F. sec., (long fine coil). Sin., local. S. spray, (114). G. con., ana., cocaine, in Bennett phoric, (78), 5-10 ma., 5-10 min. Helios or Russian, or Minin violet light over pain, (187, 195, 198). Bennett magnetone, (170). Magnetic wave, (176). (173, 217, 223, 235).

Pannus (See Eye Diseases, Trachoma, Keratitis)

G. con., + to cheek, stab., (under surgical anæsthesia), — to lesion, lab., slowly moving, 2-3 ma., 3-5 min., repeated, p. r. n. (See lesson 28, page 4).

Paralysis, Diagnosis and Prognosis (See pages 202-206)

Paralysis

G. con., + stab., over sternum, — lab., over affected areas. Mod. current up to tolerance. Repeat, p. r. n., but NEVER treat till all inflammation has subsided.

AGITANS: G. con., + to forehead, — nucha, 3-5 ma., 5-10 ma., daily. Or + sternum, stab., — spine, lab., (38), 10-15 ma., 10-15 min., daily. S. spray, (114). S. shower, (113). S. ins., (112). S. s., (115). To spine, 15 min. daily. Helios violet light to spine, 15 min., daily. Magnetic wave, (176), 30 min., daily.

APHASIA, ACUTE: (See Aphasia). G. con., + over Brocha's speech center, — behind opp. ear, or on nucha, 3-5 ma., 3-5 min., daily. S. ins., (112), 10 min., daily.

APHASIA, SUB-ACUTE, OR CHRONIC: (See Aphasia). G. con.,— stab., over left 3rd frontal convolution, (Brocha's center), + on nucha, or opp. mastoid process, 3-10 ma., 5-10 min., daily. Increase and decrease current very slowly. Bennett head magnetone, (170), 30-40 min., daily. S. spray, (114). S. shower, (113), 15 min., daily.

BULBAR, CHRONIC: G. con., between mastoid processes. Change direction at each treatment, or several times at each treatment, without shock. G. con., to brain, long., trans., or diag., 5-8 ma., 5-10 min., daily. G. con., to pneumogastric nerve, + in fossa under left ear, — top sternum, 3-5 ma., 3-5 min., daily. G. con., to sympathetic nerves in neck, trans., 5-10 ma., 5-10 min., daily. Same through pharynx. Sin., through region of throat, 5-10 min., daily. G. alt., slow and mild, 20 per min., 5 min., daily, to throat and neck. F. prim., with electric hand massage, externally, from throat to hands, 5 min., daily. (See Aphasia, Massage).

DIPHTHERITIC: Electric hand massage, (See Massage, Aphonia), f. prim., or g. int., or sin., or s. ind., using hand as elect. with skin and hand wet, Apply externally, over throat muscles, lab., or apply two *small sponge pads*, lab., on opp. sides of throat, 5-10 ma., 2-10 min., daily.

FACIAL: G. con., — lab., over exit of nerves in front of ear, (209, 211), + nucha, stab., 2-5 ma., 5-10 min., daily. F, sec., electric massage to affected muscles, 5 min., daily. S. spray, (114), to cheek. S. surge, or s. vib., (122, 123), Bennett method, — cheek, + hands; or — to cheek, + crown, 5 min., daily. (205).

HEMIPLEGIA: (See Brain Troubles). G. con.. + nucha, stab., — on temple, and under ear, lab., 3-5 ma., 5-10 min., daily. (Only after all inflammation has subsided). G. int., or f. sec., (coarse coil), lab., to affected muscles, with mild massage, electric hand, local, to prevent atrophy, 5-10 min., daily. S. s., or roller, (115, 116), to spine, and muscles, 15 min., daily, or e. o. d., p. r. n. Bennett head magnetone, (170), 30-40 min., daily. (205).

HYSTERICAL: (See Hysteria) G. g., g. f., c. g., (97. 101). S. ind., s. s., s. roller, (115, 116), to spine and muscles. S. shower, (113). S. ins.,(112), 15-20 min., daily. In women, correct uterine troubles. (See Displacements), (228).

INFANTILE: C. con., lab., — over affected areas, + opp., 5-10 ma., 10-15 min., daily. G. g., c. g., (97, 101). F. sec., (coarse coil). electric hand massage, (See Massage). Place child in s. cage, (183), or Bennett magnetone, (175, 182), 30-40 min., daily. H. f., (148), (205).

INTESTINAL: G. int., lab., + abd., roller, or sponge elect., — back or rectum, (81), stab., 10-15 ma., 10-15 min., daily. Move abd. elect. along course of colon, (214), and downward. Slow int., 60 per min. F. prim., or sec., (coarse coil), or sin,, or s. ind., same way.

HYDRO-ELECTRIC RECTAL INJECTIONS: (See Impaction), in knee-chest posture, — rectum, with long colon tube elect., (See page 264), + abd., or back, (81, 82), with bowel full of normal salt sol. S. vib., Bennett method, (123). + abd., (82, 142), — back, (81), 5-10 min., daily, (205).

LEAD: G. con., hydro-electric, and electro-vapor baths, (92, 96), to favor active elimination. (See Hyperæsthesia of Skin, Rheumatism, Gout).

OCULAR MUSCLES: G. con., — hydro-electric cup, (80), or wet sponge, over eye, + nucha, 3-5 ma., 5-10 min., daily. F. sec., (long fine coil), mild, same way. S. ind., same way. S. spray, (114), lo-

cal, over eye. S. s., short, to temples and neck, 3 min., daily. S. vib., Bennett method, (123), + to eye, with soft sponge elect., — nucha, or crown, 5 min., daily.

ŒSOPHAGUS: G. int., — lab., to throat, external, + nucha, stab., 5-10 ma., 5-10 min., daily. F. prim., same way. Electric hand massage, same.

PARAPLEGIA: (See Brain Troubles, Hemiplegia, Ataxia, Sclerosis).

PERIPHERAL, FACIAL: (See Facial Paralysis).

Pelvic Diseases, Inflammations, Exudates, Adhesions (See Metritis, Sub-Involution, Displacements) (228)

G. con., — vag., + abd., Bennett disc, (82, 142), 20-60 ma., 10-20 min., e. o. d. G. con., + abd., — back, (See Amenorrhœa).

Pelvic Peritonitis, Chronic (See Appendicitis)

Treatment same as above.

