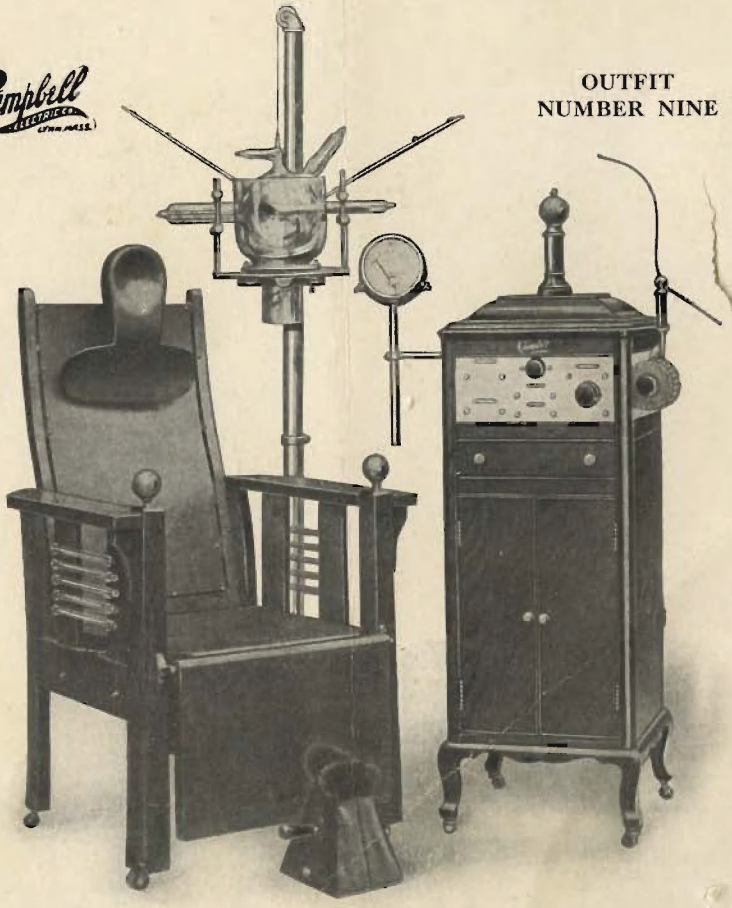
Practical Electro-Therapeutics

Campbell Electric Corporation

Lynn, Massachusetts, U. S. A.

Campbell X-Ray *and* High-Frequency Apparatus



OUTFIT
NUMBER NINE

The Complete and Ideal Office Equipment

For

All High-Frequency Treatments, Fluoroscopy, X-ray Therapy, and all Radiographic Work within the Requirements of the General Practitioner.

Practical Electro-Therapeutics

Sixth Edition

Campbell Electric Corporation

Lynn, Massachusetts, U. S. A.

CAMPBELL
X-RAY AND HIGH-FREQUENCY COIL
MODEL "F"

The Most Powerful X-ray and High-Frequency Coil Built

The Most Efficient X-ray Apparatus

(Short of an Interrupterless Transformer.)

For use on Alternating Currents.

PREFACE TO SIXTH EDITION

Each year the use of High-Frequency currents is becoming more and more a routine matter in the office of the general practitioner, and no longer can use of this form of electricity be claimed by the specialist in electro-therapeutics as his exclusive prerogative.

It is a practical necessity for every doctor to be at least familiar with the various forms of High-Frequency currents and their indications, even if he does not administer them, in order that he may not do an injustice to his patients by failure to direct them to proper treatment in such conditions as yield more promptly and satisfactorily to this method than to any or all others.

The present supply of reliable textbooks on this subject does not justify us in presenting this little book as anything like complete, but simply as an index to treatment and an incentive to more complete investigation.

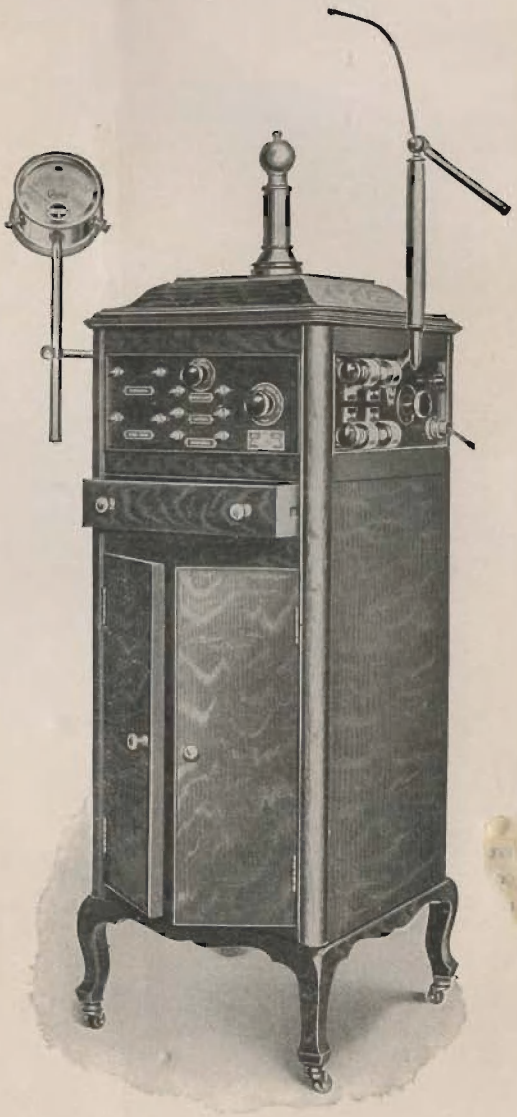
We will take up briefly the various forms of high-frequency currents now in general use with a statement of conditions in which they are indicated and in which they have proved efficient in the hands of an ever-growing number of professional men.

We are proud of the fact that our five previous editions of PRACTICAL ELECTRO-THERAPEUTICS have been the means of starting many thousand doctors in the right direction, and we believe the Campbell Electric Corporation has the unique distinction of representing the only manufacturers of electrical apparatus who have undertaken an educational campaign for the benefit of their prospective customers.

Our host of professional friends is our reward for past efforts and we shall endeavor in the future, as we have in the past, to furnish our customers with the best possible apparatus, and what is of equal importance, the best possible SERVICE.

CAMPBELL ELECTRIC CORPORATION
Lynn, Mass., U. S. A.

CAMPBELL
X-RAY AND HIGH-FREQUENCY COIL
MODEL "I"



This model has been introduced to supply the demand for a permanent installation and at a moderate price.

The Model" I" is the most popular type of apparatus designed to meet all requirements of the general practitioner and is specially designed for those who require powerful X-ray and at the same time one which is an excellent treatment machine.

It gives a powerful X-ray, D'Arsonval, Thermo-Faradic and Sinusoidal current, Fulguration, Cataphoresis, Tesla or Oudin current for use with vacuum electrodes, Cautery and Diagnostic lamp.

Campbell

CHAPTER I

PHYSIOLOGICAL THERAPEUTICS. During the last quarter century there has been a growing tendency on the part of the medical profession to introduce methods of cure which depend in no way on the administration of drugs, but which, on the other hand, tend to aid or stimulate the natural resistance of the system to disease. To these various methods the name of Physiological Therapeutics has been applied, and so important has this field become that several medical publications are given up entirely to this subject and numerous textbooks have appeared which are devoted entirely to methods of treatment which do not consider drug action.

Recognizing the value of a large majority of these newer means of cure, we shall confine ourselves to those produced by electrical currents, and shall narrow the field still further to embrace only those electrical currents which are of high potential, rapid alternation and of appreciable volume.

ELECTRICITY IN MEDICINE. Electricity has been used in medicine for a century or more, but only in a limited way, and unfortunately up to a comparatively recent period it has been seized upon by the irregular practitioner as a means of gaining public attention and given too little thought by the regular practitioner.

However, since the introduction of high-potential currents, the attention of the medical profession has been turned more and more toward electricity, until to-day it is the most generally used of all the extra-drug methods of treatment.

EARLY FORMS OF ELECTRICITY. In the past the use of electricity has been limited to three forms, Galvanic, Faradic and Static currents. All of these have had a limited field of usefulness and possess certain good qualities, but each is lacking in some important factor. Static and Faradic electricity are currents of high voltage and low volume while Galvanic electricity has volume without sufficient voltage to overcome the resistance of the body sufficiently to enable it to exert any marked effect upon the deeper tissues or organs of the body.

MODERN DISCOVERIES. The discoveries of D'Arsonval and Tesla have given to the professional world an entirely new form of electrical energy, possessing both impulse and volume and in the light of clinical experience, capable of producing profound effects upon the human system, and paradoxical as it may seem, less likely to produce injurious or harmful effects than the less efficient Galvanic and Faradic currents. These forms of electrical energy meet all requirements when handled by a competent operator, and so comparatively simple is their use that the technique is much more easily acquired than that of the less efficient currents already mentioned.

ALTERNATING CURRENTS. The ordinary electrical current from a battery or other generator passes either continuously or in impulses along a conductor in one direction and is known as a direct current. An alternating current flows along a conductor for a given period of time, reverses and flows in the opposite direction for a like period. This change of direction is technically known as an alternation, and one impulse along a conductor and back again is known as a cycle.

Either the direct or alternating current when of sufficient voltage and volume is dangerous and even destructive to life when passed through the body, the alternating less so by reason of its change of direction which tends to prevent electrolytic action upon the tissues. The commercial supply of electricity from power stations may be either direct or alternating and for economic reasons is more commonly alternating; and when supplied for lighting purposes or light motors is usually at a voltage of 110 and having 120 alternations per second, or 60 cycles. Within a comparatively short time it has been demonstrated that if this current be properly stepped up in voltage and the rate of alternation increased to infinite rapidity, it becomes harmless to living tissues and possesses certain valuable therapeutic properties heretofore not possessed by any other form of electrical energy.

The Campbell High-Frequency Coil is a transformer of the Tesla type which converts the commercial current of slow alternation to one of infinite rapidity and allows a control of volume of sufficient latitude to adapt it to a variety of therapeutic uses which will be discussed at length under the various forms of current produced.

HIGH-FREQUENCY CURRENTS. A High-Frequency current, as its name implies, is one of extremely rapid alternation from ten thousand per second up to over a million. It is also essential in order to be of any great therapeutic value that it should possess volume as well as rapid alternation. The earlier High-Frequency currents were produced from the static machine by means of a resonator or other device, and while they had both voltage and rapid alternation, were almost wholly lacking in volume. Later, with the general introduction of the induction coil, a rather more efficient current was developed but still lacking in several essential features.

