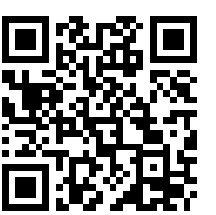

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New Series.

MEDICAL ELECTROLOGY AND RADIOLOGY,

AN INTERNATIONAL QUARTERLY REVIEW.

(With which is Incorporated "The Journal of Physical Therapeutics.")

The Official Organ

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NOTICES.

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Literary contributions are invited.

Advertisers are reminded that nearly every method of treatment dealt with in this Journal involves the use of apparatus in one form or another.

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MEDICAL

Electrology and Radiology.

No. 3. JULY, 1903. VOL. IV.

"ELECTROTHERAPEUTICS AND ELECTROETHICS."

By W. S. HEDLEY, M.D.

IN the April number of this Journal there appeared an article under the above heading which in plain and forcible language dealt with certain rather unpalatable truths. It spoke of good repute and of evil repute, of the "shady groves of quackery," of deviations from the path of strict professional rectitude, and, descending from the general to the special, it reviewed with some severity the ethical position of electrotherapeutics. It pointed out that, although therapeutic electricity had never been altogether destitute of honest workers, it had all along been overweighted by charlatanism. Pursuing its subject, it significantly proceeded to advert to certain recent "cases," in which even members of the profession have laid themselves open to the charge of trying to secure practice and patients by means of inspired articles in the lay press.

Plain speaking of this kind is always salutary, and will not be resented by any one who really has at heart the best interests of therapeutic electricity. Although the latter needs no apology, although its ethics are as high, its results as good, and its science as sound as in any other branch of medicine, still it may be freely admitted there is much that is wrong that ought to be put right. The pity of it is that any one who errs in the ways referred to cannot but be aware that he does so in more or less good company. He knows of instances where medical men of repute, anxious to have their "say" upon some favourite professional topic, and impatient of the limitations, and, perhaps, of the criticisms of a strictly medical audience, have addressed themselves *urbi et orbi* in the columns of the *Times*. He knows that sometimes, and somehow or another, the names of more or less obscure medical men find their way into the health reports of more or less distinguished invalids. He has seen the movements of ordinary medical practitioners whose goings and comings cannot possibly be a matter of public interest duly chronicled in the "fashionable and miscellaneous paragraphs" of the daily papers. Now if the electrotherapeutist when he finds himself lectured on the depravities of his own particular art does not stop to comment

on all these things—is it not that living in his own glass house he is afraid to throw stones? It is simply that, anxious to put his own house in order, he is not perpetually on the look out for possible instances of the puff indirect amongst his friends, nor for the opportunity to whisper a *tu quoque*. He is content to know that appearances are often deceptive, that what may at first sight appear to be unworthy conduct on the part of a *confrère* may after all turn out to be nothing more than the well-intentioned indiscretion of a newspaper reporter. In short, he thinks that every case should be strictly inquired into, but judged individually and on its own merits.

But there is another aspect of this question. What has hitherto been the attitude of the majority of our profession towards electrotherapeutic work? Have medical men taken due trouble to inform themselves of its scope and capabilities and possibilities? Have teachers impressed on the student the vital importance of electro-diagnosis, or have they in the examination hall confronted him with morbid conditions of nerve and muscle without supplying the means of ascertaining their electrical reactions? Or, before stating that "electricity has failed" in a given case, has every care been taken to ascertain that it was properly administered? For instance, before prefacing the account of an operation in a presumably intractable case of trigeminal neuralgia with the statement that "electricity had been tried," has the surgeon ascertained in what way it was tried, and in what doses? Is he aware that in such cases electricity has not been properly "tried" until the patient has been submitted to twenty or thirty sittings, each of about one hour's duration, under a localised current of 50, 60, or 70 milliampères of galvanic anode? Again, when a medical man hands over his patient for the electrical part of his treatment, is it to the care of a duly-qualified brother practitioner, or is it to the ministrations of one of those "unworthy people who work electrotherapeutics as a trade"? Has the former had reason to grow weary of waiting for recognition and support from quarters where he might most expect it, and whence, alas! it never seems to come? Would it be surprising had the repeated "pin pricks" of professional neglect made him callous to the dictates of sound ethics, or goaded him on to appeal from his own profession to that "other Cæsar," the voice of public opinion?

Happily such dangers are now for ever past. The enlightened action of the British Medical Association in setting apart a sub-section of medicine for therapeutic electricity is to be interpreted as an act of friendly recognition, an atonement (were such needed) for possible slights in the past, a stimulus to us all for the future to act up to the best traditions of our profession.

THE ELECTROSTATIC TREATMENT OF RHEUMATOID ARTHRITIS.

By WILLIAM BENHAM SNOW, M.D. (New York).

SOME differences of opinion exist as to whether the term rheumatoid arthritis should be applied to one or a class of affections.

Virchow called it arthritis deformans, which was suggestive of the deformity, and has generally included three types of deforming arthritis : (1) The type under consideration, which, for want of a better name, may be called rheumatoid arthritis ; (2) a type characterised by osteophitic enlargement of the bone, which is known as osteo-arthritis ; and (3) a condition, characterised by deposits of various chalky concretions in the vicinity of joints, which is properly known as gouty arthritis.

Rheumatoid arthritis has many characteristics by which it may be distinguished from the other two types : (1) It occurs in all ages, from childhood to advanced age, but is most common in women between the ages of twenty-five and forty years ; (2) the affection, as a rule, is associated with some other disease or condition which affects the general health of the patient, and is in most cases a secondary disease ; (3) the swelling surrounding the joints always involves the soft structures in the vicinity and is never associated with bony exostosis or chalky concretions as has been too often supposed ; (4) in advanced stages of the disease affecting the finger joints absorption of the inter-articular cartilages and bony structures as shown in fig. 1 ; (5) the lesion, which may at first be limited to a few joints, later becomes multiple and may include all of the articulations of the body.

Osteo-arthritis usually occurs in advanced life, commencing at or after the menopause in women, and is characterised by bony exostoses which usually appear at the terminal phalanges of the fingers. It is persistent, and may or may not be painful to the patient. The condition as shown in the skiagraph, fig. 2, will be found present in these cases. The affection rarely involves other parts, but is sometimes associated with varying degrees of pain in one or more large joints. Rarely, however, are exostoses formed in other than the terminal phalanges of the fingers. These enlargements should never be mistaken for the chalky concretions of rheumatoid arthritis. The skiagraph clearly differentiates this point in the diagnosis. The patients thus affected are usually otherwise healthy individuals and limited to no class or condition in life.

Gouty arthritis, the rarest of these affections, is usually found in gouty subjects past middle age. Much confusion has existed in the professional mind with reference to this affection, and prior to the use of the X-ray very many cases of

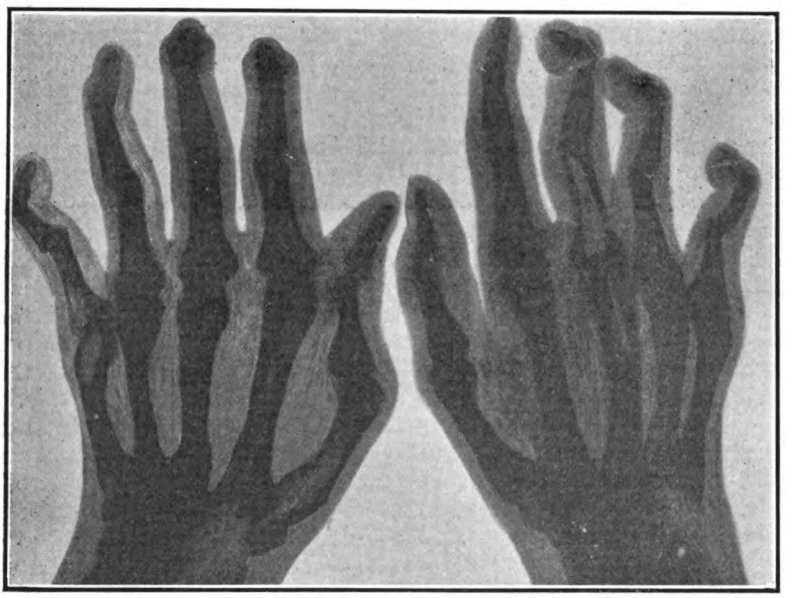


FIG. 1.

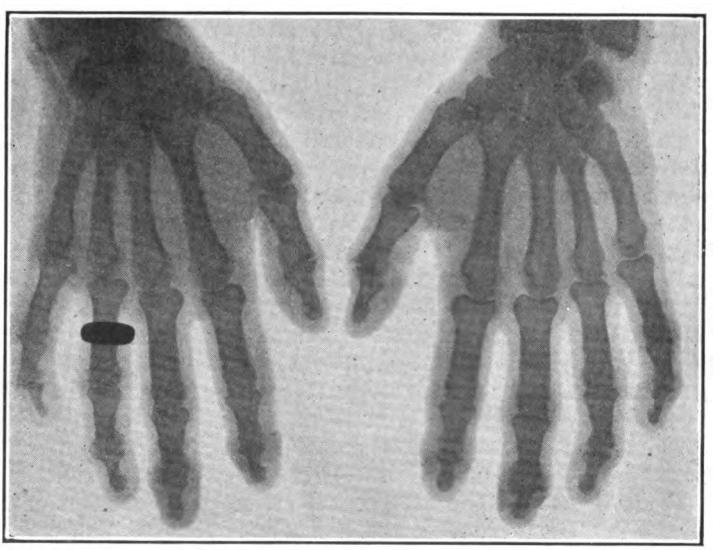


FIG. 2.

the preceding type had been considered gouty arthritis and the patients subjected to the usual routine of drug medication. It is to be deplored that the usual remedies for rheumatism and gout are so universally employed in the treatment of cases of rheumatoid arthritis and osteo-arthritis. The X-ray is a valuable aid in differentiating these three classes of conditions. The skiagraphs shown will indicate the marked contrast in the lesions of the two former.

The *etiology* of rheumatoid arthritis is still in doubt. Some, including Garrod, Spender and Bannatyne, incline to the theory of a specific germ as the cause of the affection; others consider it to be a disease of the central nervous system. In the latter view the writer of this paper is disposed to concur. It seems most probable that it is a disease of the trophic nerve centres, occurring as it does invariably in patients suffering from some nervous or other physical derangement. This leads to the opinion that it is perhaps always a secondary disease arising probably from an affection of the spinal cord by impairment of the nutritive processes. It is apt to occur in nursing women and those suffering from disease of the pelvic organs. It also occurs in those who are ill-nourished. Children, the subject of Bright's disease of the kidneys, or marasmus, are occasional victims. In the records of the writer's cases there is no instance in which some neurosis or other exhausting process was not also present.

The *pathological conditions and symptoms* of rheumatoid arthritis are characteristic of the disease. The first pain and swelling are associated with the establishment of a local stasis impairing the nutrition of the affected joint. The joint then undergoes a retrograde metamorphosis. The cartilages are first destroyed, and later the articular surfaces of the bone are absorbed as shown in fig. 1. Coincident with the inflammatory process the muscles of the joint contract and the finger becomes fixed in a flexed position.