Penis, Non-Development (See Atrophy, Bust Development)

G. con., — to penil developer, (see cut), + back, (81). Mod. vac., 5-10 ma., 5-10 min., daily. G. con., to mug elect., (See Orchitis), + back, (81), 5-10 ma., 5-10 min., daily. F. sec., same way. S. vib., (123), Bennett method, — to penis, + back, (81), 10 min., daily. (See Spermatorrhœa, Neurasthenia, Sexual)

Penis, Glans, Anæsthesia (See Anæsthesia, to relieve)

F. sec., locally to glans with wire scourge, p. r. n. (See cut).

Pigmentation (See Blemishes, Nævus, Powder Marks)

Piles (See Hemorrhoids)

Pleurisy

G. Con., + to pain, — distant; or from front to back, (38), 5-10 ma., 10-15 min., daily. Helios violet light, (198), to side, 15 min., daily. (197).

Podalgia

G. con., + heel, — hands, 10-20 ma., 10-20 min., daily. S. surge,

(122), or S. vib., (123), Bennett method. + foot, — back, (81), or crown, 15 min., daily. Look for soreness in sacral spine, (220, 221).

Polio-Myelitis (See Myelitis)

Post-Partum Hemorrhage (See Hemorrhage, Menorrhagia, Obstetrics, Uterine Inertia)

Powder Marks, Removal (See Blemishes)

G. con., — Bennett needle holder, (120), or Naevus elect., (See Naevus), 5-10 ma., 5-10 min., wkly. (See lesson 25, page 28).

Pregnancy, Extra-Uterine, Tubal (See Gestation, Ectopic)

Pregnancy, Vomiting

G. con., + in fossa under left ear, — top sternum, stab., or over stomach, (213), 5-10 ma., 10-20 min., p.r.n. Or + over stomach — back, (38), 10-15 ma., 15-20 min., p.r.n. daily.

Prevention of X-Ray Burns (See Burns, X-ray, to prevent)

Priapism

A symptom only, of some diseased condition of the urethra, prostate, or bladder, or reflex from the genito-urinary spinal center. "Find out the cause", (224), and give sedative electric treatments, central and peripheral.

Procidentia (See Prolapsus Uteri)

Proctitis

G. con., + in rectum with soluble hydro-elect., (91), No. 3 tip, — back, (81), 5-10 ma., 10-15 min., daily, for the phoric interstitial copper effect, (87,88).

Prognosis in Peripheral Paralysis (See page 205-207)

Progressive Muscular Atrophy (See Atrophy, Muscular)

Prolapsus, Rectal

Sin., or f. prim., or f. sec., (coarse coil), or g. int., slow. Bipolar elect., in rectum, or single pole in rectum, other abd., (82). Current strong enough to cause muscular contraction, 5-10 min., daily. Soluble hydro-electric douche, (91), No. 3 tip.

Prolapsus Uteri (See Amenorrhœa)

G. int., — int.-ut., + back, or abd., Bennett disc, (82, 142), slow int., 10-20 ma., 10-20 min,, e.o.d. F. prim., and s. ind., same way.

Prostate Gland, Enlargement

G. con., — prostatic phoric elect., (89, 91, 221) flexible copper wire covered with cotton, wet with sat. sol. potass. iod., inside tube, in urethra, or rectum, (221), + back, (81), 5-8 ma., 5-8 min., e.o.d., or wkly, p.r.n. G. con., + in rectum., opp. gland, (221), — sponge pad on perinæum, 5-10 ma., 10-20 min., e.o.d., (89). X-ray, to perinæum. Bidet chair, (194). S. vib., Bennett method, (123), — perinæum, + back, (81), 15-15 min., daily.

Prostate Gland, Granular (See Gonorrhoea, Gleet)

Treatment same as above, but with copper wire only, in phoric elect., (89), wet with normal salt sol. G. con., + with hydro-electric soluble set, (91).

Prostatitis, Inflammatory (See Inflammation, Prostate, Enlarged)

Proud Flesh (See Ulcer, Lupus)

Pruritis (See Eczema)

G. con., + to lesion, lab., — opp., stab., 5-10 ma., 5-10 min., daily. F. sec., (long fine coil), or sin., same way. S. spray, (114), local, 10 min., daily.

PUDENDAL: Bidet chair bath, violet light, (194). X-ray, soft tube, short treatments, daily. Protect surrounding parts, with Allen shield (159). H. f., surface vac., elect., (147, 148), local, daily.

Pseudo-Leukemia (See Leukemia)

Psoriasis (See Eczema)

G. con., + Bennett phoric, (78), with witch hazel, or antiseptics, local, 5-10 ma., 5-10 min., daily. Russian or helios violet light, (188, 198), 15 min., daily. Electro-vapor baths, (92). Oxyoline, (229,) 30 min., daily. X-ray, soft tube, mild radiations, to slight erythema only, required to relieve the itching. H. f., surface vac., elect., (147, 148), local, daily.

Pterygium (See Eye Diseases, Pterygium)

QUINSY (See Tonsils)

RECTAL DISEASES (See Erosions)

ANAL FISSURE: (See Anus, Fissure).
INFLAMMATION: (See Proctitis).
HEMORRHOIDS: (See Hemorrhoids).
PARALYSIS: (See Paralysis, Intestinal).

PROLAPSUS: (See Prolapsus, Rectal, and Uterine).
STRICTURE: (See Stricture).
ULCER: (See Ulcer).

Reaction or Degeneration (See page 206)

Reaction, Normal Muscle (See page 206)

Respiration, Artifical, to induce (See cut, page 214)

F. sec., one elect. just above collar bone, at bottom or sterno-cleido-mastoid muscle, on right side, (as shown at A), other pole below end of sternum, (as shown at E), or along costal cartilages, on left side. Make and break circuit by raising and lowering either pole, 10-15 times per min., continue p. r. n.

Retained Placenta (See Abortion, Hemorrhage, Post-Partum, Obstetrics)

Retro-Flexion (See Displacements) (228)

Retro-Version (See Displacements) (228)

Rheumatism, Articular (See Sprains)

ACUTE: G. con., + to joint, stab,, or lab., — opp., 10-20 ma., 10-20 min,, daily. If very painful: — distant. S. spray, (114), 5-10 min., local, daily.

CHRONIC: G. con., — cat., stab., or lab., to joint, Bennett phoric, (74, 76, 78), lithia or soda salts,+ opp., 10-15 ma., 10-15 min., daily. Electric hand massage, (See Massage). S. s., (115). Bennett magnetone, (170), 10-15 min., daily. Electric light baths, general or local, (187, 193, 194). Electro-vapor baths, (92), daily or e. o. d., p. r. n. Helios violet light, (198), 15 min., daily. H. f., surface, vac. elect., (147). (102), (124). (173), (181), (188), (197).

GOUTY: (See Gout).

GONORRHŒAL: (Gonorrhœal Rheumatism).