CHOICE OF APPARATUS. Of late, leading authorities agree that the most efficient High-Frequency current is that obtained by the direct transformation of a commercial alternating current, and it is this type of apparatus which is in general use at the present time.

Many pieces of apparatus have been designed by electricians and given to the profession to adapt them to treatment as best they might. The evolution of the Campbell Coil was directly the reverse, inasmuch as it was designed and made to meet the actual requirements of the physician as learned by consultation with a number of expert electro-therapeutists.

THE CAMPBELL COIL has been manufactured for sixteen years; the present form is an evolution, the result of actual clinical use during that time, and produces all of the various High-Frequency currents. Owing to its original design has been granted comprehensive patents by the U. S. Government covering over twenty essential points for the production of currents and the protection of machine, patient and operator from accident or injury.

It consists of a transformer by which the commercial current is stepped up in voltage, passed through a condenser, spark gap and supplementary High-Frequency transformer. By various combinations of windings and condenser the different currents are produced and delivered to various terminals of the coil, each

distinct and plainly marked. To the physician who is also a practical electrician, we shall be glad to send a copy of our patent, entering fully into technical details.

It is agreed by competent operators that this coil is the ideal apparatus for High-Frequency currents, and the suggestions embodied in this book will have reference to the various currents as produced by it with methods of technique applying to this particular coil.

For a number of years we made nothing but a portable coil, but the increase of demand for coils of greater power and more in the nature of a pemanent office fixture have compelled us to manufacture a variety of models.

The general construction is the same in all of our coils, the variations being in size, shape and different ratios of windings to meet varying demands.

The control of all our coils is practically the same and all switches and points of connection are plainly indicated by name plates.

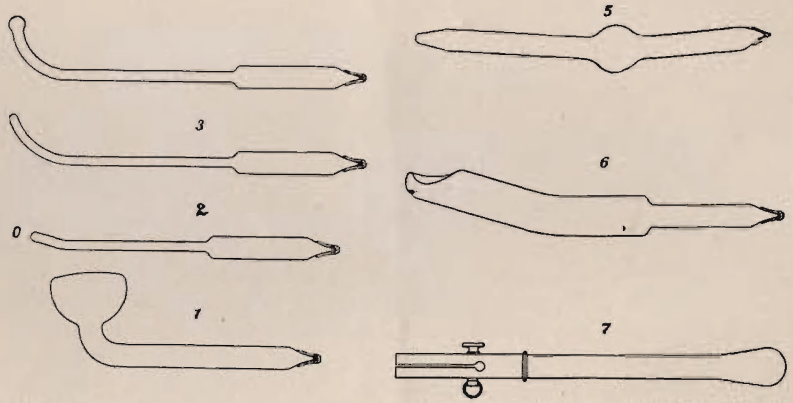
In all coils the Frequency Regulator with its four points controls the frequency of the current by means of a variable condenser. The Primary Regulator with seven points controls the volume of current. In Model "I" there is a three-point switch which is connected with an impedance coil and which allows still further modification of the curent, especially desirable in fulguration and in currents where voltage rather than volume is the important feature.

CHAPTER II

HIGH-FREQUENCY CURRENTS; THEIR CONTROL AND TECHNIQUE

TESLA OR OUDIN-CURRENT. This current is for local application to definite areas and for general treatment by application to spinal nerves with vacuum electrodes.

Electrodes are of special form and size, according to the locality to be treated. Plain where surface application is to be made and insulated for work within the cavities where localization is desired. The most generally used electrode is the surface electrode. It consists of a vacuum tube expanded at one end as best adapted for treatment of considerable areas.



1. Surface. 2. Nasal. 3. Urethral. 4. Throat. 5. Rectal. 6. Vaginal. 7. Insulated Handle.

TECHNIQUE. Insert electrode in insulated handle and tighten thumb nut until it is firmly held by the handle. Connect hook on end of one of the cords furnished with the coil to ring on metal sleeve of handle and connect the taper tip of same cord to top of post "B." Place Frequency Regulator at "High" and Primary Regulator at point marked "Off" then turn on current at fixture or switch from which supply is received. Grasp electrode handle near the tip away from metal sleeve, being careful that neither the metal sleeve nor any part of the connecting cord is allowed to come in contact or close proximity to either yourself or patient. Open Primary Regulator to the first point and regulate spark gap by control handle until the electrode is filled with an even radiance which will vary in color from a rich magenta to a bluish white, according to the vacuum of the electrode. If the electrode is now brought in contact with the skin, there will be a soft, even discharge from the

surface of the electrode, giving little sensation other than one of warmth. It will also be noted that if the shaft of the electrode is grasped by the hand, there will be a much less volume in the body of the electrode. This point should be well noted, as it has an important bearing on technique as considered under special treatments hereafter described. As the Primary Regulator is advanced point by point, there will be an increase in volume of discharge from the electrode with no change of frequency. This current is very soft and non-irritating and should be used for treating sensitive surfaces or for work in the cavities.

Surface Application

FREQUENCY AND ITS REGULATION. Inasmuch as there may be some misconception as to the terms "High" and "Low," it should be understood that this refers entirely to the frequency of the current and not to its power. The terms "High" and "Low" are merely relative, the frequency of the lowest being extremely high as compared with the power circuit. When the regulator is at "High," a very small section of the condenser is in the circuit and its charge and discharge are extremely rapid, occurring before there is sufficient charge in the condenser to produce a sharp, disagreeable spark upon its discharge from electrode, and at the same time having good volume. If now the spark gap be opened slightly, it will be noticed that the current changes somewhat in character. The volume will be slightly less and there will be more tendency to slight sparking discharge from the surface of the electrode. This is due to the fact that the voltage is increased because the condenser is allowed to charge to a higher pressure before discharge.

If the current now be shut off at the Primary Regulator and the Frequency Regulator turned to the point next to "High," upon turning on the current it will be found to be much sharper owing to increased condenser capacity, and there will be a decided shower of short sparks from the surface of the electrode when brought close to the skin. Here, too, a considerable modification may be obtained by manipulation of the spark gap, and it is possible to produce a fairly soft current by nearly closing it.

Even on the other points of the condenser, there is no sensation except warmth when the electrode is in absolute contact with the skin.

NOTE: In referring to the various points of the Frequency Regulator, consider "High" as the first point. Interposition of even a thin layer of clothing removes the surface of the electrode slightly from the skin and allows the passage

of a shower of minute sparks with a decidedly biting sensation and some tendency to counterirritation. This may be taken advantage of if a particularly stimulating current is desired or if slight counterirritation is wanted.

CAUTION: This current is hot, and under favorable circumstances will ignite inflammable material; therefore use it with care when treating through flimsy clothing and do not apply it in the immediate vicinity of an oily or collodion dressing.

For all applications by means of vacuum electrodes, the first two points of the Frequency Regulator will give sufficient range of frequency, and one to four points of the Primary Regulator will give sufficient volume. With a lower rate of condensation the sparks will be too painful, and there will also be danger of puncture of the electrode from heavy sparks.

When using lower condensation the spark to patient may be entirely avoided if the operator after current is turned on grasps the electrode with his free hand and applies the electrode to the patient before removing the hand, reversing the process when electrode is removed. *Always use this method* when treating through clothing, and keep electrode firmly pressed to surface during treatment.

PHYSIOLOGICAL EFFECTS. The effects of treatment with vacuum electrodes are an increase of blood supply to the part treated, thereby increasing the local nutrition; there is an increase of secretion and excretion; there is a direct liberation of ozone at the surface, having a decided germicidal effect, and there is an increase of local heat without rise of bodily temperature. This current is either sedative or stimulant, according to whether frequency be high or low, the former being more sedative. Aside from the purely local effect, there is also a slight general effect. If with the Frequency Regulator on the second point, a surface electrode be grasped in the hand of the patient and the current turned on, a perceptible and visible spark may be drawn from any part of his body by touching with the finger or an electrode held in the hand. There is, therefore, a general charging of the whole body and a rapid cell vibration synchronous with the frequency of the current. A general tonic effect may be obtained by treating up and down the spine. As this form of treatment tends to increase arterial tension, it is contraindicated in such cases as show hypertension.

FREQUENCY OF TREATMENT. Like the X-ray, this form of treatment is cumulative and the good effects of each treatment are of correspondingly longer duration than those of previous ones. At first, treatments should be daily, if possible, not less frequent than on alternate days at any event, and as improvement is noted, the intervals may be gradually increased.

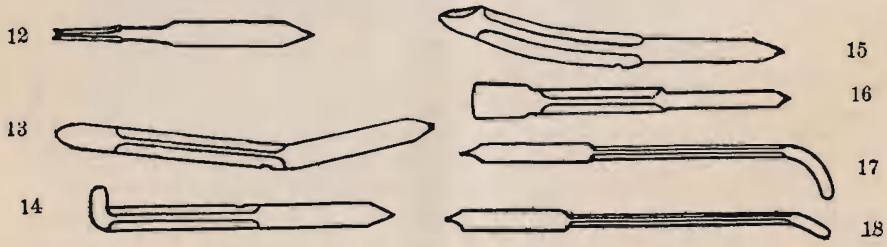
DURATION OF TREATMENT. Treatment should be given for from five to fifteen minutes, according to indications and toleration of patient, and in the majority of cases each treatment is to be supplemented by general tonic treatment along the spine unless contraindicated as above.

PREPARATION OF PATIENT. Where the surface is to be treated, it is desirable to remove clothing unless the slight sparking is deemed advisable. If clothing is not removed, it should be thin and the electrode pressed firmly against

the surface. Owing to short spark length from the highest frequency, it is better to have Frequency Regulator on the second point when treating through clothing or other material.

WORK IN CAVITIES. For this form of treatment the special electrode adapted to part should be used. It should be placed in situ before the current is turned on, and the current should be turned off before its removal. Introduction may be facilitated by lubrication of electrode. The sensation is one of warmth only, and owing to the sensitiveness of the mucous membranes and the fact that the electrode is to remain stationary, treatment should not be longer than from three to seven minutes, else there may be produced a local, direct burn. From the tendency of the current to leave the electrode at the first point of contact, it is best to use insulated electrodes in cavity work. An insulated electrode is one whose sur-

INSULATED ELECTRODES



face with the exception of a definite area at the terminal is surrounded by an air chamber which prevents discharge of current except to parts in contact with the active area. *Caution.* Be sure that metal sleeve of electrode, also connecting cord, do not come near enough to patient to allow direct spark discharge.

LUBRICATION OF ELECTRODES. As all oily substances are natural insulators, it is necessary to lubricate electrodes for internal work with one of the mucoid lubricants.