A remarkable change takes place in the bones of the hands when the disease attacks young children. The phalanges become wider and the epiphyses fail to develop, giving the fingers a widened and shortened appearance, as shown in the skiagraph, fig. 3, and the cut, fig. 4. This condition is pathognomonic of rheumatoid arthritis occurring in young children. In these little patients, the limbs become flexed early in the process of the disease, and the muscles fail to develop with the growth of the patient, creating a permanent contracture unless the cases are brought under proper treatment during the early days of the trouble. Not uncommonly they are found with the disarticulation of various joints. The case shown in fig. 4 had a dislocation of the femur at the hip.

Atrophy of the interosseous muscles of the hand and the long muscles of the forearm occurs in advanced cases. The

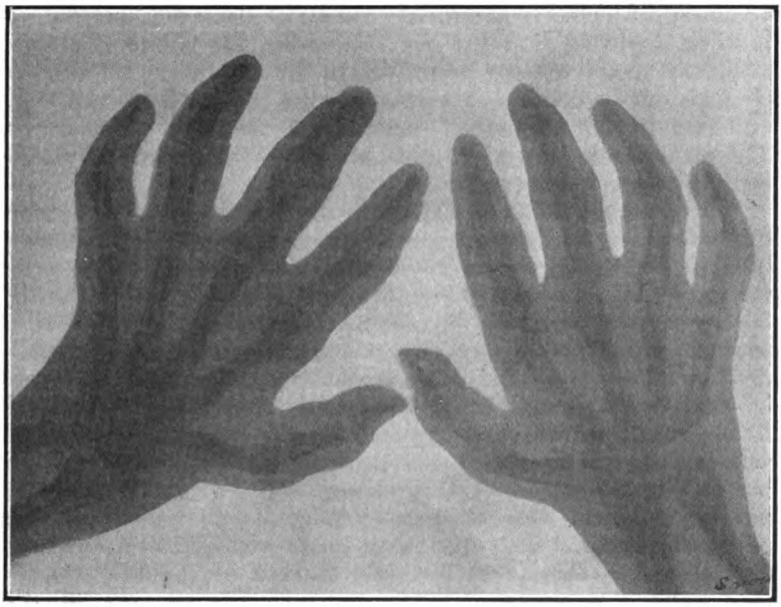


FIG. 3.

FIG. 4.

fingers become fixed in various distorted positions, and in the advanced stages of the disease ankylosis will have taken place in many joints, especially of the wrist. No definite pathological changes have been discovered in the spinal cord to the writer's knowledge.

The first symptoms are pain in the affected joints associated with swelling and severe pain on motion, and a sense of heaviness especially noticeable in the hands. A peculiar brown discoloration of the skin, which is characteristic of trophic changes, is present in many cases. If not properly treated, the suffering of these patients, as the disease progresses, is remarkably severe, and no class of patients are more grateful and persistent than these in carrying out the treatment which affords relief.

The *prognosis* during the first year of the trouble is uniformly good in cases in which the primary derangement is but functional and can be properly relieved. In the writer's experience, the joint conditions are never beyond the possibility of a complete recovery within the first two years, except in cases with organic trouble, as Bright's disease of the kidneys. If there is a question of other organic disease, the prognosis is doubtful. When the inter-articular cartilages of a joint are destroyed, as will be clearly shown by a skiagraph, it may be inferred that the other joint structures are also beyond repair, and their ultimate recovery is impossible. Other joints, however, in the same subject, that are not involved to the same extent, may be restored. In the writer's experience, the prognosis depends upon the relative condition of the various joints at the time the electrostatic treatment is instituted, provided that the case be kept under observation and receive the requisite attention.

The *indications for treatment* are (1) the improvement of the general nutrition of the patient, and the correction of all conditions which contribute to the same; (2) a restoration of local activity in the functions of the involved joints, including the removal of local stasis and the restoration of normal circulation in the parts; and (3) the restoration to normal activity of the nutritional centres.

The treatment of rheumatoid arthritis, according to the indications, is the employment of means of improving nutrition and the general and local metabolism. The various static modalities offer more for the relief of these sufferers than any other method which has been adopted. When properly applied, they meet the second indications and also materially assist in improving the nutritive processes.

The four modalities which are used by the writer in the treatment of these conditions are the static-induced current, wave-current, sparks, and the brush-discharge from electrodes of wood. The affected joints are encased in soft metal which

is firmly bandaged to the surface, and the spark-gap regulated to the conditions and effects produced, *i.e.*, at the commencement of the administration, when the joints are painful, it is possible to administer a current measured by but a short spark-gap, which should be gradually increased during the progress of the treatment as the administration will become less painful. The spark-gap should never be long enough to produce muscular contractions, consequently only those joints should be connected (as they may be) in series which respond similarly to the effects of the current.

The writer has succeeded by this method in relieving the swelling and painful conditions always within a week in the joints of young children without recourse to the other modalities. The wave current is administered with the patient insulated. The electrodes, either single or several connected in series, are attached by one rheophore to the positive side of the machine, the negative pole of the machine being grounded and the length of the discharge at the spark-gap regulated to the conditions to be treated.

The static-induced current is employed only in adults when it is desirable to treat several large joints at one time, the local effect of that current being far more intense than of the wave-current. The wave-current, however, should be administered in the course of each treatment for the effect upon nutrition. Observers who have used this modality have been generally impressed by the fact that during the treatment of local troubles the improvement of the general condition of the patient has been remarkable. It is well, therefore, to apply the current for at least twenty minutes for that purpose. The application to all joints should be continued for from fifteen to twenty minutes. In addition to the conductive discharges employed in the treatment of the affection, sparks and the brush-discharge deserve a large measure of recognition. Many of the early cases could be cured with either of these modalities. The brush discharge is administered with the patient insulated, the shepherd's crook in the hands of the patient being connected to the negative side of the static machine, the positive side of which is grounded. The balls of the discharging rods should be widely separated, so that no spark can pass during the administration. The machine should then be run at a rapid rate of speed; the operator employing a wooden electrode of white wood or any other wood of even texture. It should be at least 16 inches in length, and $\frac{3}{4}$ inch in diameter, and provided with a round ball terminal about 1 inch in diameter. To the other extremity of the electrode a ground chain should be connected, the operator taking the electrode at the extreme end of the handle will then apply the discharge to the affected parts.

When the brush-discharge is applied to swollen and inflamed areas, it causes severe pain and should be therefore moved to and fro over the surface, until the application feels the same as over surfaces not involved. If persisted in to this extent, the pain and swelling may be entirely relieved in some cases and diminished in all. The only objections to this modality in severe cases is, that in order to produce the desired sedation the rubifacient effect of the application is such that the surface may become much irritated. It also requires considerable time when many joints are involved. The disruptive discharge is invaluable in the treatment of many cases and will relieve satisfactorily most patients, but is so painful that it is better with those who are exhausted with suffering to first employ the other modalities, and later, if necessary, sparks may be used. It is customary to apply short sparks ($\frac{1}{2}$ inch) to the joints of the fingers and proportionately longer ones to the other joints. These modalities overcome local stasis and induce an active metabolism in the structures of the affected joints giving remarkable relief and at the same time promoting the ultimate cure of the case. In most cases the best success will be obtained by combined use of the three modalities, wave current, sparks and brush-discharge; the static-induced current only being employed when it is impossible to make sufficiently intense application to the large joints, or when it is desired to treat a number of large joints connected in series.

The frequency of administration will vary with the individual cases. As a rule, however, they should be treated at least daily for the first two weeks, and in many advanced cases the daily treatments may be required for a much longer period. The treatment should be continued at intervals until the patient remains absolutely free from recurrence.

THE NAUHEIM BATHS.

By Dr. G. WACHENFELD (Bad-Nauheim).

THERE are six kinds of baths, the three first mentioned below being each different and distinct from each other, and the three last mentioned being combinations or varieties of the first three.

(1) Brine Baths.—This water flows through a graduating arrangement and loses CO_2, carbonates of iron, manganese and fluorine, arsenite and phosphate of iron, and other salts; what remains is chiefly chlorides. It is quite cold on its arrival at the bath-room, and is there heated to the desired temperature —usually 89° to 95° F. These baths stimulate mildly because

they have lost so much of their salts. They are used largely for tuberculous diseases of the bones and glands of children, and in certain gynæcological cases.

(2) Thermal Baths.—The water of the springs flows into basins, and much of the CO_2 is evaporated. The iron combines with the oxygen of the air and becomes iron protoxide, which gives a yellowish-red colour to the water. On reaching the bath the temperature is 82° to 88° F. They are prescribed at 82° to 95° F., the higher temperature being got by adding thermal bath water heated at the bath house.

These baths stimulate more than the brine baths, since they contain more salts. Some children and weak adults require a greater stimulation than can be got from the brine baths, but cannot bear the full stimulation of the thermal bath. For them this water is diluted with pure warm water. These are used largely for heart disease, gout, rheumatism, and gynæcological cases.

(3) Effervescent Baths (sprudel bader).—The water from the springs flows directly through pipes into the baths, and first comes in contact with the air in the bath. It retains all its ingredients, including CO_2, and the iron is not oxydised, so that the water is transparent and colourless. These baths stimulate more than any of the others, owing to their free CO_2. The temperature is 88° to 91° F., the water being cooled when necessary by putting ice in the bath, *e.g.*, in all cases of spinal or nervous diseases. They are prescribed at 77° to 91° F. They are used largely for cases of heart disease, when the patients are strong enough, *i.e.*, in the last part of the bathing course, and for cases whose central nervous organs are affected, especially spinal diseases.

(4) Thermal-Effervescent Baths.— The water from the springs is conveyed to cisterns underground. Also this water first comes in contact with the open air in the bath, but on the long way through the pipes to the cisterns, and in the cisterns, it is not possible to keep it free from contact with the air, and therefore a little part of its iron is combined with oxygen, and the water is not absolutely transparent and colourless. The water of these baths contains nearly all the CO_2 and also the greatest part of salts in the same combination as the effervescent baths. The thermal effervescent baths are not quite so strong as the effervescent baths. They are used especially in cases of heart disease, rheumatism and gout.

(5) Thermal Stream Baths (thermal strom bader).

(6) Effervescent Stream Baths (sprudel strom bader) are respectively thermal and effervescent baths in which the current flows through the bath while the patient is in it.

The duration of a bath depends entirely on the condition and circumstances of the patient. There is no hard and fast rule. Usually it is from ten to fifteen minutes—the shortest

time is six minutes, and the longest twenty-five minutes. Usually, but not always, the patient begins by baths of short duration, and the duration of each bath is gradually increased as the cure continues. Drugs are as a rule not given.

The kind of bath, temperature, duration, &c., depend on the patient's strength at the time of bathing, on the patient's capability of withstanding the effect of the bath, which again depends on the ability of his nerves to transmit the stimulating current. Often patients begin with the milder baths and later in the cure take the stronger ones.