Rheumatism, Muscular (See Lumbago)

G. con., + electric hand massage, or g. con., + lab., to muscles, — distant, 10-20 ma , 10-20 min., daily. S. s., (115). S. roller, (116), to muscles. S. ins., (112), 10 min., daily. Use all the methods, same as in articular form, above, p. r. n.

Rheumatoid Arthritis, with Deposits, and Anchylosis (See Arthritis Deformans, Anchylosis, Gout)

G. con., — lab., cat., Bennett phoric, (74, 76, 78), sat. sol. potass. iod., to joints, + opp., 15-20 ma., 10-15 min., daily. S. s., (115). Electric hand massage. H. f., surface vac. elect., (147), (See all treatments for rheumatism).

Ringworm (See Eczema, Favus)

G. con., + ana., copper or zinc tip, amalgamated, (21), or plain, wet with brine, lab., to lesion, (74, 88), — distant, till there is a green color. If on head: 3-4 ma.; if on body: 10-20 ma., 2-5 min., e. o. d. Finsen light, local, (192). X-ray, local, soft tube. Helios violet light, (198), 15 min., daily. H. f., surface vac., elect., (147).

SALPINGITIS (See Appendicitis, Inflammation, Ovaritis, Pelvic Disease)

G. con., + vag., carbon elect., — sacrum, 10-20 ma., 10-20 min., e.o.d., G. con., + abd., Bennett disc, (82, 142), — back, (81), (See cut, Amenorrhœa), (243), stab., 10-20 ma., 20-30 min., daily.

Sarcoma (See Carcinoma, Epithelioma, Lupus, Moles)

G. con., — needles under base, + near, (See cut, page 86), 10-20 ma., 10-20 min., e.o.d. Massey method of massive zinc-mercury interstitial diffusion, (88), is best. (See lesson No. 29, page 3).

Seminal Emissions (See Emissions, Seminal, Spermatorrhoea)

Sequelæ to Acute Diseases (See Marasmus)

Give general tonic, sedative or stimulating treatments, p.r.n., as indicated, to stimulate tissue metabolism, catalysis, and restore electro-magneto-tonus.

Scales in Colon (See Constipation)

Scars (See Cicatrix, Contractions, Nævus)

Sciatica (See Brachial Neuritis)

G. con., + stab., to sacrum or hip, — feet, 10-15 ma., 10-20 min., daily. S. s., (115), mild to nerve and spine. S. spray, (114), local to pain, 10 min., daily. S. ins., (112), 15 min., daily. Helios violet light, (198), 15 min., daily. Electro-vapor baths, (92), daily, (107), (197).

Scirrhus (See Carcinoma)

Sclerosis (See Lateral Sclerosis, Paralysis)

Sexual Neurasthenia (See Neurasthenia, Sexual)

Shingles (See Herpes Zoster)

Shock, Surgical, to prevent

Apply magnetic wave generators, (176), one on each side body, under arms, for 2 hrs., before, all during, and 2 hrs., after the operation. Has invariably prevented shock or pyrexia, and sustains animation, requiring less anæsthetic.

Singultus (See Hiccough, Spasm of Diaphragm)

Sleeplessness (See Insomnia)

Small Growths (See Blemishes, Epithelioma, Moles, Nævus, Warts)

Softening, Cerebral (See Apoplexy, Aphasia, Brain Troubles, Hemorrhage, Cerebral)

G. con., not till after 3rd wk., + over site of pain, long, trans., diag., p.r.n., to influence tissue metabolism and promote normal circulation and absorption of clot; + to relieve pain, check hemorrhage, harden and contract tissues, — to dilate, absorb, and relieve pressure. Bennett head magnetone, (170), 20-50 min., daily.

Spasm, Bladder (See Bladder Irritable, Cystitis)

G. con., + over pubes, — sacrum, 10-20 min., daily.

Spasm, Facial (See Neuralgia, Trigeminal)

G. con., + above or in front of ear, — nucha, 3-6 ma., 5-10 min., daily. S. spray, (114), 5-10 min., daily. S. shower, (113), 15 min., daily. H. f., surface vac. elect., (147), local, 5-10 min., daily. Bennett head magnetone, (170), 20-30 min., daily.

Spasm of Diaphragm (See Hiccough)

G. con., + fossa below left ear, — top sternum, or over stomach, (214), 5-10 ma., 5-10 min., repeat, p.r.n. G. con., + over stomach, (214), — between shoulders, on back, (38), or nucha, 10-20 ma., 10-20 min., p.r.n. Magnetic wave generators, one on each side, or front and back, (38), 10-30 min. (See photo of case, page 180). F. sec., (long fine coil), lab., stomach to back, (38), 5-10 min., every 3-4 hrs. Sin., same way.

Spasm, Sterno-Cleido-Mastoid (See Torticollis)

Spermatorrhœa (See Hemorrhoids, Prostate, Orchitis, Varicocele)

G. con., + rectum, — abd., Bennett disc, (82, 142), 5-10 ma., 5-15 min., daily, or e.o.d. G. con., + perineum, — feet. G. con., + spine, — feet, 10-15 ma., 10-15 min., daily. S. vib., (123), Bennett method, + perineum, — nucha, sacrum, or crown, 10-15 min., daily. F. sec., (long fine coil), or sin., mug water elect., (273), to back, (81), 10-15 min., daily.

Spinal Meningitis, Chronic

G. con., + nucha, stab., — down spine, stab., or lab., (39), 5-10 min., daily. Helios violet light, to spine, 15 min., daily. Magnetic wave, (176), front to back, (38), 30 min., daily.

Spleen, Enlarged (See Leukemia)

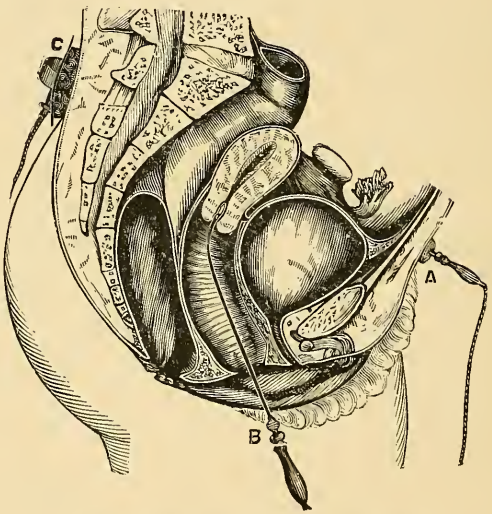
G. con., — over spleen, lab., deep massage, electric hand, sponge pad, (142), or roller, + sacrum, 10-15 ma., 10-15 min., daily. F. sec,, (long fine coil), or sin., or s. ind., same way, X-ray, (See Leukemia). Oxyoline, (229), 30-40 min., daily.