CARE OF ELECTRODES. Be sure that, like all surgical instruments, your electrodes are properly cleansed after each use. Being entirely of glass, this may be accomplished by means of antiseptics or by boiling. If you are treating any specific cases, *keep an individual electrode* for each patient.

For ordinary cleansing, it is sufficient to use a piece of surgical gauze moistened with denatured alcohol, and every electrode should be so cleansed before use.

FULGURATION. This treatment is escharotic and consists in direct application of a small spark to any desired point or area. This may be accomplished either by a discharge from the tip of one of the small glass electrodes (nasal or urethral), or, better still, by a special fulguration electrode consisting of a fine metal point in an insulating handle, which is connected by means of a small cord to post "B" of the coil, and so arranged that current may be controlled by a small thumb-spring on the handle. For fulguration the Frequency Regulator should be at "High," and one or two points of the "Primary Regulator" will give sufficient volume. The point should be brought in close proximity to the part to be treated and the current applied for a few seconds only, or until slight blanching is produced. If an extensive area is to be treated, this should not be done all at one time, but rather in successive operations. Treatment is usually followed by a serous infiltration, followed in turn by a scab which drops off in a few days, taking with it the growth and leaving clean scar tissue which usually becomes practically normal cuticle. Fulguration is used chiefly for warts, moles, papillomata, nævi, and sometimes as a supplementary treatment to the X-ray for malignant growths. If treatment is too painful, local anesthesia may be employed.

DESSICATION. The use of the three-point impedance switch, previously alluded to, enables the application of a thin spark, of high voltage (the so-called "cold spark"), whose action is more one of dessication than escharotic. This current may be obtained by placing the switch at point 1.

THE D'ARSONVAL CURRENT. This current is a true High-Frequency current but of moderately low voltage and ample volume. The D'Arsonval winding proper has a voltage of about twenty-five thousand, and volume varying in the different models up to fifteen hundred or more milliamperes (Model "F").

PHYSIOLOGICAL EFFECTS. The effects of this current are a general increase of metabolism, glandular activity, secretion and excretion, an increase of bodily temperature, with a consequent increase of oxidation and elimination. Where there is arterial hypertension, the blood pressure is materially reduced. The effect upon the nervous system is sedative. It will be readily seen that this current is of extreme value where a general effect is desirable, and it will be found applicable in the large majority of cases treated where anything more than local effect is desired.

TECHNIQUE. The D'Arsonval current may be applied direct by means of metal electrodes held in the hands, but by far the best and most general use is by auto-condensation. As this current is of appreciable volume and as there is a wide variation of the amount of current which can be passed through different patients, it is absolutely essential that volume of current passing should be accurately measured.

MEASUREMENT OF CURRENT. This measurement is accomplished by means of a hot wire milliamperemeter, an ingenious apparatus which consists of a fine wire tightly stretched and whose middle point is attached to the short arm of a spring-actuated indicator. The meter is put in series with the patient, and a shunt current passing through the wire causes it to expand, allowing the spring to move the indicator along a graduated dial accurately registering the amount of current passing through the patient. To insure absolute accuracy, we have, after a good deal of experimental work, succeeded in producing a hot-wire meter carefully calibrated by a standard meter with no greater error than one per cent at any point. To use this meter, it should be attached to the cabinet on the Campbell Model "E" or other portable coil, or to a base or suitably insulated bracket for other type coils. A wire should be attached to the binding post of the meter nearest the coil and should be fitted with a tip of proper size to fit the terminals on the coil. This tip should be placed in one socket for the D'Arsonval current. From the other terminal of the meter a cord extends to electrodes or whatever medium of treatment is being used. The circuit is completed through the patient, back to the other terminal of the coil.

DIRECT TREATMENT. Electrode in one hand of patient passing through meter to coil terminal, electrode in other hand of patient connected direct with other terminal on coil. Frequency regulator at "High." As primary regulator is opened step by step, a gradual increase in reading will be noted up to the maximum. Spark gap should be so regulated that there is the greatest volume of current with the least amount of oscillation of needle. By this method of treatment, the amount of current at maximum reading will vary from four to six hundred or more according to capacity of patient. The sensation produced is one of warmth in the wrists, noticeable after a few minutes' treatment, and gradually extending up the arms with a possible feeling of general warmth and slight perspiration. If the spark gap be opened rather wide, there will be a slight Faradic sensation. Direct D'Arsonvalization as described in many of the textbooks is preferably obtained from the Campbell coil by application to the affected part by means of block-tin electrodes in direct contact with the bare skin, thus securing maximum heating effect.

AUTO-CONDENSATION. As stated, the most valuable and frequent use of the D'Arsonval is for auto-condensation, and it is this form of treatment which produces the most profound physiological effects.

Auto-condensation is accomplished by means of a condensation chair or couch. The general construction of these is similar, and a description of our treatment chair will illustrate the principle of this form of treatment. The back and seat of this chair consists of metal plates covered with an insulating material,—or dielectric, which in turn is covered with Chase leather. Back and seat are electrically independent and provided on each side with a socket in direct contact with the metal plate. On each front post of the chair is a socket to which is fitted a large hand electrode with a taper tip. These sockets are connected to a common connector beneath the chair, which in turn may be connected to the coil. The

seat and back may be made a unit by cord connection. In giving auto-condensation, the back and seat of the chair are connected by cord and this unit in turn connected with one of the D'Arsonval terminals of the coil. The electrodes are also connected together and through the meter to the other D'Arsonval terminal of the coil. The patient is then seated in the chair and instructed to grasp the metal electrodes firmly, but not rigidly. With the Frequency Regulator at "High," turn on the Primary Regulator step by step until the desired volume of current is reached, regulating the spark gap to get the maximum volume of current at each point with the least oscillation of the needle. This form of treatment will give up to eight hundred milliamperes or more, according to capacity of individual, with Campbell Model "E" coil; with the Model "F" up to 1200 or more M. A., and with the "I" up to 1500.

In auto-condensation, as its name implies, a condenser is made in a secondary circuit, one plate of which is the body of the patient, the other the metal plates of the chair, with an intervening dielectric. As in every condenser, there is a rapid oscillating discharge from plate to plate, and this rapid charge and discharge of a heavy current in the patient's body produces the therapeutic effect. There is an infinitely rapid and infinitely fine massage of every cell of the body plus heat and the effect of the current itself, which consists of oxidation and other effects, noted above, not produced by mere vibration of cells. The sensation is the same as in the direct form of application, not so pronounced, although the volume of current is some twenty-five per cent more than on corresponding points during direct application. The D'Arsonval currents supply the only method of introducing heat generally to the body interior.

HIGH VOLTAGE *vs.* LOW VOLTAGE D'ARSONVAL

A cushion is not used in the chair for the reason that the thinner the dielectric which will produce perfect insulation the better the result, also as the current to be of the most benefit should be of moderate voltage, it has been found that a current of sufficient voltage to pass through cushions is undesirably high, if the best therapeutic effects are to be obtained, and that if a moderate voltage is used with cushions, there is a decided waste of volume. As some authorities maintain that a thick cushion with a high voltage and low amperage produces superior results in a limited class of cases, we have so constructed our Model "F" and "I" coils that in addition to the regular D'Arsonval current, the Tesla current can be used through cushions four or five inches thick, supplying with moderate milliamperage. It is the high voltage (pressure) of the D'Arsonval current that makes it possible to overcome the natural resistance of the body, and it is its extreme High-Frequency (rapidity of alternation) that makes it possible for such volume of current to pass through the living body without any sensation other than of agreeable warmth.

NOTE: Better conductivity will be obtained if the hand electrodes on chair are covered with several thicknesses of surgical gauze moistened in a salt solution.

THERMO-FARADIC OR DIATHERMIC CURRENT

As we have previously stated, this is a true **High-Frequency** current of comparatively low voltage, and while it may be used by means of the chair for general and auto-condensation treatment, it is particularly desirable for localizing concentrated electrical heat to a given area.

The greatest heat is generated in a direct line between two poles, and thus applications of heat may be localized to any section of the body by merely properly placing the electrodes. This effect may best be illustrated by placing two block-tin electrodes connected to the Thermo-Faradic current, one on each side of a piece of raw beefsteak and see how quickly it will cook. Interesting experiments may also be made in cooking eggs, potatoes, etc.

Application may be made by means of either metal or moist electrodes. Metal electrodes are of two forms, either a flexible sheet of block-tin with a socket for connection with the coil, or a moist electrode, consisting of a metal disc attached to an insulating handle, provided with a spring collar for holding a padded gauze over the surface of the electrode.

Mild local effect may be secured by seating the patient in the chair, or on the auto-pad, which is attached to one of the Thermo-Faradic connections of the coil; a block-tin electrode is connected with the other coil terminal and firmly applied to the surface to be treated, usually by a light roller bandage.

The more common method of local treatment is as illustrated and consists of the application of the two hand electrodes, connected one to each of the Thermo-Faradic terminals of the coil, to opposite sides of the part to be treated. This application may be made either with the electrode uncovered or with a padding of gauze, well moistened with normal salt solution.

In treatment with the chair or pad in circuit, the frequency regulator should be on the second point and the primary regulator opened from two to five points. Where two electrodes are used Frequency Regulator should be on "High" and Primary Regulator opened until desired amount of heat is produced.

During treatment by the latter method, the electrodes should be moved from time to time as the sensation of heat becomes uncomfortable to the patient. The

spark gap should be closed until there is an even discharge of current with a sensation of heat only. A wider spark gap opening adds a Faradic sensation to that of heat.

SINUSOIDAL CURRENT

In the Campbell coil the High-Frequency current which alternates with such extreme rapidity that it produces little or no muscular effect, is supplemented by the Sinusoidal current which is especially valuable for producing painless muscular contractions. It therefore fulfils the same purpose as the Faradic current but in a much more satisfactory manner, enabling the physician to secure results which it would be hopeless to attempt with the Faradic current.

The physical characteristics of the Sinusoidal current are similar to those of alternating currents used commercially. The Sinusoidal current is, in fact, an alternating current, each wave of which is in the form of a sine curve from which the name is derived. Owing to the smooth, even flow of these waves, it is possible to apply sufficient energy to produce powerful, muscular contractions with a practical absence of pain, thus causing valuable tonic and stimulating effects upon partially atrophied or unused muscles, and exerting a contrary sedative effect when mildly applied to congested and painful areas.

While some sinusoidal apparatus has been so constructed that it is possible to vary the length and frequency of the wave, it has been clinically demonstrated that the important physiological effects can be satisfactorily obtained by a current of constant frequency, also that serious direct harm may be done by the use of a slow Sinusoidal current if improperly applied.