Action of the Baths.—In cases which come to Nauheim, the condition is more or less chronic derangement of the absorbent system. None of the salts of the water are absorbed, and the action is due to stimulation by the CO_2 and salts. These salts and CO_2 stimulate in three ways: (*a*) Movement of the absorbent system is stimulated; (*b*) reflex stimulation of the affected organs through the cutaneous nerves; (*c*) reflex stimulation of the vagus nerve. The action of the heart becomes stronger and slower.

The Class of Cases chiefly Benefited by the Baths are:—

(1) *Fatty Degeneration of the Heart, and Chronic and Sub-acute Myocarditis* following acute diseases, such as influenza. In such cases the strengthening of the heart is rapidly effected.

(2) *Neuroses*, in which there is infiltration in the medullary sheath of the nerve-fibres.

(3) *Inflammation of the Valves of the Heart.*—Reabsorption occurs with certainty in recent cases.

Some of these cases arrive so exhausted that they require some weeks' rest until the heart is fit for the exertion required of it by the bath, otherwise it will not react to the stimulus of the bath.

(4) *Commencing Atheroma of Arteries.*—During the cure the thickening becomes less, the resistance of the vascular walls less, and the second sound of the valves of the arteries will not be so attenuated as before.

(5) *Gout.*—In gout there are two objects to be aimed at: (1) To produce an effect on the abnormal composition of fluids; (2) to produce reabsorption and excretion of painful deposits.

The baths stimulate movement of lymph, and thus absorption of painful deposits is accelerated. A more rapid excretion of abnormal lymphatic materials is brought about, and in consequence of the increased secretion of all the glandular organs a normal combination of the fluids of tissue is effected.

(6) *Acute and Chronic Articular and Muscular Rheumatism.*—More pain is often experienced at the beginning of the cure, because existing infiltration in the tissue increases, and by pressure on the surrounding nerves causes pain. After a few baths, as soon as reabsorption begins, no more pain is experienced.

(7) *Metritis, Endometritis, Parametritis, and Periovaritis.*—In these conditions the effect is the same, viz., a strong stimulation to the organs of the abdomen, softening and reabsorption of the induration.

For long-standing parametritis and periovaritis it is well to combine bath treatment with the massage of "Thure Brandt." This massage must follow the bath. After the bath the tissue becomes softer and therefore the pressure of the massage has more effect. After the first bath premature periods of menstruation often occur. When there is chronic endometritis accompanied by frequent hæmorrhage, the vascular tissue becomes strengthened, the conditions of the circulation improve rapidly, and the next menstrual period is often normal.

(8) *Spinal Complaints, Tabes, Sciatica.*—Where the nerve tissue has been destroyed no regeneration can occur. But recent sciatica and similar ailments can be quite cured, because it is only a question of an acutely inflamed induration.

(9) *Chlorosis and Anæmia combined with Retarded Development; Tuberculosis of the Bones and Glands, especially of Children; and General Weakness.*—The stimulating effect of the baths is shown by the increased activity of the heart and the improved condition of the absorbent system, the digestion being also improved.

In all the above cases the origin of the disease is essentially the same, viz., derangement of the absorbent system and consequent stagnation in single organs. The effect of the baths is in every case the same, viz., the fluid movement is strongly stimulated, and thereby the existing exudation is reabsorbed.

The advantage of Nauheim lies in the six different forms of baths, so that it is possible here more than in any other place to individualise, according to the condition and strength of the patient, and according to the nature and gravity of his disease.

IT was intended in the present issue to have published *in extenso* Dr. Herschell's paper on Polyphase Currents reviewed elsewhere. The length of the Electrotherapeutic Society's reports prevents this, but we can confidently promise its appearance in the next number of the Journal.

Reviews and Notices of Books.

"HIGH FREQUENCY CURRENTS IN THE TREATMENT OF SOME DISEASES." By Chisholm Williams, F.R.C.S.ED. 9 × 6, 222 pp., 74 illus. (Rebman, 10s. 6d.)

The appearance of this, the first systematic treatise in English on high frequency currents, will be welcomed by a large circle of appreciative readers. That its author should also be the first Secretary of the British Electrotherapeutic Society is quite in the fitness of things. A short introduction states that its object is to "give some more or less connected account mainly derived from the author's own practice," but also, as it goes on to say, collected from other sources. A short history of the origin and evolution of high frequency currents is also given, and this, the first chapter, ends with some very weighty sentences on the so-called high frequency "cure of cancer":— "During the past year the British Electrotherapeutic Society . . . has had no case of undoubted cancer reported to it as cured by this agency. . . . Other cases of so-called cancer could be numbered on the fingers of one hand; no microscopical evidence of the various growths has been forthcoming." The author goes on to state that he has treated a number of post-operative cases with marked diminution of pain and of the local growth, but with no arrest of the progress of the disease. After this comes about fifty pages dealing with sources of electrical energy, cells, accumulators, coils, &c., illustrated by figures from standard electrotherapeutic works, which will be familiar to many readers. Here the question arises whether it would not have been more advantageous if, instead of overweighting so small a volume by such matter, the author had assumed a certain amount of elementary electrical knowledge on the part of his readers, and reserved the space so gained for a more detailed account of the technique employed, and a greater elaboration of the clinical matter. The latter is, nevertheless, highly instructive, much of it being the direct outcome of the writer's own experience. The most important item under this heading consists of the forty-three cases of phthisis brought before the British Medical Association, 1901. Of these we are now told that three have died. Of the rest none have required treatment during this year. The author truly says that sanatorium statistics do not furnish so large an amount of "arrests," and therefore he concludes that high frequency should "prove a valuable adjunct to a sanatorium." It would have been well in a systematic treatise like this to have reproduced the full and original account of this important and unique series of cases. It seems desirable that an influential committee of the Electrotherapeutic Society should be appointed to inquire into

this interesting subject, viz., the employment of high frequency currents in tuberculosis.

In the treatment of lupus vulgaris the writer finds high frequency better and quicker than X-rays. Internal hæmorrhoids are amenable to the treatment, but operation is preferable.

The last few pages are reserved for a very critical notice, with which most readers will find themselves in agreement, of Dr. Freund's paper, read at the British Medical Association in 1902. Exception is justly taken to that writer's statement that the action of d'Arsonval's apparatus is superficial only, and that the physiological effects of the method are solely due to the spark discharges accompanying the use of the apparatus.

There is added an appendix giving the after-history of Dr. James Allan's four cases reported in a previous part of the book, and a case of tuberculosis of the urino-genital tract by Mr. McAdam Eccles.

One or two unfortunate slips of the pen or printer's errors have crept into the text; thus at p. 40 "undirectional" is printed where "*uni*directional" seems to be intended, and at p. 41, in describing the nodon valve where the cells are said to heat up to 50 centimetres, it is possibly 50° centigrade that is meant. The words "resonater," "commutater," &c., may appear unfamiliar to many, and not quite in accordance with established usage. Still such spelling is not without a good deal to recommend it, and—we live in a free country. The same remark can scarcely be applied to "effleuve"; here it is possible that the tyrannous prejudices of a foreign land might insist upon the word being spelt "effluve."

The book is "got up" in excellent style, and appears in the now well-known "colours" of its publisher.

POLYPHASE CURRENTS IN ELECTRO-THERAPY. By George Herschell. M.D.Lond. $8\frac{3}{4} \times 5\frac{1}{2}$. Pp 44. 12 Illus. (Glaisher, London. 2s. 6d.)

This *brochure* is the reprint of a paper read before the British Electrotherapeutic Society on February 27 of this year. For some reason it was not published in the official report of the Society's Transactions. It is to be hoped that this precedent, which is in direct contravention of the Society's rules, will not be followed in the future. Those members who were unable to be present at the reading of the paper had a right to expect a report of it, and of the discussion which followed, in the first number of the Official Journal that appeared after the meeting in question. Its non-appearance was the more disappointing inasmuch as the paper is one of exceptional interest and exceptional merit.

Taking it in detail, we have first to express our entire agreement with the remarks of the author upon the criminal

folly of a law which, in deference to the liberty of the subject, allows unqualified men or women to procure powerful high frequency, or X-ray installations, and treat indiscriminately all patients whom they can attract. It is eminently desirable that those who use electrical treatment should understand not only the benefits which can be derived, but also the dangers which attend it. It is advisable also that practitioners should be fairly conversant with the science of electricity. This unfortunately is not always the case.

The first 18 pages are devoted to an explanation of the nature of polyphase currents and their methods of generation, together with a description of the Herschell-Dean triphase generator. We regret we cannot follow the author through his description of the principles of the dynamo. It is possible that he means something different to that which is written. At any rate that which is written can scarcely be called correct. On page 2, when speaking of the armature conductors rotated in a magnetic field, he says "When, for example, it is opposite the centre of the pole of the electromagnet, it will cut the lines at right angles, but as it moves the angle at which it will cut them will become successively more acute, until when it is exactly between the poles it will not be cutting lines of force at all, but will be moving parallel with them. At this point, therefore, no electromotive force will be generated in the conductor." As a matter of fact we must consider a loop of conductors, and not a single conductor, and it is therefore convenient to consider a pair of conductors lying on the periphery of the armature cylinder and parallel to its axis, diametrically opposite to each other and connected at both ends. The connection of one of the ends would be by slip rings or commutator, and the external circuit. Now when this loop is opposite the centre of the pole of the electromagnet (say horizontal) it encloses no magnetic lines. When it has moved through an angle of 90 degrees, that is midway between the poles, it encloses practically all the lines of force; but its rate of change of the enclosed lines of force is greatest in moving from the horizontal position, and least when moving from the vertical position, therefore the electromotive force per degree of rotation will be greatest when near the horizontal position and least when near the vertical position.

The author advocates the use of the Herschell-Dean triphase generator, which consists of a rotary converter, and three single-phase slip-coil transformers mechanically connected. The novel feature of this apparatus is a friction brake applied to the armature shaft, in order, by increasing the amount of work to be done per revolution, to reduce the number of revolutions per minute, and thus reduce the periodicity. The apparatus is made for converting either the current supplied by a 12-volt accumulator, or from a general

supply of continuous current at 100 volts. The author does not appear to have considered the danger of using a rotary converter from ordinary town mains. This is apparent when we look at page 27, where he tells us that we may obtain a reliable measurement with a delicate reading voltmeter in shunt across two phases; and "this voltmeter should read to 20 volts." But it must not be overlooked that with a rotary converter, the copper circuit is complete up to the tri-phase windings of his tranformer. A word of warning should have been given here. It is absolutely necessary when using the towns supply that an inductive method be adopted. In other words, when using the Herschell-Dean apparatus the transformers must in all circumstances be employed, otherwise the danger would be that while reading 20 volts or less upon your voltmeter, you might as a matter of fact be applying 100 volts to the patients, by reason of the faulty condition of the towns mains.

It seems to us that the difficulty could be overcome, and all the advantages of the Herschell-Dean apparatus obtained, if a motor generator were employed. This would consist of two small armatures on the one shaft, and two field magnets. One armature and one field magnet would constitute the motor, and the other the polyphase generator. The speed could be regulated by the motor both by inserting resistance in its armature circuit and in its field circuit. The periodicity would be governed by the speed of rotation of the armature shaft; the electromotive force of the polyphase current by the strength of the field in which the polyphase armature rotated.