Sprains (See Arthritis)

G. con,, + stab., or lab., to lesion, — distant 5-10 ma., 10-15 min., daily. Bennett magnetone, (170), 15-30 min., daily. Helios violet light, (198), 15 min., daily.

Stammering (See Aphasia, Aphonia, Brain Troubles)

G. con., to brain, long., trans., diag., p. r. n, Through neck and larynx. S. ins., and s. shower, (112, 113), 15 min., daily. Bennett head magnetone, (170), 20-30 min., daily.



Treatment of Uterine Stenosis

Uterine Stenosis Electrodes

Stenosis, Uterine (See Dysmenorrhœa, Stricture)

G. con., — tapering tips, (see cut), (216), int.-ut., + abd., Bennett disc, (82, 142), 20-40 ma., 15-20 min., e. o. d. or wkly., using successively larger tips.

Sterility

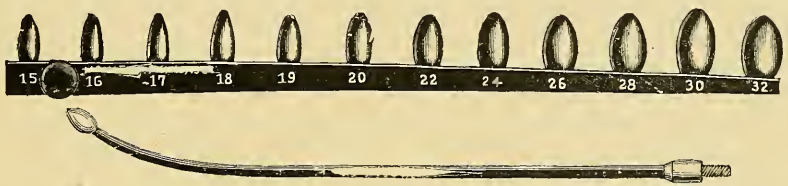
MALE: (See Obesity, Orchitis), "Find out the cause," (224), and remove it if possible. Treat p. r. n., any acute inflammatory process, or sequelæ, or remote or reflex functional trouble. Give tonic, sedative or stimulating applications, as indicated, both peripheral and central.

FEMALE: (See Amenorrhœa, Obesity, Metritis, Stenosis, Sub-Involution). If due to venereal infection, treat endometrium with g. con., copper tip, + int.-ut., (216), — abd., Bennett disc, (82, 142), 5-15 ma., 5-10 min., e. o. d., to get interstitial metallic diffusion, (88).

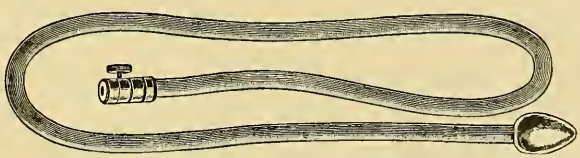
INFANTILE UTERUS: (See Atrophy, Displacements). G. con., — vag., or int.-ut., + abd., Bennett disc, (82, 142), 10-20 ma., 10-20 min., e. o. d. G. int., or f. sec., (coarse coil), or sin., same way. F. sec., bipolar, int.-ut., (228), 5-10 min., daily.

Stiff Joints (See Anchylosis)

Stomach, Atony of (See Atony of Stomach)



Urethral Stricture Tips and Staff



Œsophageal Stricture Electrode

Stricture

EUSTACHIAN:

LACHRYMAL:

NASAL: (See Hypertrophy, Turbinate)

ŒSOPHAGEAL:

URETHRAL:

UTERINE: (See Stenosis)

VAGINAL:

The technique of treatment of stricture is practically the same in any

canal, the only difference being in the size or shape of the active electrode, the current strength, and duration, and frequency of applications; governed in each case, by the location, extent, size, number and character, and the idiosyncrasy of the patient. The plan is to learn the caliber of the stricture, then to use a tip a size larger, so as to put tension on the tissues, thus insuring perfect contact, which facilitates electrolysis, by which process the stricture is dissolved, and removed. (16, 83, 87). USE ONLY GALVANIC CURRENT, attached to the bare metal tip, on an insulated staff, in the canal, (see cuts). This is attached to THE NEGATIVE POLE ONLY. Introduce elect., till it strikes stricture, + distant. TURN ON CURRENT SLOWLY, till distinctly but NOT PAINFULLY FELT, by patient, (DO NOT USE COCAINE), 2-6 ma., in urethra, 5-20 in rectum. USE GENTLE PRESSURE ONLY, and WAIT, till tip passes through the band, which takes from 2-20 min. Remove same way, till again passed band. Turn off current, and remove. Do not use another size tip the same day. Repeat in 3-10 days, and continue, each time with the same or a size larger tip, till THE STRICTURE IS REMOVED. When properly treated this way, it is not stretched, torn, bruised, cut or made worse, but is slowly and surely dissolved, and removed forever, (83).

Sub-Involution, Uterine (See Displacements)

F. sec., (coarse coil), slow int,, bipolar elect., int.-ut., (228), or one pole abd., (82, 142), Bennett disc, other in rectum, (see cut, page 243), 15-20 min., daily, swelling current, (75). S. ind., or sin., same way. G. con., — int.-ut,, (216), + Bennett disc, (82, 142), 20-40 ma., 15-30 min., e. o. d., or wkly. G. int., same way, 5-10 min.

Superfluous Hairs (See Hairs, Superfluous)

Supra-Orbital Neuralgia (See Migraine, Neuralgia)

Sweating of Axillæ and Feet (See Hyperidrosis)

Swelling Currents (See page 75)

Sycosis (See Eczema, Favus, Ringworm)

X-ray almost a specific. Treat same as for above.

Syncope (See Brain Troubles, Anæmia)

Synovitis (See Arthritis, Inflammation, Rheumatism, Sprains)

G. con., + to part, — distant, 5-10 ma., 10-15 min., daily. Local, electric light bath, (193). Helios violet light, (198), 15 min., daily. Bennett magnetone, (170), 20-30 min., daily. (173).

Syphillis, Chancre (See Chancroids, Ulcer, Warts)

GENERAL: Electro-vapor baths, (92), daily, or e. o. d. Electric light bath, (187). Oxyoline, (229), 30-40 min., daily. This treatment has produced clinical results, and symptomatic cures, in from 3-6 mos. that would require 3-4 yrs. with ordinary drug medication.

CEREBRAL: G. con., + to forehead, large pad, (142). — nucha, 2-4 ma., 5-10 min., daily. Bennett head magnetone, (170), 20-30 min., daily. In addition to the foregoing.

TABES DORSALIS (See Tuberculosis, Spinal)

G. con., + nucha, — sacrum, (39), 10-20 ma., 10-20 min., daily. Oxyoline, (229), 30-40 min., daily.

Tattoo (See Blemishes, Powder Marks)

Tetanus

G. con., + to affected muscles, lab., or stab., electric hand massage, hand pad, (142), or roller elect., — distant, mild, 2-10 ma., 5-15 min., repeated, p. r. n. C. g., (101). Bennett head magnetone, (170), 15-30 min., daily. Helios, Russian or Minin violet light, locally to spine, or generally, p.r.n., (195, 198). Oxyoline, (229), 30-40 min., daily.