The Sinusoidal current from the Campbell coils is secured from a special winding which supplies a proper regulation of volume and intensity for therapeutic use.

TECHNIQUE. As this current is not interrupted, the spark gap should be well opened until there is no possibility for a spark to pass. Although the current does not pass through the condenser, it is well to have the frequency regulator at "High." The terminals of the coil marked "Sinusoidal" should be connected with the proper electrodes, the electrodes placed, and the volume of current regulated by the primary regulator to the desired strength. It may be applied by metal electrodes of such size and shape as are desirable, or, better still, by means of moist electrodes. The electrodes employed should be firmly pressed upon the points or surface to be treated.

PHYSIOLOGICAL ACTION. Its important action is in the relief of pain. It may be used both for stimulation or sedation of contractile tissues, has some effect on metabolism, and a decided action through the vasor motor and general nervous systems. The best effects are obtained by the use of moist electrodes applied over motor points or areas where local effect is desired. It may be used in cavity work by means of a properly adapted local metal electrode attached to one terminal of the coil with a large pad from the other terminal of coil applied to the abdomen.

USES AND INDICATIONS FOR SINUSOIDAL CURRENT. As previously stated, this current may be successfully employed in all cases where Faradic current is indicated for therapeutic use. This current is best applied by absorbent pads, moistened with a normal saline solution. The maximum efficiency of current is obtained when one electrode of sufficient size is applied over the abdominal region and in close proximity to the solar plexus. This may be called the "indifferent pad," the "active pad" being applied to the locality to which the treatment is specially directed. In the case of rectal, vaginal or other cavity work, the active pad should be replaced by a metal electrode of proper size and form.

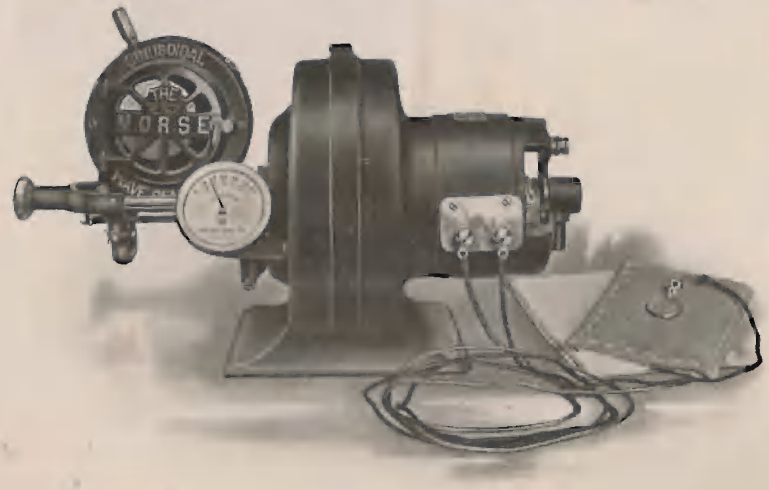
GENERAL TREATMENT for diseases of abdominal viscera and diseases arising from faulty metabolism, neurasthenia or any condition where general treatment is indicated, is best given by two moist electrodes on opposite sides of abdomen.

LOCAL TREATMENT for hyperesthesia, muscular rheumatism and local pains outside of cavities is best treated with indifferent electrode over abdomen and small moist electrode applied directly to seat of disturbance.

CAVITY WORK indicated in vaginal, rectal and urethral disturbances is accomplished by means of the indifferent pad as above and a metal electrode adapted to the locality treated and applied directly to the diseased part. Lubrication of electrodes should be with a mucoid and not an oily lubricant, the latter serving to produce more or less insulation and to prevent an unimpeded flow of current.

FREQUENCY AND DURATION OF TREATMENT. The intervals between treatments should be regulated as for High-Frequency treatments, and the duration from ten to fifteen minutes, according to toleration of patient and production of desired effects.

SURGING SINUSOIDAL CURRENTS



The Morse Sine Wave Generator

For the Treatment of

Intestinal stasis and subsequent complications, constipation, gastric and colonic stasis or general enteroptosis, paralysis, post-operative abdominal conditions, and many relaxed muscular conditions where nerve stimulation and increased nutrition is indicated

EFFECTS

It is an Electro-Medical fact which may be emphasized, that the continuous current, more commonly known as the Galvanic, should not be used in the treatment of disease in conjunction with any other form of electricity, as, for instance, the Faradic or Sinusoidal and its modifications. It is easily explained when one analyzes the physiological action of each, and no one has any moral right to apply the continuous current to diseased areas without being absolutely familiar with its action, because of the harm that may be done by selecting the wrong pole for the case at hand, and unsuspected electrolysis either of tissue or metal contact.

Galvanism has its place and is valuable where indicated, but should be used with discretion and knowledge of its limitations. The above remarks on the continuous current explain why a sine wave which is intended only as applied in Therapeutics, to improve metabolism, deep or superficial, as indicated, with the least possible disturbance to areas not designed to be treated which may approximate.

To differentiate between the indications for use of the sine wave and that of the Galvanic or High-Frequency currents, we need only to draw a comparison between pathological conditions where EXERCISE and MASSAGE are indicated to aid nature in strengthening those nerves and muscles controlling the organs whose natural function has been impaired, and where chemical action is indicated as in the dissipation of neoplasm by galvanism, effects upon the nerve and arterial system, metabolism, and elimination actuated by High-Frequency currents. The distinction between the two forms of current and their respective therapeutic effects is so marked that it may be readily understood that in one case currents of appreciable volume are required to produce the physiological effects above mentioned, and in the other, currents of insufficient volume to produce chemical reaction, but of a voltage, frequency of alternation and control adapted to the EXERCISE and MASSAGE of muscles, and to increasing cellular activity.

The Therapeutic action of the sinusoidal current is, therefore, purely MECHANICAL and should not be used simultaneously with the Galvanic, Faradic, or any combination of these currents, the character and therapeutic properties of which are so entirely foreign to it. We do not mean to imply that there are not cases in which the **High-Frequency currents** may not be used in conjunction with the sinusoidal current to GREAT ADVANTAGE, but we DO NOT RECOMMEND the use of the Sinusoidal current in combination with any other over the same wire at the same time, as common sense tells us that the therapeutic property of each may be thereby counteracted.

CAUTERY AND DIAGNOSTIC LIGHT. A part of the regular equipment of every Campbell coil is an insulated handle for holding the cautery point or diagnostic lamp.

As both these currents are of low voltage it is important that the cautery point, or lamp, should be firmly set in the proper sockets by means of the thumb-screws provided for that purpose; also that the cords from the base of the handle to the proper connections on coil should be firmly seated.

As neither of these currents depend upon frequency regulation, it is well to open the spark gap as in the use of the Sinusoidal current.

Cautery

Diagnostic Light

With each coil is furnished one cautery point of medium weight, but other forms of cautery points may be used, as the coil provides sufficient current for very heavy work. The heat of the point is regulated entirely by the primary regulator.

For use of the diagnostic lamp, it should be placed in the cautery handle. Its regulation is still further controlled by means of a special rheostat.

Any illuminating apparatus may be used with this current, the only essential being that it shall be supplied with a 6 volt lamp.

CHAPTER III
X-RAY THERAPY

HISTORY. Early in the use of the X-ray it was discovered that it had a profound action upon the skin and various organs of the body. It was observed that if the surface of the body was long or constantly exposed to the X-ray there was a resulting erythema, similar in many particulars to the action of direct sunlight, but more intense in its destructive action, of longer duration and capable of penetrating to deeper tissues. It was immediately evident that there had been discovered a potent and heretofore unknown therapeutic agent, and clinical investigation was at once begun. One of the earliest noticeable effects was the profound inhibitory action upon malignant growths, and it was believed that at last a specific for cancer had been found. Countless reports of palliation and cure of this disease were reported and numerous institutions were established for this method of treatment. After a time it was discovered that in the severer forms of cancer, apparent cure or palliation was followed by recurrence, and while certain cases are still classed as amenable to X-ray treatment, it is not depended upon at the present day as the sole means of treatment except in absolutely inoperable cases. It is, however, being used as a supplementary treatment to operation, and so used, seems to aid materially in rapid recovery and prevention of recurrence in a definite proportion of cases. Incidentally, it has been found to have a profound effect upon the skin and upon glandular structure, not so disappointing as its use in malignant conditions and more permanent in its results. It has also a profound effect upon the nervous system which, intelligently used, makes it of value in a number of conditions.

TECHNIQUE. Owing to its peculiar construction, the Campbell Coil is particularly adapted to X-ray therapy. It is desirable in order to estimate dosage that the action of the tube should be practically constant and that the same degree of vacuum should be maintained. By means of proper regulation, it is possible to maintain uniform treatment during an extended period providing the tube is properly constructed and properly seasoned. For therapeutic work, the frequency regulator should be on the point next "Low" and the primary regulator from one to three or four points advanced. The spark gap should be adjusted so that the radiance in the tube is steady and even. With this adjustment, a tube may be operated from five to fifteen minutes without great variation of vacuum.

TUBES. High-Frequency apparatus requires a tube of special construction in order that the current may pass through it in only one direction. For this purpose it is provided with an extra cathode which acts as a valve to choke back one alternation of the current. In connecting to the coil one wire should pass from post "B" of the coil to the large cathode of the tube, and one wire from post "N" of the coil to the small cathode of the tube. *The second wire should never be connected to that terminal of the tube which leads directly to the anode or target of the tube.*

With a tube of the High-Frequency type, it is essential that during its manufacture it should be exhausted to a point somewhat higher than that which will enable it to start off readily upon application of current.

Before use, therefore, it may be necessary to reduce the tube to the desired vacuum. The method of reduction will vary with the type of tube which is used, and instructions for reduction will be furnished by the manufacturer.

Inasmuch as the Campbell Electric Corporation has given special attention to the production of a tube best adapted to use with its coils, it is strongly advised that to get the best results, this tube should be used. If the tube is not overused while it is unseasoned, after each use there will be an absorption of gas directly into its metal parts, requiring reduction before subsequent use. Overheating when new may drive out sufficient gas from metal parts to prevent entire reabsorption upon cooling. It is best, therefore, for therapeutic purposes to use a tube which has already been seasoned by radiographic work. By seasoning, we mean an establishment of a condition in which there is a perfect balance between the driving out of gas and its subsequent reabsorption. If a new tube must be used, do not reduce the vacuum too much before treatment, and discontinue its use upon the first appearance of a material drop in vacuum. The first warning of this dropping will be an appreciable lessening of the hum of the spark gap; the color of the tube will take on a bluish tinge; if run is continued, there will be a bluish pencil from cathode to target.