Considerable doubt appears to exist in the author's mind on the question of electro-terminology. The paragraph on page 27, headed "Measurement of Current," emphasises this. We read down to find the method which the author advocates for the measurement of current, and we find that he tells us that "a reliable measure of *energy* (the heading is Current) can be obtained with a delicate reading *voltmeter*. Then he goes on to say that the *galvanometer* should be a commercial *voltmeter*. With the triphase generator recommended by the author it is necessary in our opinion to measure on the polyphase side. It is therefore essential that both voltmeter and milliampèremeter should be specially constructed for the purpose, otherwise their use might be dispensed with, as only false readings could result. On the other hand, if the motor generator, which we consider preferable, were employed, the fact that no braking device is adopted to reduce periodicity would render it possible to read both volts and milliampères on the continuous current side. The instruments for the purpose are cheaper and more reliable.

Passing to the physiological effects of the currents in

question, their influence on the pulse, upon the excretion of urea, and upon the motility of the gastro-intestinal tract, are tersely and lucidly set forth. That is to say, the experiments are detailed in such a way that they can be repeated and verified, a feature which is often lamentably absent from electrotherapeutic writings. Instances have lately occurred of lengthy communications describing electrical cures, many and marvellous, without giving any single definite or useful hint as to the *technique* employed. Such papers may be listened to with courtesy, but they convey no real information, and therefore carry no weight. Coming back from this digression, it may be justly said that the book under notice is in no sense open to strictures of the above kind. On the contrary, it is a model in this respect of what such a book ought to be. The treatment of neurasthenia, headache, &c., is by no means the best part of the book. But when the author comes to conditions of the gastro-intestinal tract he is fairly on his own ground; his observations are the outcome of his own personal experience, and although as yet very limited in number, they are nevertheless clear, emphatic, and convincing.

NATURAL PHYSICAL REMEDIES IN THE TREATMENT OF DISEASE. By H. H. Hulbert, B.A.Oxon., M.R.C.S., &c. 7½ × 5, pp. 152, 25 illus. (Bexhill Publishing and Printing Company, Limited.)

In language which is brief, clear, and devoid of technicalities, this little volume sketches the outlines of physical therapeutics. The medical employment of light, heat, electricity, exercise, massage, and medical gymnastics are instructively discussed. Amongst physical remedies the author's experiences enable him to give special prominence to that form of "radiant heat" which is fitly known as "the Dowsing System"; but curiously enough he fails to go back to the first chapter of the therapeutics of luminous heat, viz., a "classic" demonstration given before the Balneological Society (so far as the present writer remembers) about the year 1896 or 1897. However, this is ancient history now, and a "modern" writer is perhaps justified in overlooking it. The volume opens with a full-paged picture—a weird collection of miscellaneous instruments and implements all tumbled up together, and looking more like a nightmare than a decorous assembly of medical appliances. On recovering from this, the reader will find each piece of apparatus and its purpose singly and suitably described and figured in the pages that follow. There are chapters on chemical rays, the therapeutics of colour, exercise and "exercises," the treatment of constitutional diseases, joint troubles, heart and chest diseases, diseases of digestion, nervous system and skin, X-rays, high frequency, and hydro-electric methods. Massage is not very fully dealt

with, in view, no doubt, of the many monographs already devoted to this subject. The most important section of the book is certainly that devoted to the medical employment of luminous heat (Dowsing System)—undoubtedly one of the most important weapons in the whole arsenal of physical therapeutics.

Altogether it may be said that the author is well suited by previous studies and experience in kindred subjects, to take in hand the present work. It will not fail to find interested readers amongst the public as well as amongst medical men.

A System of Heat, Light, X-Ray and Electro-Therapeutics, Worked from the Alternating Mains. By G. B. Batten, M.D. (Bale and Co.)

Electrolysis and Phoresis. By Dr. Donald Baynes. (Bale and Co.)

Notes of Cases Treated with Benefit by High Frequency Currents. By W. F. Somerville, M.A., B.S.C., M.D. (Bale and Co.)

This and the two preceding *brochures*, are the reprints of papers read before recent meetings of the British Electro-therapeutic Society. They attracted considerable attention at the time they were read; and there is probably no one amongst us, whether a member of the Society or not, who will not find in each of these papers something to learn.

Der Chronische Kopfschmerz und seine Behandlung mit Massage. Von Dr. Gustaf Norström.

In a former publication (1885) the author advocated the treatment of migraine by massage. That is to say, he tried to show the relationship of cause and effect between cervical muscular inflammations and cephalic pains, and to prove that they can be cured under a methodical treatment. It was objected that he used the word "migraine" in cases of cephalalgia which had really nothing in common with migraine. He does not think it worth while to dispute this point, and therefore is content to describe his present set of cases as cephalalgias treated by massage. They are recorded at considerable length, and are interesting and instructive.

Index Medical des principales Stations Thermales et Climatiques de France. Par le Syndicat Général des Medicines des Stations Balneaires et Saintaires de France.

An excellent account—short, complete and scientific—of the health resorts of France, with a useful map and careful Index. It must prove of service to the balneological specialist, and even more so to the busy general practitioner or consulting physician.

THE MANUAL TREATMENT OF DISEASES OF WOMEN. By Gustaf Norström, M.D. (Published by G. E. Strechert. London and New York).

Whatever may be said in its favour, it is quite certain that gynæcological massage, or the manual treatment of the female organs, has not yet "caught on" in this country. Indeed, it has been tacitly condemned. In France, the Surgical Society of Paris having formally considered the matter, has pointed to very grave risks in its application. Of course it cannot be doubted that in cases such as pyosalpinx and sarcoma it would be a very dangerous procedure, but these are the cases in which, as the author points out, massage is emphatically contraindicated. Those who wish to study the subject ably set forth and warmly advocated, cannot do better than read Norström's Treatise.

THE RÖNTGEN RAYS IN THERAPEUTICS AND DIAGNOSIS. By Dr. W. A. Pusey and E. W. Caldwell, B.S. $9\frac{1}{2} \times 6$. Pp. 591. (Saunders.)

This, the most complete and important book that has yet appeared on the subject of X-rays, reaches us almost at the moment of going to press. We are obliged therefore to defer until our next issue a more critical notice of the work, and to content ourselves for the moment with the bare announcement of its appearance.

BOOKS RECEIVED.—*Propriétés Physiologiques des Bains de Lumière.* Par le Doct. Gunzburg. Report of the Committee on "Current Classification and Nomenclature." Reprinted from *The Journal of Advanced Therapeutics. Le Massage des Fractures.* Par le Doct. Gunsburg. *Annales de la Soc. de Medecine Physiques d'Anvers.* Report of the Special Committee on Static Induced Current (American Electro-Therapeutic Association).

Digest of Current American Medical Literature.

AIR.

THERAPEUTICS OF DRY HOT-AIR.—Skinner, in discussing the advantages of dry hot-air in local sepsis, concludes that there is secured: (1) Rapid relief of pain; (2) the induction of hyperleucocytosis, whereby the infective process is frequently abruptly arrested and nearly always prevented from spreading from structure to structure; (3) relief of the nerve-centres to a large extent from toxin depression, because of an increase in the process of elimination; (4) the avoidance of reaction from drug stimulation, because an amount of depres-

sion sufficient to demand the same does not ordinarily obtain after the administration of hot-air has been commenced.—*Advanced Therapeutics*, February, 1903.

THE GIANT MAGNET IN OPHTHALMIC SURGERY.—Connir reports two cases of foreign body in the vitreous, in each of which enucleation would have been imperative without the aid of the magnet. The power of the small magnet is shown best, by experimental and clinical work, to be equal to, or greater than, the giant magnet at contact and up to 2 mm., but from this up to 10 mm. the power of the giant increases in almost geometric ratio. This demonstrates that for splinters in the vitreous the giant magnet is needed. The action of the magnet is less jerky and more uniform the farther from the splinter it can be used. The eye may be brought slowly to the magnet from a considerable distance, or it may be brought close to the magnet point and the current turned on gradually. Firm fixation in the posterior wall of the eye, or in the ciliary body, or in a fibrinous exudate, or when the splinter has become encysted, form the limitations to the giant magnet's usefulness.—*Journal of the Am. Med. Asso.*, March 21, 1903.

THE PENETRATING POWER OF HIGH-FREQUENCY CURRENTS.—Bishop reports the following experiment, prefacing his description with the statement that it was supposed that currents of high frequency and high potential possessed neither electrolytic nor phoretic action. A few drops of a saturated solution of starch were placed under the middle of a pane of glass and a solution of iodide of potassium in glycerine was placed immediately over it on the upper surface of the glass. A current of high frequency and high potential was then passed through it for five minutes. At the end of that time there was a decided iodine reaction in the starch on the under surface of the glass. The glass was pasted to white paper, with starch around the edge. No reaction took place at the edges. In consequence of this experiment he has since used iodide solutions and other remedies in the treatment of sore joints, where a local medicinal action was desirable. In using a glass metal-lined electrode he discovered that the metal inside the electrode was stained with free iodine, showing that the phoretic action had taken place in both directions into the tissues and the electrode.—*Advanced Therapeutics*, April and June, 1903.

Remarks.—It is a recognised physical law that, so far as is at present known, no current can pass through such a mass of material as that of which the human body is composed, without effecting *electrolytic decomposition*, or in other words, that the only medium of conduction in such a mass is *chemical decomposition* or *electrolysis*. According to this view rapidly alternating currents produce electrolytic effects, not

only in the medium immediately surrounding the poles or electrodes, but also in the *intrapolar* or intervening tract. Owing to the feeble electric conductivity of the body the skin effect, or tendency of the current to seek the outer layers to the exclusion of the inner layers, is comparatively small at the frequencies which can be practically produced, for while the depth to which such currents would penetrate in good conductors, such as copper wires, is very small, yet in the case of high resisting materials, such as those constituting the human body, the penetration would probably extend practically through the entire mass. Therefore, conclude Houston and Kenmelly, from whom the writer quotes, high frequency alternating currents are powerful but painless currents, and are probably attended by electrolytic effects in the entire mass, although, as in the case of all alternating currents, little if any accumulation of electrolytic products can take place. It must also be remembered that electrolytic phenomena are associated with, and accompanied by, phoretic phenomena, and that there is recognised both anaphoresis and cataphoresis, or a movement of the products of decomposition from both. Likewise drugs are transferred from the one or the other, according as to whether they are electropositive or electro-negative, anaphoric and cataphoric medication; and it is quite possible, with an oscillating current such as the current of high frequency and high potential from a static machine, that the phoretic action would be in both directions.—*The American Editor.*

DIET.