Tic Doloreaux (See Neuralgia Trigeminal, Spasm Facial, Pain) (107). (197)

Tinea Circinata (See Ringworm) (192)

Tinnitus Aurium (See Deafness)

Telephone Ear (See Deafness)

Tonsils, Enlarged (See Glands, Enlarged)

G. con., + platinum or gold spear in tonsil, — in hand, 5-10 ma., (cocaine), 2-5 min., e.o.d., or wkly, p.r.n. G. con., + ana., cup shaped copper elect., on an insulated stem, to surface, — in hand, lab., to prevent sticking, till green color, (88), 5-10 ma,, 5-10 min., daily, or e.o.d. G. con., — steel needles, in glands. + hand, 2-5 ma., 3-6 min., daily. Galvano-cautery point or knife, (34, 35), to gland.

Tonsils, Folliculitis (See Ulcer)

G. con., — needles in follicles; or g. con., ana., + copper needle, lab., in follicles, — hand, 2-6 ma., 2-3 min., daily.

Toothache, Neuralgic (See Neuralgia, Pain)

S. spray, (114), local, + to pain, — crown, 10-15 min. S. ins., (112), 20 min., daily. G. con., + sponge pad over nerve, — nucha, lab., or

stab., 2-5 ma., 5-10 min. G. con., + platinum wire, wrapped with cotton, wet in strong sol. cocaine, in cavity, — in hand, 1-3 ma., 5-10 min. H. f., surface vac. elect., (147). local, 5-10 min. Helios or Minin violet light, (196, 198), 15 min. Bennett head magnetone, (170), 15-20 min, Magnetic wave, (176), 15 min.

Torticollis

F. sec., (coarse coil), slow int., 5-10 min., lab., to muscles of opp. side, daily. G. con., + pad, (142), to weaker muscles. S. ins., 15 min., daily. G. con., electric hand massage, 15 min., daily. C. g., (101).

Toxæmia (See Constipation, Marasmus)

Electro-vapor baths, (92). Electric light baths, (187). Oxyoline, (229), 20-40 min., daily.

Trachoma (See Eye Diseases, Trachoma)

Tubal Pregnancy (See Gestation, Ectopic)

Trichiasis (See Hairs, Superfluous)

Tuberculosis (See Marasmus, Debility, Fever Convalescence)

G. g., g. f., c. g., (97, 101). Electro-vapor baths, (92). S. ins., s. spray, s. shower, (112, 113, 114). Oxyoline, (229), 30-40 min., daily. Electric light baths, (187). Helios violet light, (198), 15 min., daily. Diasolenic zone, and s. cage, (183). (107), (108), (188), (197).

Tuberculosis

ARTICULAR: (See Tuberculous Glands, Arthritis, Synovitis).
CUTANEOUS: (See Lupus).
INTESTINAL: (See Tabes, Diarrhœa, Constipation, Pain).
PULMONARY: (See Consumption).
SPINAL: (See Tabes Dorsalis, Spinal Meningitis).
TESTICULAR: (See Glands Enlarged, Tuberculous Glands).

Tuberculous Glands (See Carcinoma)

G. con., ana., + Bennett phoric, (78), cocaine, 5-10 min.; or Russian, Minin, or helios violet light, (196, 197, 198), 15-30 min., till anæsthetised. Then cut skin over gland, and incise down to gland, if possible. Then apply g. con., — distant, + to sliver of zinc, or elect., (88), amalgamated, (21), lab., to keep wound open for drainage. Then insert a gold tip, insulated and amalgamated, (21), as deep in the wound or sinus as can be. Apply g. con., + to point, 2-10 ma., 10-15 min., or till mercury is deposited by interstitial diffusion, (88),

e. o. d., till cured. Dress with cotton, dioxygen and ungt. $Hg.O_2$. Oxyoline, (229), 30-40 min., daily. This combination gives best results with minimal scarring. (See lesson No. 30), (197).

Tumors (See Blemishes, Growths, Moles, Warts)

BENIGN: G. con., — over growth, + opp., 10-30 ma., 10-20 min., e. o. d. G. con., — Bennett needle holder, (120, 212), with from 1-10 needles, according to size of base, + distant. Remove and re-insert, as before, at right angles to 1st insertion, and repeat, 5-20 ma., 10-20 min. One treatment usually enough.

FIBROID: (See Fibroids Uterine, Warts).

MALIGNANT: (See Carcinoma)

VASCULAR: (See Nævus, Varicose Veins).

ULCER, CORNEAL (See Eye Diseases, Corneal Ulcer).

Ulcer, Exuberant, Fungus, Indolent, Phagedenic, Rodent, Sloughing, Syphillitic, Varicose (See Carcinoma, Lupus, Syphillis)

G. con., ana., copper or zinc elect, (88) plain or amalgamated, (21), + to surface or into ulcer, lab., — near, stab., 5-20 ma., 5-15 min., (cocaine), e.o.d., till get green, (copper), of white, (mercury), deposit, by interstitial diffusion, (88). S. spray, (114). S, s., (115), to ulcer. X-ray, soft tube, (153), short, and often, p.r.n., till gray exudate appears, then less frequent, till well. Follow with Minin or helios violet light, (196, 198), 15 min., daily. Protect healthy skin against burn by Allen shield, (159). Oxyoline, (229), 20-40 min., daily, to oxidise blood. Splendid, especially in syphillis, (91), (197), (232)

Urethra, Female, Polyp, or Caruncle (See Growths, Moles, Warts)

G. con., cautery point, (34, 35), local. G. con., — needle in growth, + abd., (82, 142), Bennett disc, 2-10 ma., 2-4 min. G. con,, ana., + copper needle in growth, — abd., (82), 2-5 ma., 2-4 min., p. r. n. Usually one treatment enough.

Urethra, Hyperæsthesia (See Pain, Functional Nervous Diseases)

F. sec., (fine coil), or sin., to cold bare steel sound entire length of urethra, other pole, back, (81), mild current, 5-10 min., daily. G. con., — same way as above, + back, (81), 2-5 ma., 5-10 min., daily. Hydro-electric injection, soluble set elects., (91). Bidet chair, violet light, local, (194), 15 min. daily.

Urethra, Stricture (See Stricture)

Urethritis (See Gleet)

Urine, Incontinence (See Bladder Irritable, Spasm, Incontinence of Urine)
F. sec., (fine coil), or sin., one pole in rectum, urethra or on pubes, (228), other pad, (142), on perineum. Mild swelling current, (75), 5-15 min., daily. G. con., + pubes, — sacrum, (81), or perineum; or + sacrum, (142), — feet, 10-20 ma., 10-15 min., daily. S. s., (115), spine. S. ins., (112), 20 min., daily.