In the event that upon cooling off the vacuum is found to be too low for the work in hand, it may usually be raised by reversing the connections from coil to tube,— that is, connect wire from post "B" to the small cathode and from post "N" to the large cathode: with frequency regulator at point next to "Low" and primary regulator at second point, spark gap fairly well closed, turn on current and allow it to run for several minutes, or until the desired vacuum is obtained. To gauge the increase of vacuum, reconnect the tube properly, push in the sliding rod through post "N" until a spark will pass from post "B" to rod; withdraw rod slightly beyond sparking distance, and after a brief run this gap will again be jumped by the spark; withdraw rod still further and repeat until desired vacuum is obtained.

VACUUM AND ITS ESTIMATION. The proper vacuum for various treatments will be indicated in the discussion of physiological action of the X-ray. The vacuum may be roughly estimated by the length of spark which the tube will back up. One to two inches is low, two to four is medium, and four to six is high. At the same time the color of tube will also show the vacuum. A low tube is a bluish green; medium, bright green; high, yellowish green; very high, almost a canary yellow.

PHYSIOLOGICAL ACTION OF X-RAY. The final action of the ray is destructive, due to inhibition of cell activity. Its action is more marked on abnormal than on normal tissues, hence its value in therapeutics, as the desired effect may be produced without serious disturbance of surrounding normal structure. It contracts the blood vessels and has a profound effect upon glands, inhibiting their action and producing atrophy. It diminishes the leucocytes and the lymphocytes are specially sensitive to it, being first and most profoundly affected. The effect upon testicles and ovaries is atrophy without inflammatory reaction and sterility without impairment of function.

The lower vacuum rays have a much more decided chemical action and are much more superficial in their effect, owing to a lesser degree of penetration. They are much more inclined to produce dermatitis and even necrosis of superficial tissues.

Higher vacuum affects the skin less, but has a more profound effect upon deeper tissues and organs. The low rays are of comparatively short wave length, and their action diminishes rapidly as the distance from tube to part treated is increased. It is possible, therefore, by selection of vacuum and regulation of distance to produce a maximum effect at any desired depth, to avoid profound effect upon deep structures when treating surface conditions and vice versa.

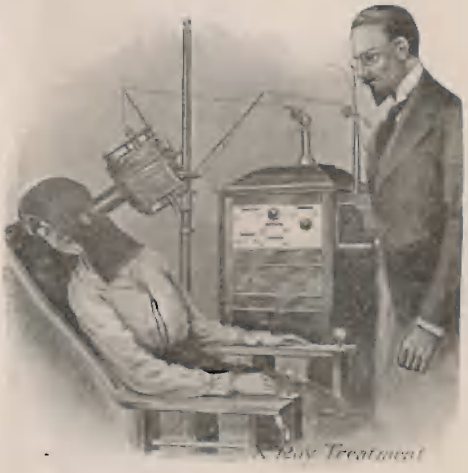
INDICATIONS FOR USE. At the present time the X-ray has its widest field of usefulness in the treatment of skin and glandular diseases. It is a specific for unmixed Psoriasis, relieves a large proportion of cases of Eczema, Acne, Lichen, Impetigo, Favus, etc.; cures a majority of cases of Tubercular Adenitis; has been used with marked success in Goitres, both simple and exophthalmic; will cure about eighty per cent of Epitheliomas and Rodent Ulcers; has been used successfully in Leukæmia. Obviously it is impossible in a short treatise to list the conditions in which the value of the X-ray has been proven, or to give detailed technique for these conditions. Before entering the wide field of X-ray therapy, the operator should make himself familiar with these points from one of the later and more extensive works on this subject, of which there is a large and constantly increasing choice.

PROTECTION OF PATIENT AND OPERATOR. With the potential dangers from prolonged or reckless exposure to the X-ray, it is obvious that certain precautionary measures should be taken to limit the action of the rays to a given point, and that the operator, particularly, should be as free as possible from any exposure whatever. A properly adapted tube-shield will cut off practically all rays except those passing through its diaphragm, and as the opening of this diaphragm may be regulated to any desired area down to a fraction of an inch, it is possible to limit the area treated sufficiently by this means alone. Still further protection to patient may be had when desired, by covering the region of part treated with a sheet of tea lead in which is an opening a little larger than the point treated and directly over it. An aluminum disc fitted to the diaphragm will cut off the most active chemical rays of extremely low vacuum and is a good precaution where a medium to medium low tube is used. For the operator there are many safety devices, among which are the lead-lined cabinet, lead-lined screen, or apron and gloves of protective material. A full list of these devices will be found in complete textbooks.

While we do not wish to minimize the danger of the X-ray, nor to destroy a wholesome respect for its harmful properties, we believe that with ordinary precaution there should be no untoward effect upon the operator. In our factory, the room for exhausting tubes is entirely lined with heavy sheet lead, with a lead glass window for observation of tubes during exhaustion. Four tubes are on the pumps at the same time and current is constantly passed through them during this process. With the above protection, one man has done our exhausting for more than three years, working ten hours a day, and at the present time has no ill effects to show

from exposure in spite of a subsequent test of tube when removed from the pump, which is made within a large shield of heavy lead glass. On the other hand, many operators who worked unprotected before the dangers of prolonged exposure were recognized, are now paying the penalty by profound suffering. It is well, therefore, to treat the X-ray with the same respect which you would give to dynamite or a violent poison, and err on the safe side of protection.

FREQUENCY AND DURATION OF TREATMENT. The effect of the X-ray is cumulative and its maximum effect is apparent some days after treatment. There is also the factor of the personal equation. It is well, therefore, to make haste slowly.



X-Ray Treatment

We purposely omit definite instructions as to these points as the technique of X-ray therapy varies from time to time and according to the experiences of different individual operators.

There are sufficient text-books devoted entirely to this subject to guide the one who wishes to take up this line of work, and we would advise their careful study before undertaking so potent a method of therapy.

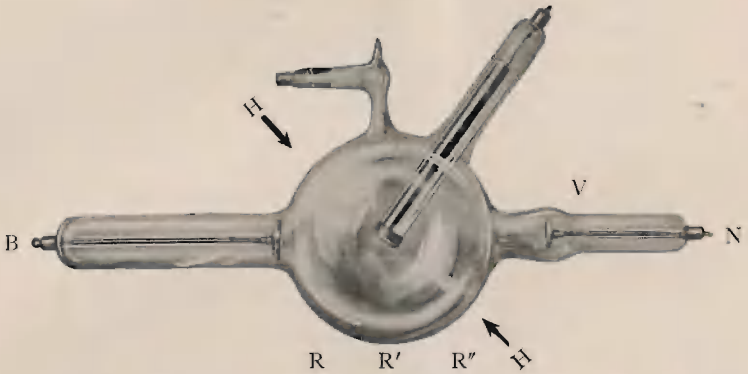
CHAPTER IV

RADIOGRAPHY WITH A HIGH-FREQUENCY COIL

While it has its limitations, any first-class High-Frequency coil will do a surprising amount of X-ray work if properly understood and properly handled. No matter what the apparatus, be it a portable coil, or an interrupterless transformer, there are certain necessary adjustments of the apparatus itself, proper regulation of the tube for the work undertaken, proper selection of plates, and a proper handling of plates after they have been exposed.

While it is manifestly impossible in a limited space to give complete instruction for successful radiography, we shall try and take up enough of the essentials to enable the beginner to conduct intelligent experimental work, and in case of failure to be able to estimate the cause of his failure. We shall consider the matter only so far as the use of a High-Frequency coil is concerned.

THE X-RAY TUBE



X-rays are produced by passing a high-tension, unidirectional current through a properly constructed tube which has been exhausted to a high vacuum As the current produced by all High-Frequency coils is alternating, the first essential is to make it unidirectional, which is accomplished by means of a valve or choke ("V"). When this tube is used the terminal "B" should be connected with post "B" of the coil and terminal "N" with "N" of the coil. If the current is then turned on there will be a hemisphere of brilliant radiance in the tube in front of the line H H′, while back of this line will be a hemisphere of dull radiance. From the target of the tube, at its center, invisible X-rays are projected along the lines R, R′, R″; while these rays diverge slightly they may for all practical purposes be considered as passing parallel from the center of the tube and at right angles to its axis.

PHOTOGRAPHIC ACTION OF X-RAYS

X-rays have the peculiar property of being able to pass directly through solid objects, penetrating them in practically direct proportion to their density or specific gravity. They also have the property of acting on specially prepared photographic plates in a manner similar to that of light waves. These two properties make possible the recording on a photographic plate a shadow picture of any object placed between it and the source of the rays. The varying densities of matter through which the rays pass, result in the production of a detailed image of the object, or a radiogram.

As the vacuum within the tube increases, or decreases, the waves become shorter or longer and their power to penetrate increases as they become shorter. Consequently the higher the vacuum, the denser the object through which they will pass and the less their absorption. The higher the penetration of the rays, the less active they are on the silver salts with which the plate is coated. It should also be understood that the higher the vacuum of the tube, the less the amount of current which can be forced through it.

In addition to the X-rays projected directly from the target of the tube, there are also tangent rays which are thrown off from the surface of the tube and which, though comparatively feeble, have some action on the photographic plate. The higher the vacuum of the tube, the greater the number of the tangent rays. For these reasons it is best to limit, so far as possible, the passage of all but the direct rays. This is accomplished by means of placing below the tube some impenetrable object, having a central opening of sufficient size to permit the covering of the plate which is used. Therefore, to do the best work a special tube stand with diaphragms of varying sizes should be used.

The speed with which a radiogram is produced is in direct proportion to the volume of current passing through the tube.

ESSENTIALS FOR GOOD X-RAY WORK

As a summary of the above, the best results are obtained when there is the largest possible volume of current passing through a tube of as low vacuum as will allow penetration of the part to be examined. Inasmuch as the focus changes as a tube drops in vacuum, and a changing focus has the effect of distroying detail, it is necessary that the volume of current in tube be not so great as to drop the vacuum during exposure.

The vacuum of a tube may be approximately estimated by the spark which it will back up. Work with High-Frequency coils is best accomplished by a vacuum which will back up from 3 to 6" of spark, according to density of part examined.

Inasmuch as we usually request the making of an elbow plate in our investigations of difficulty on the part of our customers in getting good work, we will take up, step by step, the production of such a plate.

1. The plate used must be an **X-ray** plate of recognized merit; it must be fresh,—or at least well preserved.

2. The plate must be loaded in a room from which has been excluded every particle of light and which is illuminated only by a safe photographic red light.