THE COMPOSITION AND ALCOHOLIC CONTENTS OF CERTAIN PROPRIETARY FOODS FOR THE SICK.—According to Harrington the following foods were found to contain appreciable amounts of alcohol: (1) Liquid peptonoids 23·03 per cent. by volume of alcohol, 14·91 per cent. of total solids and 0·17 per cent. of mineral matter; (2) panopepton 17·99 per cent. of solid matter, including 0·97 per cent. of mineral matter and 18·95 per cent. by volume of alcohol; (3) hemapeptone contains 10·60 per cent. by volume of alcohol, 19·54 per cent. total solids and 0·09 per cent. of mineral matter; (4) nutritive liquid peptone contains 14·81 per cent. by volume of alcohol, 15·20 per cent. of total solids and 0·69 per cent. of mineral matter; (5) hemaboloids contains 15·81 per cent. by volume of alcohol, 6·36 per cent. of solids and 0·62 per cent. of mineral matters; (6) tonic beef contains 15·58 per cent. by volume of alcohol, 18·16 per cent. total solids and 1·04 per cent. mineral matter; (7) Mulford's pre-digested beef contains 18·72 per cent. by volume of alcohol, 10·39 per cent. of total solids and 0·20 per cent. mineral matter.—*The Boston Medical and Surgical Journal*, March 12, 1903.

PHOTOTHERAPY.

AN EXAMINATION INTO THE CLAIMS OF THE RED LIGHT TREATMENT OF SMALL-POX.—Schamberg believes that it is impossible for diffuse winter daylight to cause any irritation of the skin. That the eruption of small-pox has a predilection for the face and extremities he believes to be due to the greater vascularity of these parts. If a part is congested prior to the eruption the lesion is increased, but an irritation after it has appeared does not influence it unfavourably. Because of the pigmentation, the negro should suffer less severely than the white if Finsen's theory were correct. This is not the case. Immunity from scarring depends in his opinion upon the vaccinal condition of the patient and the severity of the disease.

The data quoted by Finsen in support of his theory is drawn from Norway, Sweden and Denmark, the best vaccinated countries in the world. As a rule vaccinated patients suffer mild attacks and are not scarred. Mild attacks in the unvaccinated may leave no scars. Conclusions should only be drawn in determining the value of a remedy from non-vaccinated patients. Schamberg supports his belief additionally on two non-vaccinated cows treated by red light as formulated by Finsen, one died, the other recovered, badly scarred.—*Journal Am. Med. Association*, May 2, 1903.

ULTRA-VIOLET RAY ANÆSTHESIA IN MINOR SURGERY.—Brockbank reports two cases in this comparatively new field of study, believing that it is desirable that all men who have a chance to study the conditions best suited for the use of this method and the class of cases or conditions to which it is most applicable should report their results, that the proper field for usefulness and therapeutic limitations may ultimately be determined.

CASE 1 suffered from a clean incised wound of the left forearm, extending from the head of the ulna parallel with the bone for two inches, exposing the tendons of the muscles in that region throughout their entire length. The parts were cleansed in the usual manner and then exposed to the rays of light from a No. 4 Minim lamp for fifteen minutes, after which five interrupted silk sutures were placed without causing the patient any discomfort. The area was dusted with an antiseptic powder, equal parts of ur-a-sol and aristol powder, covered with a 10 per cent. iodoform gauze, a compress of absorbent cotton and a small roller bandage. The wound healed without trouble.

CASE 2.—Fatty tumour just below the left breast. Patient had been advised to have it removed but had not done so because of her dread of anæsthesia. The site for the operation was thoroughly cleansed, then exposed to the rays of a

No. 4 Minim lamp at eight inches for twenty minutes, and at slightly greater distance during removal. An incision two inches long down to the tumour was made without causing sufficient pain to give any distress. Adhesions were then broken up and the tumour shelled out without difficulty. Pressure readily controlled the slight hæmorrhage, and the edges of the wound were brought together by fine interrupted silk sutures without complaint on the part of the patient. The wound was dressed with antiseptic powder, iodoform gauze and compress held in place by adhesive strips and a roller bandage. No shock, distress, nor discomfort of any kind followed the operation. An examination of the dressings on the second day found them perfectly dry, and on the fourth they were removed. The wound was perfectly healed and the stitches were removed. An iodoform gauze dressing was then applied for two days longer.—*American Medicine*, April 25, 1903.

LIGHT IN THE TREATMENT OF LUPUS AND OTHER CHRONIC SKIN AFFECTIONS is discussed by Kime, who uses a modification of the ray filter employed in photography, with an eighteen-inch focus. At the focal point it is intensely hot, but in some cases nothing short of this will arouse reparative action. With a beam of sunshine, one foot in diameter, falling through the office window, the instrument is ready for use. The diseased surface is freed from crusts, and washed with water without antiseptics. The light is moved over the surface, coagulatiug the albumin in the tissues until it is of a smoky white colour. This takes but a few minutes, and should be done by the physician, who can then turn the treatment over to the nurse, who seats the patient so that the true focal point is avoided. The application is then continued twenty minutes longer. A wet dressing is then applied. This is removed the following morning, and a twenty minutes' exposure is again made by the nurse. On the third day the physician uses the light at the focal point again upon any part which has failed to respond to the irritative influence of the light. A solution of sulphate of copper is used to absorb the non-chemic rays. The parts are thoroughly cleansed twice a day. Four cases are reported with photograhs.—*Journal Am. Med. Association*, April 11, 1903.

THE ROENTGEN RAY.

THERAPEUTIC USE OF THE ROENTGEN RAYS IN THE ORAL CAVITY, was the subject of a paper by Geo. F. Eames, of Boston, at the recent meeting of the American Medical Association. He believes that the X-ray acts by the decomposition of the tissues and the liberation of oxygen. He has used it extensively in treating neuralgia, and with good effect,

but has found when applied to the human body an excess of uric acid is produced. The X-rays do not destroy germ life any more than does the sun's rays; the bactericidal effect of both is due to ionisation or electrolysis. The factors to be considered in X-raying are: the potential of the ray; the resistance of the tissue to the ray; the intensity of the radiation. He summarises their effect upon malignant growths as follows: relief from excruciating pain; establishment of the process of repair; reduction in size of new growth; removal of odour if present; cessation of discharge; softening and disintegration of lymphatic nodes; disappearance of lymphatic enlargements not submitted to treatment, and often quite distant; improvement in the general health; cure up to date of a certain number of malignant growths. Eames believes that these changes suggest that X-ray vibrations acting on cancer cells tend to stimulate many to maturity, at the same time breaking down the weaker ones, which are absorbed by the lymphatics and enter the circulation, producing the auto-intoxication so frequently observed; the number of cells reaching maturity and those undergoing destruction depending upon the intensity of the reaction established.—*Am. Medicine*, May 16, 1903.

THE CURATIVE POWERS OF THE X-RAYS UPON LUPUS AND MALIGNANT GROWTHS, WITH REPORT OF CASES.—Five cases are detailed by Buchanan illustrative of the curative powers of the Roentgen rays upon lupus and malignant growths. He believes that in many cases superficial epitheliomas, lupus, rodent ulcers, eczema, and many kindred affections can positively be cured; the growths of deep-seated carcinomas can sometimes be retarded and the pain very much lessened by means of the rays, but that such patients can be permanently cured is as yet not demonstrated. A tube of medium high vacuum is better suited for therapeutic applications than a tube of low power, particularly for deep-seated carcinomas; the tube should never be nearer the part exposed than twelve inches, and the exposure should never last longer than from five to ten minutes at one sitting. An interval of from three to four days should intervene between exposures. The writer believes that superficial carcinomas and other similar affections of the skin can be cured without any burning of the skin whatever. All cases of inoperable carcinomata, sarcomata, &c., should be treated with the X-rays before they are abandoned as hopeless. After the suspension of treatment carcinomata show a disposition to return quickly.—*Phil. Med. Journal*, April 25, 1903.

THE RATIONAL BASIS AND INDICATION FOR THE X-RAY was discussed by W. A. Pusey, at the recent meeting of the American Dermatological Association. He states that there

are found changes in the tissues and in bacteria in which the X-ray is used. It is agreed by all observers that in normal skin subjected to the action of the X-ray there is a hyperplasia of the epidermis followed by an increase in the pigment and proliferation of cells without mycosis. Later there is disintegration of cells. Similar changes take place in the appendages of the skin. The nails, hair and glands atrophy. Inflammatory changes take place in the blood-vessels; the cells of the intima are swollen. In diseased tissue the changes are similar to normal tissue. Tissue taken from nodules of cutaneous carcinomas showed disintegration, the nuclei are broken down and scattered; later the areas of carcinomatous tissues were filled with connective tissue. The blood-vessels showed marked endothritis. There is degeneration and absorption of the diseased cells without effect on the healthy stroma. The Roentgen ray has a distinct effect on bacteria; when used on acne and sycosis they clear up and disappear (this may not be due to X-ray *per se*); but disease cells are destroyed, phagocytosis is increased, and the healthy cells are better able to resist. The indications for the X-ray are: (1) To remove hairs, especially in sycosis and tinea tonsurans; (2) in exfoliation of the nail substance; (3) to cause atrophy of the sweat glands; (4) to decrease the activity of the sweat glands, especially valuable in acne rosacea; (5) for its destructive effect on bacteria in the tissue, the most brilliant results being obtained in lupus; (6) for stimulation of metabolism of skin, a very valuable adjunct in eczema, psoriasis, and lupus erythematosus; (7) for destroying tissues of low resistance, as in epithelioma; (8) to relieve pain and itching, especially of value in eczema and pruritus.—*Reprinted from American Medicine*, May 30, 1903.

SUNSHINE AND FRESH AIR, VIZ., ROENTGEN RAYS AND FINSEN RAYS IN THE TREATMENT OF TUBERCULOSIS OF BONES AND JOINTS.—De Forest Willard (Philadelphia) discussed the above subject at the recent meeting of the American Medical Association, before the section on surgery and anatomy. The inhibitory action of light upon the growth of tubercle bacilli was demonstrated in the laboratory seven years ago. When patients are treated by being sent into the open air and sunshine very marked improvement frequently follows, but the bacilli are not directly exposed to the light. Willard strongly advocates the treatment of tuberculosis of the bones and joints as well as the soft parts by sending the patients out of doors in the sunshine, protecting their eyes from the sunlight if necessary by the use of green glasses, having them live in tents, and feeding them on large quantities of milk and eggs. The sanatorium treatment of disease of the hard as well as the soft tissues will give corre-

spondingly good results, and tent life in the pine woods is especially favourable. The bactericidal action of light seems almost entirely in the blue-violet and ultra-violet rays. In the laboratory the electric light has a more powerful effect on the bacteria than has sunshine, but this is not true in practice. The disadvantages of the Finsen light treatment lies in the large staff of nurses necessary, the length of exposure, the small area that can be exposed and the cost of operating, not less than 3,000 dols. a year. The X-ray has also considerable germicidal power, the tube of high vacuum more than the tube of low vacuum. Further experience is necessary to determine the best distance for the tube, time of exposure and the size of area to be exposed. Willard regards these methods as all in the experimental stage. The mechanical and other methods of treatment should not be neglected. These newer methods, light and the X-ray, promise to be of some help, and nothing should be neglected which will help in the battle with disease. At least five years' experience with the use of these methods Willard regards as necessary before their real value can be estimated.—*American Medicine*, May 30, 1903.