Urticaria (See Hives, Pruritis)

Uterine Derangements

ATROPHY: (See Atrophy)
F. prim., or sec., (coarse coil), or sin., or s. ind., or g. int., or g. alt., slow, — int.-ut., (228), + abd., (82, 142), Bennett disc, or sacrum, (81). (See cut, Amenorrhœa, page 243), 10-30 ma., 10-20 min., e. o. d. (228).
CANCER: (See Carcinoma).
DISPLACEMENTS: (See Displacements, Prolapsus, Sub-Involution).
FIBROIDS: (See Fibroids, Uterine).
INERTIA: (See Hemorrhage, Post-Partum, Obstetrics, Sub-Involution).

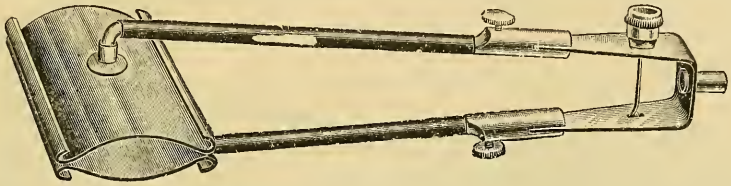
Uterus, Infantile (See Sterility, Infantile Uterus, Uterine Atrophy)

VAGINAL LEUCORRHŒA (See Endo-Metritis, Leucorrhœa)

Vaginismus (See Stricture, Vaginal)
F. sec., (fine coil), or sin., vag., and abd., (82,142), Bennett disc, (See Cut, Amenorrhœa, page 243), mod. current, 10-20 min., daily. G. con., + aluminum or carbon elect., vag., — abd., (82), 5-20 ma., 10-20 min., daily. H. f., vag. vac. elect. (No. 2, 147), vag. S. vib., (123), Bennett method, same way, + vag., — abd., (82), Bennett disc. mild vib., 5-10 min. daily. Put sphincter on tension, with speculum, or large rectal olive tip elect., attached to f. sec., (long fine coil), or sin., 5-10 min., daily.

Varicocele (See Varicose Veins, Orchitis)
G. con., + to scrotum, — abd., (82), or back, (81), ana., + Bennett phoric, (78), wet with adrenalin, cocaine, thuja, hammemelis, held firmly against varix, 5-10 ma., 5-10 min., daily. G. con., ana., + mug, water bath elect., as in orchitis, (273), filled with above drug solutions, in which is immersed the scrotum, 5-10 min., daily. G. con.,

ana., + with divided varix clamp elect., (see cut), plates covered with cotton, wet with above drugs, clamped closely on both sides varix, 5-10 ma., 5-10 min., daily. Continue, p. r. n.



Varicose Veins (See Aneurism, Nævus)

G. con., + platinum or gold needle in vein, insulated except tip, — near, 5-10 ma., 5-10 min,, or till clot forms. G. con., ana., + copper needle, same way. Reverse polarity, 1-3 min., to loosen needle. G. con., ana., + Bennett phoric, (78), with cocaine, adrenalin, thuja, or hammemelis, stab., with pressure, 5-10 ma., 5-10 min., daily. If painful, Minin or helios violet light, (196, 198) 15 min., daily.

Vascular Tumors (See Aneurism, Nævus, Varicose Veins)

Verrucca (See Warts)

Versions, Uterine (See Displacements) (228)

Vertigo (See Brain Troubles)

Virginal Amenorrhœa (See Amenorrhœa, Chlorosis)

Virginal Dysmenorrhœa (See Dysmenorrhœa)

WARTS (See Blemishes, Epithelioma, Growths, Moles)

G. con., — needles in base, + near, 3-10 ma., 5-10 min., once. S. s., (115), to growth. H. f., vac. surface elect., (147). Apply chrom-ethylate sodium, (271), local.

Wakefulness (See Brain Troubles, Insomnia)

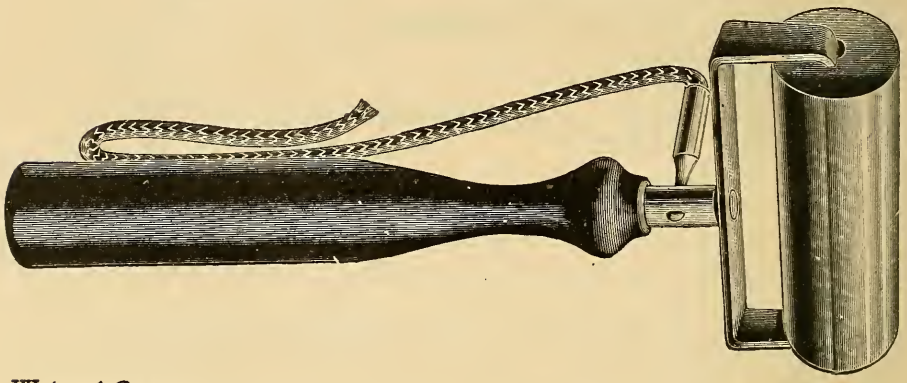
Wine Marks (See Blemishes, Nævus, Moles)

Wounds (See Ulcer)

Suppurative wounds best treated as old ulcers, with interstitial metallic diffusion, (88), and helios violet light, (198), 15-20 min., daily. (192).

Wrinkles

G. con., — sponge, hand pad, (142), or roller.elect., (see cut), electric hand massage, making strokes lengthways of the folds, skin wet, roller covered with felt, wet, mild currents, 2-4 ma., 10-15 min., daily.



Writers' Cramp

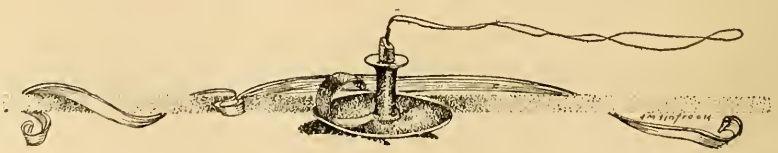
S. vib., (123), Bennett method, + in affected hand, — other hand, spine, or crown elect., mild vib., 10-15 min., daily. Several hours or days rest, during treatment is best, or change or work. G. con., + lab., to affected hand, — opp. hand, 5-10 ma., 10-15 min., once or twice daily. + in palm, if fingers extend, + on back of hand, if fingers are flexed. G. con., + where there is pain. C. g., (101). G. con., electric hand massage to affected muscles. In severe chronic cases, with anæsthesia, apply f. sec., wire brush, (202), local to affected areas. Bennett magnetone, (170), 15-30 min., daily. Helios or Minin violet light, (196, 198), 15 min., daily.