3. Place the plate in the black envelope, with which it is furnished, in such a way that the film side, or dull side of the plate, shall be away from the flap of the envelope and toward its plain side; place the black envelope and plate in the orange envelope, flap end first, and in such a position that the plain side of the exterior envelope shall correspond with that of the interior.

4. Place tube in tube stand so that it is parallel with a line from post "B" to "N" with terminal "B" of tube toward post "B." Connect cord from "B" on coil to "B" of tube, being careful that it does not come within six inches of the coil or nearer than this to any of the metal parts of the tube or stand; connect "N" and "N" in the same manner. Arrange table on which plate is to rest so that plate may be directly below the diaphragm of tube stand and at a distance of eighteen inches from the target at the center of the tube.

5. Place Frequency Regulator on "Low" and open Primary Regulator one or two points; open spark gap gradually. If tube lights up readily, with a distinct hemisphere of radiance, continue moving primary regulator until it is on the last

point. Then slide in the rod through post "X" on "E" or "K" coil, or move hinged arm found on coils of the upright type until the spark will jump from post "B" to point rather than pass through the tube. This will indicate the length of spark which tube is backing up.

6. All High-Frequency X-ray tubes are usually exhausted to a vacuum rather too high for work. It will probably be found, therefore, that when the Primary Regulator has been opened two or three points and the spark gap opened up, that the tube will light up irregularly, or not at all; that there is a good deal of leakage of current from the conductor going to post "B," and even possibly a discharge of current between the two posts of the coil. It is then necessary to reduce the vacuum as follows:

7. Place Frequency Regulator on point next to "Low", place collar of reducing wire which comes with each tube on metal terminal at "G" and bend end of wire so that it will come opposite metal terminal of tube at "B"; turn wire down by means of hinge, until point is about $\frac{3}{4}$" from metal, and open primary regulator one point for an instant, allowing sparks to pass directly through the chemical chamber "C." Turn back wire; replace Frequency Regulator on "Low" and open up Primary Regulator to last point. If tube still refuses to light up properly, repeat this process carefully until, when the point of sliding rod is 4" from post "B," there will be just a spitting of current across this air gap, with spark gap well open. Then pull sliding rod way back and shut off current at main switch.

8. Bring plate from dark room, place it on table, with film side up, so that center of plate is directly beneath center of diaphragm; have subject place elbow, flexed to an angle of about 60 degrees, so that articular surface is at center of plate, condyles in a direct line from target of tube to center of plate, forearm pronated. See that no part of patient's body, at any time, comes nearer than 8" of tube, or connecting wires, or of radiators, registers, piping, fixtures, wires, or of any other metal. Turn on current at main switch and expose for 30 seconds with "E" Coil. ("F" or "K" Coils, 5 to 10 seconds; "I" Coil, 15 to 20 seconds.)

9. If familiar with plate development, develop plate until it is practically opaque to ordinary dark-room light. If given to a photographer, instruct him to develop until it will make a strong transparency.

If above conditions are followed, the result will be a clear plate showing fine bone detail, a fair outline of muscular tissue, and fat layer outside muscles.

With a tube of the same vacuum, a plate of the ankle, either anterior, posterior, or lateral, can be made in about the same time; a wrist in one-third the time. For a knee or shoulder of a person of average weight, the 6" tube should back up about 5", the 7" tungsten target tube, 4", and the exposure from 2 to $2\frac{1}{2}$ times as long as for elbow; chest, 2 times as long as elbow. On a patient of medium weight, a hip plate can be made in 4 to 5 times that of elbow, and 6" tube should back up about 6"; 7" tungsten target tube, $4\frac{1}{2}$"; a tungsten target tube will improve the work wonderfully on any coil over that which can be produced by a 6" tube.

BODY RADIATION. In doing deeper work, there is an element to be contended with in the way of secondary radiation set up in the body of the patient, which tends to make the plate indistinct. This body radiation is bound to occur,

either from prolonged exposure, or even from a moderate exposure with a tube of high vacuum. It is best, therefore, to use an intensifying screen for heavy work, with a small coil.

USE OF INTENSIFYING SCREEN. An intensifying screen is a sheet of cardboard or celluloid, coated with fine crystals of some substance which fluoresces actively when exposed to X-ray. Its coated side is placed next to the film side of the plate, and an exposure made for about one-fifth the time that would be required without a screen. The resulting image is, in reality, a contact print upon the plate of the flourescent image produced upon the screen, and can be made with a tube of lower vacuum than if it were not used. Modern screens are free from granulations, and will, if properly used, produce results which can scarcely be told from those produced directly by the action of the rays. They are durable, and may be used repeatedly for a long time, if they are properly cared for. With an "E" coil and a good screen, a hip plate of average patient can be made in about 25 seconds, which is clear and rich in detail, showing distinctly the shadow of the border of the acetabulum, through the head of the femur.

LIMITATIONS OF THE X-RAY TUBE

Prolonged exposure tends to heat the tube and cause a drop in vacuum, and once the vacuum begins to drop, penetration becomes insufficient and further exposure is useless. This is another important reason why screens should be used for deep work, and it is not unusual for expert operators, with the heaviest apparatus, to resort to the use of a screen for the more difficult work.

Given standard apparatus, no matter what its size or capacity, the results obtained depend largely upon an intelligent use of the tube. This is the most sensitive part of the equipment and the only one which cannot be made "fool-proof." It is at the mercy of its user.

No two tubes are exactly alike as to speed, focus or ability to stand hard work. So far as construction is concerned, they are practically standardized and are exhausted to practically the same vacuum. It is reasonable to suppose that any reputable manufacturer of tubes will not send one out that is not up to standard, and any subsequent misbehavior is more than likely to be the fault of the operator, rather than of the tube.

Within the metal parts of every tube there remains a small quantity of what is technically known as residual gas. A prolonged run heats the metal and drives a minute portion of this gas into the body of the tube. Unless the tube is run for too long a period, this gas will reabsorb into the metals, and the older a tube becomes the greater its capacity for restoring its vacuum. This property is known as "seasoning" and a well seasoned tube is capable of standing more reduction and of doing more prolonged work than a green tube. While a tube is partly seasoned before leaving the factory, unfortunately this process can not be wholly accomplished except by use. It is well, therefore, to have several tubes, using the newer ones for the lighter work and depending upon the veterans for the harder work.

CAUSES OF FAILURE

The principal causes of failure to obtain good work, in the order of their frequency, as noted from personal instruction and correspondence with our customers are:

1. Attempting to work with a tube of too high vacuum. In this case the tube runs unsteadily; there is considerable leakage from conductor going to post "B" and the radiance of the tube is of a yellowish-green color, hemisphere not clearly defined and presenting a thin appearance. This causes the production of rays of too high penetration and too small volume. The resultant plate shows an image lacking in contrast, grayish in color even on the parts of the plate which are entirely exposed to the rays.

2. Attempting work with a tube of too low vacuum. The tube runs steadily and quietly and the hemisphere is well marked, but it shows a bluish tinge and if very low there is a distinct pencil of bluish radiance between the cathode (K), and the target at the center of the tube. The result is a large volume of rays at too low a degree of penetration and the resultant plate will show only a faint image of the denser parts,—or, if too low, even clear glass, while the uncovered parts of the plate will be a dense black.

3. Overexposure. If with a high tube the result will be a grayish plate with detail obscured by a foggy appearance. If with a low tube a dense black plate, lacking in detail and contrast of parts.

4. Underexposure with a high tube shows either practically clear glass or a faint grayish image. With a low tube, clear glass under the deeper structures and transparent greyish black under thin parts or on uncovered part of the plate.

DEVELOPMENT OF ROENTGENOGRAMS

After the plate has been exposed, the following procedures are identical with those used for any photographic plate.

The room in which plates are to be developed should be light-tight and while plates are being handled should be illuminated by a safe dark-room light, and even that should be so situated that the plate either during or before development should not be kept nearer than one foot to the source of light and should be covered while in the developing tray, except for such brief periods as are necessary to watch the progress of development.

Development consists of subjecting the plate to a solution of certain chemicals which transform such portions of the plate as have been exposed to light into insoluble silver, varying in density to the amount of light which has reached any given part. These variations in density produce the resultant image.

With each box of plates will be found a formula for developer which is best adapted for use with that particular brand of plate. All manufacturers of X-ray plates put up developer in packages of the dry chemicals which require only the addition of a certain amount of pure water to render them ready for use. When convenience is considered, and with the present high cost of photographic chemicals, the use of these prepared powders is the most economical.

After the plate has been sufficiently developed, it should be carefully washed and placed in the fixing bath, a solution which dissolves out from the gelatin film of the plate all silver salts which have not been completely reduced by the developer. It should then be washed either in running water for at least fifteen minutes, or in a dozen changes of fresh water and then dried until all signs of moisture are out of the gelatin.

If one has had no experience in developing plates, we should strongly advise that the matter be taken up with a practical photographer, or some friend who is a successful amateur. Fifteen minutes in the dark room of an experienced man is worth a hundred pages of textbook instruction.

KEYNOTES FOR TREATMENT

The following suggestions have been compiled from clinical experience, reports of cases and consultation of numerous textbooks. We do not present them as original nor as definite instructions, simply as reported successful methods in the hands of numerous operators.

ABSCESS may be sometimes prevented or aborted by the use of a low vacuum High-Frequency electrode. When suppuration is inevitable, it may be promoted by use of a high vacuum tube, and cure hastened.

ACNE VULGARIS. Best treated with X-ray, or Fulguration.

ADENITIS, CERVICAL. Many cases of cure have been reported, even after failure of other methods including vaccine treatment. A high vacuum X-ray tube is used with treatments at intervals of from three days to a week, according to progress. Where there is suppuration, the process is hastened and cosmetic effects are obtained. Any appearance of dermatitis is an indication to suspend treatment until it has been absent for a week or more. It is better to hold treatments short of any skin reaction. X-ray treatment may be well supplemented by auto-condensation for its constitutional effects.

ALBUMINURIA. Auto-condensation has been found to be of considerable value in Bright's Disease. Eberhart states that he has seen both albumin and casts disappear under this treatment, and believes it to be of sufficient value to warrant its employment in every possible case, particularly where there is co-existent high blood pressure. Treatment will lower the blood pressure and relieve pressure in kidneys by taking the strain off the tubules.

ALOPECIA. Treated with surface electrode, F. R. 2d point, P. R. 1 to 2 points, spark gap only slightly open. Pass electrode lightly and rapidly over scalp for five to ten minutes daily, occasionally raising slightly from surface. If irritation is produced use F. R. on "High" and lengthen interval between treatment.

ANEMIA and CHLOROSIS. Auto-condensation daily, or not less than three times a week, 400 to 800 m. a.