THE PRESENT STATUS OF THE X-RAY TREATMENT OF MALIGNANT DISEASES.—In a recent article Coley reviews the subject of X-ray treatment and reports a number of cases. As a result of his experience he concludes that there is abundant evidence that the X-rays have an inhibitory action on all forms of malignant tumours. The number of cases he regards, however, as insufficient basis upon which to formulate an opinion as to what particular varieties are most susceptible to this influence. Sarcomas primary in the lymph glands thus far seem to yield most readily. Superficial epitheliomas might be placed in the same category, while recurrent carcinomas of the breast have been observed in which the growths have entirely disappeared after prolonged exposure to the X-rays. The cases are, however, too recent to be classed as cured. In fact, sufficient time has not yet elapsed in a single case of cancer treated with the X-rays to justify the opinion that it is cured. Coley believes that while this should prevent on the one hand reporting patients cured in whom the tumours have merely disappeared under treatment, it should not on the other hand lead us to minimise the importance of these immediate results even though they mean no more than a prolongation of life or an alleviation of suffering. One cannot witness the marvellous melting away or disappearance of an undoubtedly malignant tumour under a few weeks' or months' treatment with the X-ray without feeling that we have a new and powerful addition to our hitherto scanty means of attacking this disease.

The knowledge of this new agent is so slight that there

is added hope in our very ignorance. For by deeper insight into its nature, gained by further experience, we may hope to better utilise its power and thus accomplish greater results. In the meanwhile the X-ray has a legitimate place in the treatment of inoperable cancer, but present data do not warrant us in advising the method in primary operable cases.—*Medical Record*, March 21, 1903.

X-RAY PHENOMENA AND PHENOMENA NOT DUE TO X-RAYS. FOR WHAT CONDITIONS, AND HOW SHOULD THE X-RAYS BE USED?—DRS. Shields, Percy, and Edward, respectively, discuss the above subject. According to them it is not the X-ray but the cathode-ray, which is curative in malignant disease. Their belief is summarised as follows :—

(1) Relief of pain is due to the action of a high tension current and connected in no way with the X- or cathode-rays.

(2) Cathode-rays are the therapeutically active agents in the treatment of disease.

(3) Affections beneath the surface, as deep-seated carcinoma, are in no wise affected by X-rays or cathode-rays.

(4) The only phenomena which can be ascribed to X-rays is their ability to penetrate thick opaque bodies.

(5) Bactericidal properties of X- and cathode-rays are *nil*.

As regards the therapeutic uses and methods Dr. Shields offers the following conclusions :—

(1) Superficial growths, both benign and malignant, can be relieved and often cured by the escharotic effect of the cathode-ray.

(2) Any lesion of the skin which can be relieved or cured by causing a superficial sloughing, constitutes an indication for the use of the cathode-rays.

(3) Neither the X-rays nor the cathode-rays affect in any degree benign or malignant growths beneath the surface.

(4) Diseases due to bacteria or fungi are not cured by the X- or cathode-ray.

(5) Painful neuralgic affections are usually benefited, sometimes permanently, by the use of the high-tension currents, but the relief is in no wise associated with the use of the X- or cathode-rays.—*Cincinatti Lancet Clinic*, April 11, 1903.

NOTES ON X-LIGHT.—Rollins is authority for the statement that the eyes of persons working with X-light grow permanently old during investigation. To those working in this line his advice is to let no X-light strike the patient except the smallest beam that will cover the area to be examined, treated, or photographed, and the hands of the operator should be protected by a non-radiable covering. During the pumping and turning of the X-ray tubes they should be kept in an oven with non-radiable walls. He has also noticed that a

number of persons have been affected by cancer while treating the disease by the X-rays, despite the fact that it is not regarded as contagious. In Rollins' opinion this might have been avoided if proper precautions had been taken. He regards it as unwise, to say the least, to be constantly treating cancer and other diseases with the X-ray without regularly fumigating the room and keeping the cryptoscope and other appliances sterile. He advises fumigating the X-ray room with formalin vapour every night, and to have the instruments used of such material that they can be sterilised with heat.—*Boston Medical and Surgical Journal*, April 2, 1903.

SOME EXPERIMENTS WITH X-RAY AS A THERAPEUTIC AGENT.—Walker reports an alveolar melanotic sarcoma of the neck, completely cured in three months by X-ray. Two fingers exposed in steadying protective mask were deeply reddened and shed the nails.—*Journal Amer. Medical Asso.*, May 2, 1903.

THE THERAPEUTICAL VALUE OF THE ROENTGEN RAY IN TREATMENT OF PSEUDOLEUCÆMIA.—Dr. Senn reports two advanced cases of Hodgkins' disease in men aged 43 and 53. Cervical, axillary, inguinal, bronchial, mediastinal and abdominal glands involved. Drugs had failed. Patient 1 had 34 treatments, one minute to each group of glands daily for ten days, 60 volts, 8 ampères at 12 inches, medium tube. Because of burns power was reduced to 28 volts. In ten months glands were nearly normal; three months later 10 daily treatments given for threatened recurrence caused complete disappearance of abnormality, which did not return. In case 2, blood count before treatment showed 208,000 white corpuscles; after, 45,500. This case showed considerable toxæmia during treatment.—*N.Y. Medical Journal*, April 18, 1903.

A SUPPOSED SARCOMA OF THE KIDNEY CURED BY X-RAY TREATMENT.—Dr. Richmond reports a case of abdominal tumour, diagnosed as above, in a woman of 40, who had lost 20 lbs. in weight and been reduced to helpless weakness by tumour. After twelve weeks of X-raying bimanual examination failed to find trace of tumour, and woman a year later was as well as before growth appeared, though of less endurance. Dr. Richmond intends to continue treatment two to three times weekly for a few months, as a precaution.—*N.Y. Medical Journal*, May 30, 1903.

GANGRENE FOLLOWING OPERATION ON X-RAY CASES.—Lloyd reports that he had seen two cases of epithelioma in which the proliferation had gone on very much more rapidly since beginning the X-ray treatment, although the latter had been thoroughly carried out by experts. Recently he had

operated upon two cases that had been subjected to X-ray treatment for a considerable time. In one there had been no X-ray treatment for some weeks prior to operation, in the other case the X-ray treatment had been continued up to the time of operation. In the latter case, although the parts were brought together without tension, a gangrenous patch developed and nearly covered the whole area that had been exposed to the X-ray. At the time he attached no importance to this, believing that it was due to some fault in the technique, but a second case led him to consider as to the significance of his observation. The case was one of carcinoma of the breast, and while an abundant flap was easily obtained there developed subsequently a gangrenous patch covering the whole side of the chest. In both instances Lloyd believed that the X-ray had produced an unfavourable change in the nutrition of the tissues. If further experience proved this to be true it would suggest the advisability of avoiding X-ray treatment until after operation.—*Medical Record*, April 4, 1903.

AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION, Thirteenth Annual Convention, Hotel Windsor, Atlantic City, N.J., September 22, 23 and 24, 1903. *Preliminary programme:* First day, Tuesday, September 22, 1903, Registration of Members; 9 o'clock, Executive Session; 10 o'clock, Scientific Session; Reading of minutes of previous meeting; Addresses of welcome and responses; Reception of Honorary Fellows and Guests; Communications; Address of President; Report of Committee on Arrangements; Resolutions; Reports of Standing Committees on Scientific Questions; "On Induction Coils and Alternators," by Margaret A. Cleaves, M.D., Chairman; "On Electric Light Apparatus for Diagnosis and Therapy, and the Roentgen Ray," by W. Scheppegrell, M.D., Chairman; "On Electrodes," by R. G. Brown, E.E., Chairman; "On Meters," by Robert Reyburn, M.D., Chairman; "On Cataphoresis," by F. H. Morse, M.D., Chairman; "On Static Machines and Condensers," by William Benham Snow, M.D., Chairman; "On Constant Current Generators and Controllers," by W. J. Herdman, M.D., Chairman; "On Current Classification and Nomenclature," by William E. Jenks, E.E., Chairman; "On St. Louis Exposition in 1904," by William Benham Snow, M.D., Chairman. Papers: "The Effects of Secondary Static Currents in Removing Albumin and Casts from the Urine," by Boardman Reed, Philadelphia, Penn.; "Employment of Static Electricity in the Treatment of Nervous Diseases," by William Benham Snow, New York, N.Y.; "The Use of Electricity in the Treatment of Diseases of the Heart," by Sigismund Cohn, New York, N.Y. Afternoon Session, first day, 2 o'clock, Exhibition Drill of the Crew at the Life Saving Station; 3 o'clock, "Electricity in the Treatment of Diseases of the

Stomach," by Harvey H. Roberts, Lexington, Ky.; "Electricity in the Treatment of Chronic Deafness," by George Z. Goodell, Salem, Mass.; "Electrical Treatment of Trachoma and Corneal Opacity, with Illustrative Case," by Margaret A. Cleaves, New York, N.Y.; "The Successful Treatment of Eighteen Cases of Granular Lids by the X-ray and High Frequency Vacuum Electrode," by Albert C. Geyser, New York, N.Y.; "A Year's Work in Electro-Therapy," by Laura V. Gustin-Mackie, Attleboro, Mass.; "The Treatment of Urethral Stricture and Fissure of the Anus by Electrolysis, with Report of Cases," by J. C. Luke, Ocilla, Ga. Second day, Wednesday, September 23, 1903. 9 o'clock, Executive Session; 10 o'clock, Scientific Session; "Treatment of Tuberculosis, with Report of Cases," by Russell H. Boggs, Pittsburg, Penn.; "The Roentgen Ray in the Treatment and Cure of Cancer, Lupus, Rodent Ulcers, and Eczema, with Histories of Cases Treated," by E. W. Smith, Terra Haute, Ind.; "The Use of the X-ray in the Treatment of Malignant Growths, with Relation of Cases," by M. M. Johnson, Hartford, Conn.; 12 o'clock, Visit to United States' Signal Station. Afternoon Session, Second Day. "The Position of the Roentgen Ray and Ultra-violet Light in the Therapeutics of Malignant Diseases of the Uterus and Adnexæ," by Margaret A. Cleaves, New York, N.Y.; "The Type of Cell and Pathological Features of Carcinoma, which do not Respond to X-ray Therapy," by W. L. Kenney, St. Joseph, Mo.; "The Present Status of X-ray Therapy in the Management of Cancer," by Clarence Edward Skinner, Newhaven, Conn.; Executive Session; Election of Officers. 9 o'clock, Reception of Members of the Association and Guests of the Marine Room, Hotel Windsor. Third day, Thursday, September 24, 1903, 9.30 o'clock, "Radio-Histo Fluorescence," by William J. Morton, New York, N.Y.; "The Roentgen Ray as an Aid in Diagnosis," by Herman Grad, New York, N.Y.; "Perineuritis," by A. W. Baer, Chicago, Ill.; "Retrospect of the Second International Congress on Electro-Therapeutics at Berne," by Robert Newman, New York, N.Y.