Wry Neck (See Torticollis)

X-RAY COMPLICATIONS

BURNS: (See Burns, X-ray, Dermatitis), (197).
CONJUNCTIVITIS: Avoid all direct exposure to rays. Have lead glass inside fluoroscope. Wear lead glass spectacles. Apply mild Minin violet light bath to eyes after exposure.
DEPILATION: (See Blemishes, Hairs, Superfluous)
DERMATITIS: (See Burns X-ray, Dermatitis X-ray).

ZOSTER (See Herpes Zoster, Eczema), (197)



Glossary of Electro-Medical Terms

and

Table of Contents

(Combined)

---

sorption and nutrition of the part treated, or the whole body, through its effect on the vaso-motor and sympathetic nervous system. It is reflex and physiological.....16, 67, 72

Catalytic Action—(See Catalysis).....16, 67, 72

Catelectrotonus—The state of increased irritability of a nerve near the cathode, or negative (—) pole.

Cathodal Electrolysis..... 87

Cathode—The "way" by which electrification leaves the body. The negative (—) pole. The concave aluminum electrode in a vacuum or X-ray tube. The negative (—) pole of the battery.....150, 156

Cathode rays—The rays from the negative end of an X-ray or vacuum tube..... 149

Cautery—(See Galvano-cautery).....34, 35, 42, 63

Cell—The jar or container, holding the elements and the electrolyte 17, 24, 24, 31

Centimeter—The hundredth part of a meter, equal to 0.39371, or about $\frac{2}{5}$ of an English inch.

Central galvanisation—Method of applying the galvanic current to the nerve centers 101

Centrifugal current—A descending current, or from the trunk outward, toward the extremities.

Centripetal current—An ascending current, or from the extremities, inward toward the trunk.

Charger—A small static machine of two plates used to charge a large static machine.

Charging galvanic cells 32

Charging static machine 131

Charging storage cells 35, 42

Chemical effects..... 71

Chloride of silver cell 23, 24

Chromo-therapy 186

Circuit—The path traversed by a current of electrification.

CLOSED CIRCUIT. A completed circuit, through the conductors, and patient.

GROUND CIRCUIT. One pole used and the other connected to the ground.

OPEN CIRCUIT. A break or gap in the metallic circuit.

SHORT CIRCUIT. A short metallic connection through wires or any good conductor. (See page 20).

Reluctance—Magnetic reluctance is the ratio of magneto-motive force to magnetic flux.

Resinous electrification—That which is excited by rubbing wax or resin with flannel or fur. Negative electrification.

Resistance—Is the quality of a conductor which impedes the action of the current, $R = \frac{E}{R}$. Resistance equals pressure ÷ by current strength. The unit of resistance is the ohm. The resistance is dependent on the size, length and kind of wire in the circuit. The resistance of different metals and conductors varies, as will be seen by reference to the following table. in which pure copper is taken as the unit of comparison, with a total resistance of 1.00.

Metal.	Resistance
Silver	0.77
Copper	1.00
Gold	1.38
Aluminum	2.29
Zinc	5.82
Iron	5.36
Tin	6.76
Platinum	7.35
Lead	9.96
German silver	10.09
Antimony	18.07
Mercury	47.48
Bismuth	64.52
Graphite	1106.00
Gas carbon	2037.00

Reverser, current—A pole-changer. A commutator.

Rheochord—A metallic wire introduced into a circuit to vary the strength of the current. A rheostat. A shunt.

Rheometer—A galvanometer.

Rheomotor—An apparatus by which an electrical current is generated. A dynamo.

Rheophore—An electrode. A conducting cord.

BOOKS AND JOURNALS WE RECOMMEND
(For Reference)

	Price
International System of Electro-Therapeutics, Bigelow-Massey	$6.00
Modern Physio-Therapy, Juettner	6.00
Roentgen Rays in Medicine and Surgery, Williams	6.00
Medical and Surgical Electricity, Rockwell	5.00
Conservative Gynecology and Electro-Therapeutics, Massey	4.00
Medical Electricity, Jones	4.00
The Electro-Therapeutic Guide, Bennett	2.00
The Skin, and Removal of Facial Blemishes, Lloyd	2.00
Journal of Advanced Therapeutics, Snow. Per year.	2.00
The Electro-Therapeutist, Bennett. Per year.	1.00
Journal of Physical Therapy, Blech. Per year.	1,00
International Journal of Therapy, Juettner. Per year.	1.00
Office Practitioner, Albright. Per year.	1.00

Good as Gold

Coupon

This Leaf is Worth Two Dollars, or Fifty Cents to You. See Other Side

This book, "The Electro-Therapeutic Guide," in a part of the mail course of instruction given by the National College of Electro-Therapeutics, Lima, Ohio, U. S. A., and each student taking the course and paying the full regular fees is entitled to a copy, Therefore any one having purchased this book, and having paid therefor the price of two dollars ($2), should he later decide to take the course or lessons, will receive credit, on the course fees for $2, the price paid for this "Guide," upon return of this leaf, with the blank on the reverse page properly filled out. Or, if the purchaser wishes to subscribe for "The Electro-Therapeutist," this leaf, with the blank on the reverse page filled out, and sent with fifty cents, will pay for the journal for one year.

So cut out this leaf, and send with the balance of the course fees, or the balance of the subscription, at any time, to the Secretary of the National College of Electro-Therapeutics.

Address,

H. C. Bennett, M. D., M. E.

Lima, Ohio, U. S. A.

(over)

Application for Enrollment

in

The National College of Electro-Therapeutics

Please enroll me as a student for your mail course of thirty lessons in electro-therapeutics, including the diploma, (shown opposite), and give me credit on the course fee for the price ($2.00) of the "Guide," from which this coupon is taken, and I agree to pay therefor, the balance of the fees, ($18.00) in ..... payments of $ ..... each, until full amount is paid. Or:

I enclose herewith the balance of the full cash fees, $16,00. to pay for the full course in advance, also including a year's subscription to "The Electro-Therapeutist," to commence with the issue of.....

Name.....

Mailing address, (St. & No.).....

To begin..... Post-office.....