ARTERIOSCLEROSIS. (See also Hypertension.) Most favorable reports in this condition are received from numerous sources following treatment by auto-condensation. F. R. at "High," P. R. 2 to 7, dosage 400 to 800 m. a., three to six times a week for from ten to twenty minutes. At each sitting the blood pressure is reduced temporarily, and as treatments progress the reduction becomes permanent. Use of vacuum electrode along spine is CONTRAINDICATED.

If half the reports are to be believed, the most brilliant results from high-tension electricity are to be found in this condition, and there is a decided improvement in accompanying abnormal condition of heart and kidneys. Early treatment in conditions where increased arterial tension is found, is reputed to prevent the inevitable subsequent arteriosclerosis.

ARTHRITIS, RHEUMATOID. Patient — female, 38 — had lost use of right hand and muscles were becoming atrophied with extreme pain. Baths, massage and local application of iodine failed to relieve. After three months of general tonic treatment with special local application to affected hand, twice weekly, use of hand and general health were restored (report of Dr. J. E. B.).

ASTHMA. Auto-condensation 500 to 800 m. a. three times a week.

BLOOD PRESSURE. (See Arteriosclerosis also Hypertension.)

BRONCHITIS. Daily auto-condensation 400 to 800 m. a. for ten minutes, followed by five-minute treatment with surface electrode (vacuum) to chest and spine. F. R. 2d point, P. R. 1 to 2. Of late, the use of ozone in this condition is coming into more general use.

CANCER. (See Carcinoma, Sarcoma, Epithelioma.)

CURBUNCLE. Treatment with X-ray.

CARCINOMA. The X-ray has been used with success in a proportion of cases but should not be depended upon except in inoperable cases or as an auxiliary treatment in cases where operation is advisable.

CHOREA. Like all functional nervous diseases, this is particularly amenable to High-Frequency treatment, both by auto-condensation and tonic treatment with the vacuum electrode.

CERVICITIS. Insulated vaginal electrode. Treatments every other day. Lubricate with vegetable rather than mineral lubricant for sake of better conduction. F. R. "High," P. R. 1 to 3 points, duration of treatment five to seven minutes.

CHRONIC ULCERS. A stimulating treatment from vacuum electrode is recommended, also treatment with surface electrode through several layers of gauze. Local nutrition is improved and there is decided benefit from slight amount of ozone produced. A direct spraying with ozone is also highly recommended.

CONSTIPATION. Patient lying on auto pad or treatment chair extended, connected with one D'Arsonval socket on coil, operator holding in one hand metal electrode connected with the other D'Arsonval socket on coil, frequency regulator on "High," primary regulator open four to five points, massage applied with other hand over entire extent of Colon.

CONVALESCENCE. Direct benefit may be received and strength regained more rapidly. Auto-condensation for ten minutes, followed by surface electrode where not contraindicated, will produce prompt and marked results.

CORYZA. Surface electrode applied over outside of nose, F. R. at "High," P. R. 2 points. This may be supplemented by ozone inhalations or direct treatment to mucous surface by insulated nasal electrode, switches as for external treatment.

CYSTITIS. Use insulated rectal electrode with same technique as in Cervicitis. Vacuum electrode may be applied externally over region of bladder.

DANDRUFF. Same treatment as for Alopecia.

DIABETES. Under auto-condensation, 400 to 800 m. a. the sugar rapidly disappears and general conditions improve. Treat daily at first, increasing interval as sugar disappears. Treatments should last from ten to twenty minutes.

DILATATION OF STOMACH. Auto-condensation 400 to 600 m. a. daily at first. Local treatment with surface electrode may also be used to advantage. If local treatment is given, adjust F. R. to 2d point, P. R. 1 or 2 points.

DYSPEPSIA. See technique as for Dilatation of Stomach.

EAR, DISEASES OF. Eberhart states, "In catarrhal deafness the High-Frequency current in connection with mechanical vibration will yield remarkable results in 90% of cases treated." Geyser (J. A. T., April, 1909), in an article on the treatment of catarrhal deafness, after mentioning the ordinary cleansing measures, etc., states, "Assuming that the nasopharynx has been properly cleansed, a mucous membrane either in a state of hypertrophy or atrophy requires a stimulating measure. Of all agents used, the High-Frequency current from a glass vacuum electrode delivered to the entire mucous membrane of the nose, is perhaps the best." In order to properly localize the treatment, an insulated nasal electrode is of course essential.

Mastoiditis. Although the resort to surgery seems to be considered the wisest course in the treatment of this condition, there have been reported remarkable results from the use of the High-Frequency current. Dr. B. R. M. reports, "Our patient, a child about ten years old, was brought to me four or five days after the trouble had started, suffering much pain. His temperature was 104 degrees. Operation was advised, but parents insisted on trying something else first, and so the High-Frequency current was applied. One treatment gave such relief that the patient slept all night, although during the previous two or three nights he had slept hardly any. Treatments were continued for about two weeks with complete cure as a result." Dr. F. S. S. reports another similar and interesting case. "In a severe case of mastoid abscess with cerebral and pyemic symptoms, a vigorous thirty-minute treatment with the white-vacuum electrode applied externally and a metal electrode in the mouth of the patient, produced an absolute dispersion of the acute manifestations, the patient sleeping naturally inside of five hours. The next day the pus was withdrawn, and although a cover-glass preparation showed countless numbers of the streptococci and staphylococci, but a few scattered colonies were obtained in a plate culture on nutrient gelatin." Dr. L. J. L. also reports a case of acute mastoiditis where in order "to do something right off" he applied the Thermo-Faradic current by means of moist electrodes with such remarkable and instant relief that he was encouraged to continue this as the sole treatment and with good results.

Otitis Media. The use of the vacuum electrode in this condition in conjunction with other methods has proven of great benefit. Dr. B. R. M. reports a case cured by application of vacuum electrodes three times a week. Dr. J. W. U. also reports excellent results in chronic infections.

Tinnitusaurium. The use of High-Frequency current in this condition has yielded good results in many cases, especially when used in conjunction with vibration. Dr. J. W. U. reports that in Tinnitus, he has not failed in a single instance to cure this symptom. Where treatment is to be directed to the auditory canal or tympanum, an insulated electrode is essential.

ECZEMA. Radiation with medium tube, eight to ten inches from surface. F. R. 3d point, P. R. 2 to 4 points, duration of treatment five minutes at intervals of from five days to a week. Supplementary or intermediate treatment may be given with surface electrode, F. R. "High," P. R. 1 to 2 points. Brilliant results are reported from both X-ray and local treatment.

ENLARGED PROSTATE. (See Prostate.)

ENDOMETRITIS. Same treatment as for Cervicitis.

EPILEPSY. Favorable reports are given of treatment with X-ray. Owing to possible ill effects on brain, this method should not be used until there are more definite reports and data.

EPITHELIOMA. (See Skin Cancer.)

EYE, DISEASES OF. Various eye conditions, varying from simple conjunctivitis to the deeper seated conditions, have been beneficially treated by the application of a mild current of extreme high-frequency with a special eye electrode. Owing to extreme sensitiveness of the eye, the treatments should be given with caution and only with apparatus which will deliver a small volume of current at a very high-frequency and perfectly uniform. One of the important features of the Campbell Coil is the attention which has been given to the production of a current of this character, for use within the cavities and on the more sensitive parts.

Atrophy of Optic Nerve. Daily treatments with the High-Frequency vacuum electrode in this condition have been reported of value.

Blepharitis. Fox reports over one hundred cases of this condition treated by High-Frequency current with no failures. Eberhart mentions a case, "which had resisted all of the usual routine treatment, which improved rapidly from three applications a week of the High-Frequency current in connection with high candle-power light.

Conjunctivitis. Many reports of benefit in this condition have been reported from the use of High-Frequency currents.

Corneal Opacity. High-Frequency currents, in conjunction with other means of treatment, have proven of great value in retarding the progress of this disease.

Glaucoma. From the association of Glaucoma with high blood pressure and hypertension of the eyeball, auto-condensation is naturally suggested. Dr. N. M. E. reports success with this method, obtaining relief sometimes in a single treatment.

Incipient Cataract. From its power to cause reabsorption, the High-Frequency current has been used in this condition in a number of cases with apparently beneficial effects.

Intra-Ocular Hemorrhage. Auto-condensation at first naturally suggests itself for the control of the high blood pressure. This can be well supplemented by local High-Frequency treatment and beneficial effects may be expected.

Iritis. The analgesic effect of the High-Frequency current is particularly marked in this extremely painful condition.

Paralysis of Ocular Muscles. From its value in general paralytic conditions, the High-Frequency current will naturally suggest itself in this form of local paralysis and many reports of successful use have been made.

Trachoma. Dr. P. makes the following report: "A young man, age twenty-five, employed in a cotton mill, came to me to see what my machine could do as a last resort. I gave careful advice as to diet and general mode of life, emphazising cleanliness, and began auto-condensation treatment accompanied with massage of the eyelids, and also a very fine current through the special eye electrode. Treatments twice a week continued for three months resulted in an apparent complete cure.

FAVUS. This disease has been variously and successfully treated by the vacuum electrode, fulguration and X-ray. In common with a number of skin diseases these methods of treatment should not be forgotten.

FISSURE (ANAL). Dr. P. reports a number of cases of this disease which he has successfully treated with High-Frequency current. For this purpose he uses a special electrode built along the lines of the regular rectal electrode, but having a spherical expansion about 1½ inches from the tip, in order that complete surface contact may be obtained.

GASTRITIS. General tonic treatment with auto-condensation or with vacuum electrode as in Dyspepsia.

GLEET. May be treated with mild treatment through insulated urethral electrode for five minutes, every day or once in two days. A safer and almost as effective method of treatment is given with insulated rectal electrode. Use vegetable lubricant.

GOITRE. Both Exophthalmic and simple goitre have been successfully treated with X-ray as an auxiliary to medication or without other treatment.

GONORRHEA. In acute stage, mild High-Frequency treatment with rectal insulated electrode. In sub-acute cases, mild treatment with insulated urethral electrode, duration of treatment five minutes, interval one or two days. Improvement due to general action of current supplemented by direct production of ozone on surface of mucous membrane.

GOUT. Auto-condensation, 400 to 700 m. a. daily or every other day except when acute symptoms are present; treatment five to fifteen minutes. Aggravation may follow first treatments, in which case they should be of short duration. The value of this treatment in Gout may be easily understood if the physiological action of auto-condensation is recalled.

HAY FEVER. General treatment, either by auto-condensation or by tonic treatment along spine, followed by local treatment externally, will oftentimes produce entire relief of this most annoying condition.