PART II.

PROCEEDINGS OF THE BRITISH ELECTROTHERAPEUTIC SOCIETY.

Edited by CHISHOLM WILLIAMS, F.R.C.S.Ed., *Hon. Sec.*

APRIL 24, 1903.

THE Thirteenth Meeting of the Society was held at 11, Chandos Street, Cavendish Square, W. The President (Dr. Lewis Jones) occupied the chair.

Eighteen members and three visitors present.

The ballot was taken and proved unanimous in favour of :—Drs. G. Douglas Kerr, Brighton; Alexander Mitchell, London; J. R. Williams, Penmaenmawr; Preston King, Bath.

Dr. COWEN then read his paper on "The Treatment of Constipation by Electrical Methods."

In one of the earliest meetings of this Society Dr. Lewis Jones remarked (in the course of a very interesting paper on electrotherapeutics) "that though electricity in one form or another might be used with success in the treatment of a great number of disorders, yet its use as a curative agent must be eventually restricted to those morbid conditions in which it was found to produce a favourable result in an easier, or at least a quicker, manner than any other remedy." After a good many years' experience of its use in the treatment of that morbid condition which forms the subject of my paper to-night, I have no hesitation in saying that this very necessary primary condition of its use is amply fulfilled.

Constipation, when not due to insufficient fluid ingested, to any other dietetic fault, or to mechanical obstruction, may be attributed in a general way to a deficient secretion or to an atonic and enfeebled condition of the intestinal muscles. These conditions are occasionally found to exist separately as a cause but most frequently are found co-existing. Such a state of affairs is very often brought about by insufficient exercise and unsuitable food. It can be acquired even by habit. Young women especially often put off as long as they possibly can in relieving the bowels, and by thus constantly setting aside the calls of Nature soon acquire the habit of constipation. Practices such as these very soon bring about the atonia and diminished secretion which characterises true constipation. For purposes of treatment I would divide this condition into three different varieties according to the cause.

Firstly, that due to mechanical causes, such as intestinal stricture, &c; with this variety of constipation I do not propose to deal in this paper.

Secondly, constipation due to what I may call local causes, such as diminished secretion or enfeebled muscle.

Thirdly, constipation occurring as the immediate result of the causes mentioned above, but having as its primary and sustaining cause a neurosis.

In dealing with the second variety a purely local treatment will usually bring about a complete cure. For this purpose I am in the habit of using the combined current, employing the primary winding of an induction coil with the interrupter working at from 130 to 150 per minute.

Much has been written about the difficulty of affecting the muscular fibres of the intestine by external applications, but by employing the current I describe and using small thoroughly moistened electrodes, very strong contractions can be usually obtained.

If one takes up almost any text book on medical electricity and tries to glean from its pages some hint as to the treatment of constipation, there is a delicious vagueness about the suggestions there made which would either make one throw up the whole subject in disgust or else from pure obstinacy blunder on from failure to failure until at last a working knowledge was gained. Such books generally say that "faradism" or "galvanism" may do good, but mere minor details such as the density, quantity, or voltage of the current, the length of the application, the nature of the coil used, &c., are left entirely to the imagination or the intuition of the reader.

The strong point, however, in most of these works is the insertion of one of the poles in the rectum! Gentlemen, I wonder if any of you here have ever tried to treat a case of simple constipation in your private practice by inserting a rectal electrode. I think any physician who made a practice of this would find his opportunities of treating constipation at all growing less and less until he abandoned such a method in disgust, a disgust which had long ago been shared by his patients.

The method which I have found productive of the greatest benefit in cases of local origin is the following. I have two aluminium electrodes of about two and a half inches diameter attached to handles. I commence by placing the plus on the right iliac region and the minus on the left upper corner of the abdomen. I first turn on the continuous current using about five milliampères, and then the induced primary current, using the latter as strong as can be comfortably borne by the patient. The electrodes are covered with four folds of lint, the anode wet with plain water and the cathode with equal parts of commercial vinegar and water. They are left in this position for five minutes, the anode is now placed midway between the crest of the ilium on the right side and

the ribs, and the cathode on the other side of the abdomen and immediately opposite, and here again they are allowed to remain for five minutes. The third and last position in which they are placed for five minutes is the anode over the transverse colon and the cathode low down the left iliac region just above Poupart's ligament. These applications should be made daily for the first three days, and afterwards three times weekly.

For long-standing cases I am in the habit of using abdominal massage for a few minutes after each application. The combined current is used, the hand of the operator connected to the minus pole and the patient connected with the plus by means of a large electrode on the lumbar spine. Such treatment judiciously administered will give permanent relief in a large majority of the cases that present themselves for treatment.

There is probably no class of case more frequently found in the physician's consulting room (and certainly no person more persistently seeking relief) than the sufferer from chronic constipation, and though perhaps the actual number of cases coming under medical care for the constipation alone is not large, yet we are so constantly confronted with, and asked to deal with, morbid conditions dependent for their causation and continued existence upon insufficient action of the alimentary canal, that the choice of an efficient remedy becomes of a great and increasing importance. As we know, many and grave are the evils arising from the continued retention of waste matter in the intestinal canal. The peptones, the phenols, the acid and ammonia compounds which result from the improper digestion of food, and above all, the ptomaines resulting directly from the putrefaction of retained fæcal matter, act with an intensely poisonous effect if they are permitted to enter the circulation. We recognise easily the characteristic skin tint and the generally unhealthy appearance of the sufferer from chronic constipation, but there is much also in the mental condition of such a subject to closely interest the observer. The "fit of the blues" in the popular mind attributed to "liverishness," and the irritable temper of the chronic dyspeptic are the characteristic effects of certain organic poisons upon the higher nerve centres. Such poisons, though habitually formed in the system, are perfectly eliminated and never enter the circulation if the excretory organs are in a healthy condition, but when from one cause or another they are not properly excreted, there is every reason to believe that this continual action has a great influence in producing conditions extremely favourable to nerve-cell degeneration. This is not to be wondered at when one calls to mind the great network of nerves by which the intestinal canal is surrounded, and the large number of local centres which play

so important a part in the processes going on. It is likely that the continued action of the toxins produced by the putrefaction of the retained contents of the intestinal canal, and the various poisonous products which are being constantly formed and as constantly excreted in health, should eventually produce the most profound changes in the central nervous system.

As long ago as 1898 Drs. Müller and Manavicide reported the results of their examination of several infants who had died from various disturbances of the alimentary canal, and in each case found that degenerative changes had been set up in the cells of the central nervous system. Such observations are very significant, and suggest that the results of indigestion and constipation are a good deal more far-reaching than we are accustomed to consider. There is little doubt that a tendency to suffer from constipation is becoming increasingly evident. This is not so noticeable amongst the class from which the average hospital patient is drawn, but is disagreeably prominent in the better class patient, who is either accustomed to work with his brain, or else occupies such a position in Society that he is particularly liable to feel what we call the high pressure of the age. In such cases constipation very frequently appears as the herald of far more serious diseases. The struggle for existence, always severe, has necessarily increased in severity as the years have passed. As the number to be provided for has multiplied, and the struggle for even the luxuries and necessaries of life has become keener, the nervous system unfit, whether through heredity or offences against the laws of health, as a natural consequence, breaks down. In the ceaseless competition, not only between the classes but between the sexes, the expenditure of nerve force is great, and, in those who have inherited an imperfect nervous system, or who through ill-regulated habits have acquired it, must lead to cell degeneration. I have emphasised the influences of abnormal conditions of the central nervous system in producing and sustaining chronic constipation, because I believe in a very large proportion of the cases we are called upon to treat it arises from this cause, and very naturally such cases are not benefited by any treatment aiming only at intestinal stimulation.

Cases that are, however, relieved in this manner are the simplest ones; but another class that very frequently comes under our notice is not by any means so easily dealt with. We find constipation very common amongst those who are leading strenuous lives, who are constantly making severe calls upon their nervous energy. With these people the constipation comes often as the first symptom of a general breakdown, and in all cases is a warning of the severe strain they are subjecting themselves to.

A young girl comes up from the country to enjoy her first season. She comes from the schoolroom, and all the healthy outdoor life of the country, and is plunged at once into all the gaieties of town life. Her days and nights are filled with social engagements, and she lives for some weeks in a perfect whirl of unaccustomed excitement. She is living every hour of her twenty-four, and we soon begin to see the effect. The strained look in her eyes, the increasing pallor of her cheeks, the visible loss of energy, and the *ennui* that becomes more apparent every day, all tell their story. Very often she is brought to a doctor to get something to pick her up, to get what the great B.P. call a tonic. She is distinctly anæmic at this stage, and probably for the first time in her life has to resort to frequent doses of aperient medicine to produce a regular motion. Careful inquiry will elicit the significant fact that the first symptom of ill-health she noticed was the necessity for aperients, and that this came long before she lost her colour or felt tired. In most cases iron in some form, and probably with aloes, will be prescribed, with more or less improvement, but the constipation will not generally disappear under this treatment. Gentlemen, you may give iron to such a case until both you and the patient are tired, until you have ruined her teeth and probably added digestive disturbances to her other troubles, without doing her very much good. The need for aperients still remains, and the tendency to anæmia returns as soon as ever you stop the medicine. Here local electrical treatment is equally impotent to effect a permanent cure.

I have often seen a similar state of affairs brought about through long-continued musical excitement in young girls. It is a very frequent thing for a girl with a really good voice of great promise, after a comparatively short period of arduous musical training, practically to lose it, or at least for all the richness and timbre which before distinguished it to disappear, and this is invariably coincident with symptoms of nerve breakdown. I have not the space in this short paper to describe these symptoms, but invariably a tendency to constipation is the first warning of mischief. The loss of voice has usually been attributed to the defects in the system of training she is undergoing, but I am convinced, from a considerable number of cases that I have had the opportunity of examining from time to time, that this breakdown, which has ruined many a promising career, is due to the effect of musical excitement, musical dissipation, on the higher nerve centres, starting its evil circle, in the first instance, by producing constipation.

In such cases as these it is absolutely necessary to produce a profound effect on the nerve centres if we would cure the constipation and benefit the general condition. As a rule the continuous current, together with static applications, are

necessary, and these applications should be made daily for some time to get the best result. An electrode made of aluminium, and concave to fit the top of the head, is covered with three folds of lint. The size is roughly about eight by four inches. This will constitute the positive pole, and the negative will be an electrode seven by three inches, which is placed on the lumbar spine. A continuous current of from ten to fifteen milliampères is passed for six to eight minutes. If the negative electrode is wet with a weak solution of acetic acid, it will be less likely to cause discomfort. The current is, of course, turned on and off very gradually. A roller electrode two inches in length is then connected with the positive wire, and rolled gently up and down the spine over the last cervical and upper dorsal vertebræ, so as to bring the cilic spinal centres specially under the influence of the current. Alternate days with this we use the soothing and alterative influence of the static souffle.