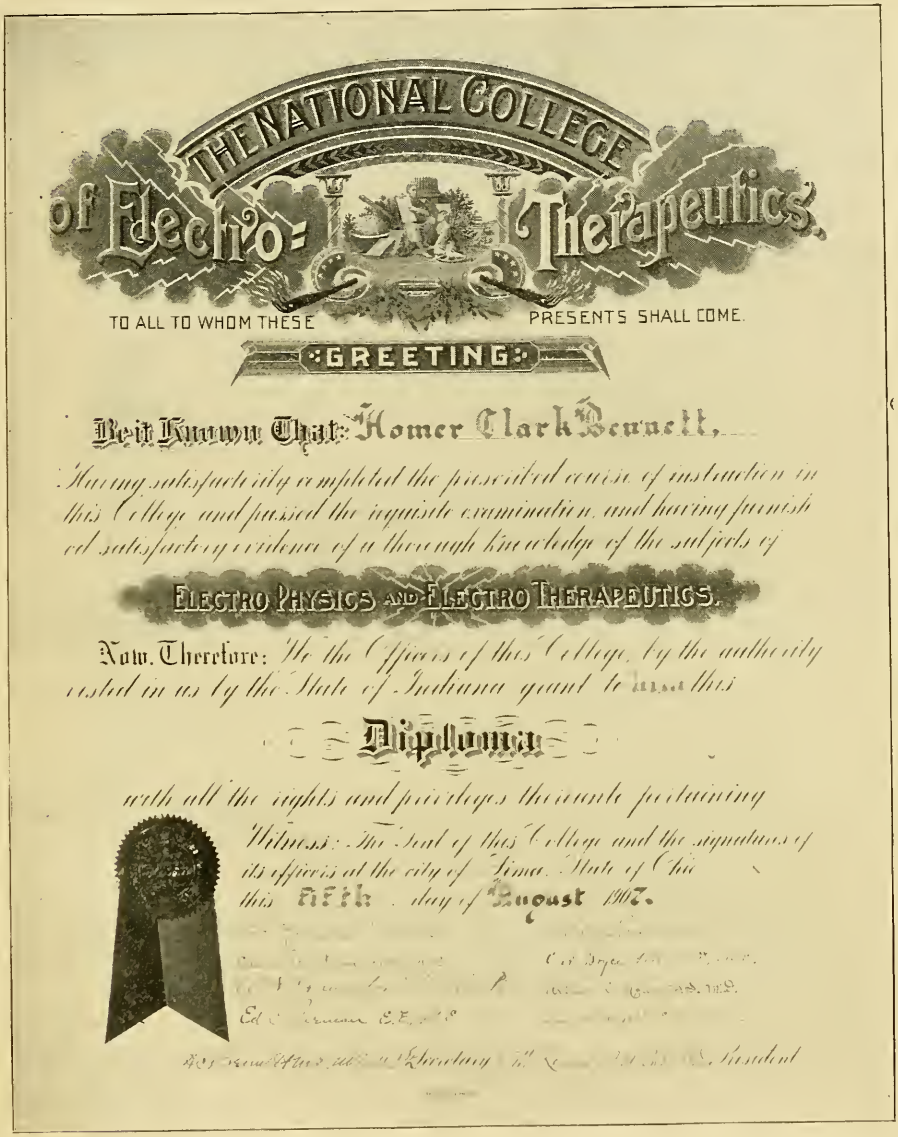
Date..... State.....

Fill out the above with ink, plainly, and send with a P. O., or express money order, or bank draft. (DO NOT SEND PERSONAL CHECKS, THEY ARE NOT MONEY), to

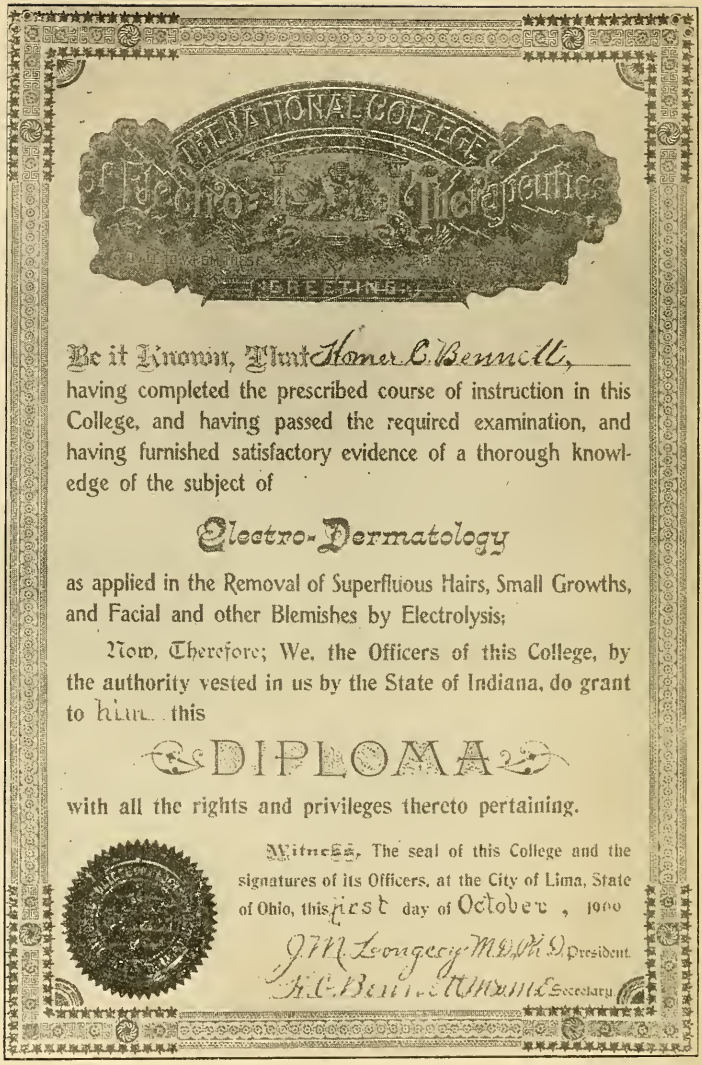
H. C. Bennett, M. D., M. E., Sec'y,
Lima, Ohio, U. S. A.

N. B. This coupon, alone, filled out and sent with fifty cents (stamps), will be accepted as payment for a year's subscription to "The Electro-Therapeutist."

(over)



N. B. The above engraving shows a reduced fac-simile of the diploma given free to all regularly matriculated students, after completing the mail course of thirty lessons. It is the regulation size, being 19 × 24 inches, hand engraved, and lithographed, on heavy parchment, with the name engrossed in fancy letters, and with the college seal and colors, and the signatures of the officers and faculty.



The above engraving shows a reduced fac-simile of the diploma given free to all regularly matriculated students, who have taken the special course of lessons in electro-dermatology. It is 10½ × 16 inches; and printed on fine paper from a half tone, in gold ink, and the name of the student and the signatures of the officers are written in gold ink, with the gilt college seal, and makes a handsome document.

The fees for this special course are $12, in payments, including a copy of the "Guide," or $10, cash in advance, including a copy of the "Guide," end "The Electro-Therapeutist," for one year.

N. B. Regularly matriculated full course students, may take this course on payment of $5 extra.