HEADACHE. Where headache is of nervous origin, relief may be obtained by five to ten-minute treatment with mild current through surface electrode (low vacuum). Congestive headaches with increased arterial tension, auto-condensation 400 to 600 m. a. Symptomatic headaches should be treated according to primary exciting cause.

HEMORRHOIDS. External hemorrhoids may be treated for five minutes daily with a mild current from plain rectal electrode. Internal, with insulated rectal electrode, active point of electrode at diseased area.

HERPES ZOSTER. Mild treatment with vacuum electrode over affected area on alternate days for five minutes, electrode in loose contact with surface or treatment given through intervening layers of gauze. Supplement with tonic treatment along nerve trunks supplying affected area. Two to four treatments will usually give permanent relief.

HIGH BLOOD PRESSURE. (See Arteriosclerosis, also Hypertension.)

HYPERTENSION. This condition is an indication for auto-condensation, and treatment by this method gives most brilliant results according to many authorities and private operators. 400 to 800 m. a. should be given daily, or on alternate days, for a period varying from ten to twenty minutes according to response to treatment. Careful tests made with the sphygmomanometer before and after treatment will substantiate the claims for auto-condensation as noted above and in the paragraph on arteriosclerosis.

HYSTERIA. Both for actual and psychic effects High-Frequency currents are extremely valuable in this condition. Auto-condensation, spinal treatment, or a combination of the two, should be selected according to the blood pressure.

IMPETIGO. Treatment is indicated as for Acne Vulgaris.

INFANTILE PARALYSIS. Daily treatments with a stimulating treatment over spine and affected parts, has produced marked benefit in a large number of cases. The white vacuum electrode is indicated with a frequency as low as can be comfortably borne.

INSOMNIA. Mild treatment for five minutes with surface electrode at base of brain and along cervical vertebrae, followed by ten minutes of auto-condensation 400 to 600 m. a. Treatments should be given daily, preferable in the evening or latter part of the day. In some cases persistent treatment is required, and treatment should not be undertaken unless patient is willing to continue for a reasonable period.

LEUCORRHEA. Treatment for five minutes with mild current from vagi. electrode supplemented by tonic treatment along lumbar spine, auto-cond when indicated by general condition.

LOCOMOTOR ATAXIA. While electricity will not cure this condition, marked palliation and prolongation of life have been obtained by use of vacuum electrode along spine, F. R. at 2, P. R. 1 to 3, spark gap open to produce discharge up to point of toleration. Stimulating treatment may also be given along back of limbs from body to calf.

LUMBAGO. Immediate relief may be obtained by stimulating treatment with surface electrode over painful area. F. R. at 2, P. R. 1 to 3, spark gap fairly well open. Treat at least daily to begin with and continue each treatment until relief from pain is accomplished. Treatment will be more efficacious if affected muscles are put on tension during application of surface electrode. Auto-condensation will assist in promoting elimination of toxins.

LUPUS VULGARIS. A goodly proportion of cases have been successfully treated with X-ray.

MOLES. A number of cases are reported as having been successfully treated with fulguration, and it is claimed that this method is superior to use of electric needle. Care should be used not to treat too extensive an area at any one time. One or two treatments are usually sufficient. Treatment is followed by infiltration, a scab, desquamation of scab leaving normal skin.

NEURALGIA. Local treatment with vacuum electrode mild or stimulating according to amount of relief obtained. General treatment with vacuum electrode along spine. In selected cases most rapid relief may be obtained by direct application of Thermo-Faradic current through moist electrodes over painful area, F. R. 2, P. R. 1 to 3, spark gap fairly well closed, change location of electrodes as they become uncomfortably warm.

NEURASTHENIA. As in all nervous conditions some form of high-tension electricity is well indicated. Whether tonic treatment with vacuum electrode, or auto-condensation, will depend upon blood pressure. As blood pressure is usually either normal or low, the most frequent method will be by tonic treatment with vacuum electrode along spine and over epigastrium. Treatments should be short and frequent at first, increasing length and interval as improvement occurs. Unless tension is subnormal an auxiliary auto-condensation (400 to 600 m. a.), will be of value.

NEURITIS. It is in this condition that High-Frequency currents have most frequently brought relief to the patient and credit to the operator. So great is the proportion of cures that the High-Frequency currents may be properly classed as specific. It is well to begin each treatment with five to ten minutes of auto-condensation 400 to 600 m. a., followed by local application to painful area with vacuum electrode F. R. at "High," P. R. 1 to 3 points, spark gap well closed. Treatment should be sedative and not stimulating. Aggravation may follow first treatments, but this is not a contraindication for continuing treatment. Interval of treatment at first should not be more than one day and decided advantage may be had and time saved by daily treatments until relief after treatment continues during the interval. Increase interval according to progress of case.

OBESITY. Inasmuch as this condition is the result of faulty metabolism good results may be expected—and are obtained by the use of auto-condensation (400 to 800 m. a.) daily for fifteen minutes. Marked reduction of weight follows in a goodly proportion of cases, and increased bodily comfort in all.

PARALYSIS. Stimulating treatment with vacuum electrode over affected muscles. Auto-condensation if tension is above normal. Length of treatment five to fifteen minutes.

POST-FRACTURE TREATMENT. Local nutrition, relief of stiffness and rapid restoration of muscular tone will follow daily treatments with Thermo-Faradic current by moist electrodes. Begin treatments as soon as part is out of splint. P. R. 2 points, F. R. 1 to 3 points, treat on opposite sides of limb or with electrodes on same side, separated four or five inches. Move electrodes from time to time to avoid uncomfortable heat. Length of treatment ten to fifteen minutes.

POST-OPERATIVE CONDITIONS. Select treatment according to special case, following indications as outlined under various conditions in which High-Frequency currents are indicated. Bear in mind at all times the tonic and nutritional value of auto-condensation.

PROLAPSE OF RECTUM. This condition has been relieved entirely by treatment with insulated rectal electrode. F. R. at High, P. R. 1 to 2 points, spark gap well closed. Treatments at intervals of two days and lasting for five minutes. For infants and children an insulated urethral electrode may be used.

PROSTATIC DISEASES. A large number of cases of enlarged prostate which have been successfully treated with High-Frequency current are reported. Insulated rectal electrode should be used and technique for work in cavities should be carried out.

PSORIASIS. This disease is most amenable to X-ray treatment and in the experience of the editor, extending over ten years and involving fifty or more cases, but one failure has occurred.

RHEUMATISM. High-Frequency currents are of value in all rheumatic conditions. Pain and local tenderness will be relieved by a mild application with surface electrode for five minutes daily. In the majority of cases auto-condensation for ten minutes (400 to 800 m. a.) should supplement the local treatment as this largel increases the elimination of uric acid. In chronic conditions, with exudation ' Thermo-Faradic current by means of moist electrodes (see technique in post-frac. treatment) rapid progress is made.

RODENT ULCER. (See Skin Cancer.)

SCIATICA. This condition yeilds readily to vacuum electrode treatment, and in the majority of cases it is well to consider auto-condensation as an auxiliary measure. (See Neuritis.)

SKIN CANCERS. The X-ray has proven curative in a large number of cases of Epithelioma and Rodent Ulcer. A medium low tube is used eight to ten inches from surface and treatments given once in five days for five to ten minutes. Surrounding parts should be protected, and if irritation (reaction) is produced, treatment should be suspended until at least ten days from disappearance of irritation. Mild fulguration from the point of a small vacuum electrode is a help, especially in preventing marginal spread.

SKIN DISEASES. Both X-ray and vacuum electrode treatment are of value in a large number of skin conditions and have already been taken up under special skin diseases. With these methods of treatment at hand, it is possible for the general practitioner to carry to a successful termination many cutaneous disturbances which otherwise in justice to his patient and to himself should be referred to the dermatologist.

SPRAINS. Treat with soothing application from surface vacuum electrode. Treatments should be given daily. The same technique with the Thermo-Faradic current as used in post-fracture conditions is also of great value.

STIFF NECK. (See Torticollis.)

STRICTURE OF URETHRA. Good results are reported by the use of an insulated vacuum electrode with a mild current, giving five-minute treatments at intervals of from two to four days. Care should be taken in handling the electrode that no strain is brought upon it as breakage has occurred in a few instances. If electrode cannot be easily introduced, its application should be preceded by introduction of a sound. (See cavity work.)

SYNOVITIS. (Same treatment as for Sprains.)

THROAT DISEASES. The external use of vacuum electrode in various throat conditions will readily suggest itself, together with such general treatment as may be indicated in special cases.

TIC DOULOUREUX. A number of operators report relief in this disease where all other means have failed. The general technique is application of vacuum electrode with mildly stimulating current over affected area with prolonged and ...t treatments.

...ORTICOLLIS. Application of vacuum electrode with mildly stimulating ...rent over affected muscles.

TUBERCULOSIS. In pulmonary and general tubercular conditions, improve...nt has followed the use of auto-condensation (400 to 700 m. a.) on alternate days. In many cases a reaction is shown during early treatment by a rise of temperature. This is an indication for lengthening interval between treatments. Favorable prog-

ress is indicated by gain of weight and disappearance of t. b. The X-ray has been used with some benefit, but owing to the long period over which treatment must extend, it should not be undertaken except by an experienced operator.

TUBERCULAR GLANDS. (See Adenitis.)

TUBERCULOSIS OF SKIN. (See Lupus.)

URIC ACID CONDITIONS. The eliminative effect of auto-condensation renders this treatment particularly valuable in all conditions where an excess of uric acid is found. Urinalysis following treatment will demonstrate this fact to the most skeptical.

VARICOSE ULCERS. We are in receipt of a number of reports of favorable treatment by means of stimulating High-Frequency treatment with vacuum electrode.

WARTS. Fulguration has proved to be most successful in the treatment of warts and small growths. Either a regular fulguration electrode, or the tip of a small vacuum electrode should be used. F. R. at "High," P. R. 2 points, spark gap moderately well opened. Treat apex of wart until it becomes white and soft. Usually one or two minutes will be sufficient. Later the growth reddens and a scab is formed which drops off in a week or ten days, taking growth with it. If treatment is too mild, one or two repetitions may be necessary.

WRY NECK. (See Torticollis.)

IN CONCLUSION. We have not mentioned all the conditions in which High-Frequency currents will bring relief and cure, but have covered sufficient ground to suggest other uses to the observant physician. There is a wide field for original research work as, although it has come to stay, this method of treatment is still in its infancy. If this incomplete booklet has been of any help to the reader, we shall be repaid for the work given to its compilation. May we ask in turn reports of success in the above diseases, but especially any new or original application of High-Frequency currents which has proven successful in the hands of individual operators?

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