To administer this I place the patient on the insulated couch, and put in the hands a large electrode connected with the negative pole of the machine. Hanging directly over the head, and about twelve inches away from it, is a large glass bell. In this glass is an ordinary bath sponge well moistened, but not sufficiently wet for any drops of water to fall on the patient's head. This little apparatus hangs from a varnished glass rod projecting from the wall of the room, and the positive pole of the machine is connected with the sponge. The machine I usually use is a modified Wimshurst, having six twenty-four inch plates. I arrange to have a spark gap of about half an inch in the connection between the sponge and the positive pole.

When properly arranged a strong souffle will be felt by the patient, and if the distance and spark gap are properly regulated, no unpleasant sensation will be experienced. Great care should be taken to avoid the chance of a spark passing to the patient's head, or a drop of water falling from a sponge too wet. In both cases the sensation is most unpleasant, and the nervous feeling induced does much to modify the good effect.

I would also advise considerable discretion to be used in the frequency with which the static souffle is employed in this manner. The effect is much more powerful than one would be inclined to believe, and it should never be used more frequently than every second or third day.

Jewesses bear all forms of static electricity very badly for the first few applications, but with perseverance the effect wears off.

The effect of this treatment is quickly manifest. The patient expresses herself as feeling better almost from the first day. She sleeps better and eats better, though the tired feeling

becomes if anything more pronounced for the first few days of treatment. She will generally feel much inclined to sleep for an hour or so when she gets home after her sitting, and this tendency should be encouraged. No purgative medicine whatever should be used from the very first. As a rule the bowels will be constipated for three or four days, then a small insufficient motion will take place. A little gentle abdominal massage, as described earlier in this paper, may be used daily, if found necessary, but in a large number of cases the constipation will be cured without touching the abdomen at all.

No doubt these applications act by modifying nerve-cell nutrition through the circulation, but whatever the theory of their action, the good effects in practice are undoubted. The anæmia disappears without iron, the confined bowels soon act regularly without aperients.

Of course, during the treatment the patient should be carefully dieted, and her life and surroundings as far as possible be regulated in accordance.

A similar kind of constipation is met with in the business man, the lawyer, the politician, and in fact in all those whose lives are lived in a hurry, and where heavy and continued calls are made upon the nervous energy. For the treatment of such conditions I have no hesitation in saying that there is no remedy we know at present so effectual and so permanent in its action as electricity properly applied in one form or another.

Drs. GEORGE HERSCHELL, SAMUEL SLOAN, JOSEPH BOLTON and the PRESIDENT discussed the paper.

Dr. SAMUEL SLOAN then read a paper on "The Therapeutic Value of Alternating Currents applied to the Abdominal Sympathetic Nervous System."

In using the term "alternating currents" I am restricting myself to the secondary faradic current and the magneto-electric or sinusoidal; the alternations of high frequency currents being more properly described as oscillating, I shall speak of the former as "alternating" and the latter as "high frequency."

In electrotherapeutics—I may add in general therapeutics—this is the age of electric currents of high potential and high frequency, so much so that currents of comparatively low potential and relatively low frequency are apt to be ignored if not despised. The latter do not appeal to the operator or to the patient as the former do, with their wonderful stage effects, their frequent startling cures, or their fascinating elements of scientific dash. After a year's experience of the high frequency currents, whilst sanguine as to the future as well as satisfied with the present, I am coming to the conclusion that the success of former days before the advent of high frequency was at least as real as we

can get from the latter. Moreover, the former methods have, in my hands, succeeded where the latter have failed, whilst the high frequency currents have failed in some cases when a return to the former methods has been followed by gratifying results. Possibly the greater experience of the older electrotherapeutic resources may account for this, "the best administered" being often the best.

These thoughts have led me to review my experience of work in this direction extending over seven years and to bring the results before the members of the British Electrotherapeutic Society. This work has been faithfully recorded and, as far as possible, scientifically carried out. Thus only can we look for progress and thus only will our work differ from that of the honest charlatan who can often legitimately boast of his success in cases where "the faculty" had failed. He naturally ignores his failures, however, whilst we record them —our aim, let us hope, being nobler than his. Again, if I can add to the testimony in favour of the older methods, I may be the means of helping to make the practice of electrotherapeutics more general, because the apparatus can more easily be in the hands of the general practitioner than the more elaborate and more expensive high frequency installation. I believe—and I speak from a fairly extensive experience—that in the great majority of cases, within certain limits, of course, the kind of electric energy employed is of comparatively little consequence, if only the dose be carefully measured and regulated to suit the nature of the case, and this will differ greatly according to the form of electric energy employed. Thus failure in electrotherapeutics often means maladministration; and this fact should be impressed on the general practitioner who has a curious suspicion of this treatment equalled only by his readiness to recommend that it be tried when he has come to the end of his own resources, leaving his patient usually to find out for himself how to employ the new remedy.

The number of cases on which this paper is based is sixty-seven, and the ailments for which the treatment has been used have been atonic dyspepsia, visceral neuroses, neuro-muscular asthenia, asthma, lumbo-pelvic neuritis, persistent sickness with or without diarrhœa, peripheral vasomotor disturbances (paretic or spasmodic), neurasthenia, uterine atony, and angina pectoris. Amongst the causes or accompanying conditions of these ailments have been the following: actively septic teeth, septic endometritis, influenza, chronic alcoholism, gastric catarrh, intestinal sepsis, epilepsy, obesity, inflammation of the uterus or of the uterine appendages, and anæmia.

It may be asked on what principle this treatment was carried out for so varied a list of affections. To that I can only say—and it may seem an unscientific reason—that it was

because I had come to the conclusion from my extensive experience of faradisation of the brain that the electricity acted, when judiciously administered, as a stimulant and tonic to nerve tissue, improving its nutrition, and that knowing little, if anything, of the pathology of the sympathetic system, but knowing how intimately any disorder there must influence the abdominal viscera and the general circulation, it seemed reasonable, if I could ascertain no cause for the disorder or could not for any reason remove that cause, that whatever improved the tone of the nervous mechanism must improve the patient. This improvement would be temporary if the cause persisted and more or less permanent if the cause were already in abeyance or could be previously removed; and this is exactly how matters have turned out. In practically all the cases drugs had been previously given and all the usual resources of the medical art had been exhausted, whilst during the electric treatment nothing was done, as a rule, which could render the cause of the result doubtful.

Leaving out of consideration the cases in which the treatment was applied once or twice, since no deduction could be drawn from these as to the efficacy of the treatment, as well as those in which the result was doubtful or was not known, and those of my early cases when I had no instrument for measuring the currents, there remain fifty-seven cases. Out of this number there have been forty-six cases of complete recovery, or of such a satisfactory result as an efficient holiday would give in favourable circumstances; that is, not what sometimes results from the action of drugs, which result ceases when the administration ceases, but a lasting beneficial effect after cessation of the treatment which brought about the improvement. Where the treatment has been adopted in only one or in a few cases of any particular ailment little can be said of its efficacy in other cases of the same disease or disorder. The oftener this occurs, however, the more reasonable will my contention be regarding the theory of action of this treatment, and even single instances of trial of the treatment if faithfully recorded and collated will at least help towards a correct selection of the cases and assist in bringing about an increase of successes and a decrease of failures.

My failures have been in all eleven, and therefore my percentage of successes amount to eighty, when those of doubtful or unrecorded results are omitted. In some of these omissions I have stated that I have left them out because at the time of treatment I had no instrument to measure the current, such an instrument being a *sine quâ non* if the treatment is to be carried out on scientific lines. Some are too recent for me to be able to judge as to the effect of the treatment. In others, again, though the application had, in

the mind of the patient, been very beneficial, yet, since only one or two applications had been employed I have left them out, lest the result might have been a mere coincidence or have followed mainly as a result of suggestion. The accompanying table will show what I mean and what I claim for this treatment :—

TABLE SHOWING THE RESULTS OF ALTERNATING CURRENTS APPLIED IN 67 CASES.

DISEASES OR DISORDERS	No. of cases	CAUSES OR ACCOMPANYING CONDITIONS										RESULTS		
		Actively septic teeth	Septic endometritis	Influenza	Chronic alcoholism	Gastric catarrh	Intestinal sepsis	Epilepsy	Obesity	Inflammation of uterus or of uterine appendages	Anæmia	Successes	Uncertain	Failures
Atonic dyspepsia ...	6	—	—	1	—	1	—	—	1	1	1	3	2	1
Visceral neuroses ...	19	—	3	1	2	1	—	—	—	1	1	12	4	3
Neuro-muscular asthenia	17	2	4	2	—	—	—	1	1	2	—	15	1	1
Asthma	1	—	—	—	—	—	—	—	—	—	—	1	—	—
Lumbo-pelvic neuritis	7	—	—	2	—	—	—	1	1	1	—	3	2	2
Persistent sickness with or without diarrhœa	6	—	—	1	1	—	1	—	—	—	—	5	—	1
Peripheral vaso-motor disturbances—paretic or spasmodic ...	5	—	2	—	—	—	—	—	—	—	—	5	—	—
Neurasthenia	2	—	—	—	—	—	—	—	—	—	—	—	—	2
Uterine atony	2	—	1	—	—	—	—	—	—	—	—	1	1	—
Agina pectoris ..	2	—	—	—	—	—	—	—	—	—	—	1	—	1
Total	67	2	10	7	3	2	1	2	3	5	2	46	10	11

The result of the treatment at the time, especially in very chronic cases, often seemed to me and to my patient unsatisfactory. However, one or more months after and without further treatment, the *vis medicatrix naturæ* having evidently received the necessary fillip from the treatment, the patient is usually gratified by the change in health which may come gradually and as a pleasing surprise after a temporary disappointment.

These results speak for themselves. I have not strained the record so as to make it tell. Rather have I sometimes placed in the list of uncertainties cases that I might have legitimately put amongst the successes. I have endeavoured to be impartial, though you know how difficult it is to refrain from trying to make "a big show." The results are gratifying. If there is any other treatment which in difficult and chronic cases would give better results I have yet to learn of it.

With reference to the list of diseases or disorders in the table, it must not be concluded that an affection has been defined when it is labelled. The classification, however, is, though not strictly correct, sufficient for practical definition,

though some of the cases I had a difficulty in classifying. In the case of the causes or accompanying conditions these were not always simple but often complex; I have, however, endeavoured to classify them as they impressed me at the time.

The following impressions, confirmed by a study of the table, of the kind of case which benefits and the kind in which the treatment is likely to fail may be taken as fairly accurate.

(1) Those cases of uncomplicated neuro-muscular asthenia where the cause had ceased, or had been removed, have proved most amenable to the treatment. By neuro-muscular asthenia I mean neurasthenia minus its psychic elements.

(2) Regarding cases of visceral neuroses almost as much can be said.

(3) Cases of persistent sickness, some of them of reflex character, have done well under the treatment, the only failure in this list having been one in which the liver was considerably enlarged.

(4) The treatment may be relied upon in vaso-motor cases, all of the five cases having been successful.

(5) The treatment will be of little avail in neurasthenia. I suspect its only chance here would be after the Weir-Mitchell treatment of it had failed.

(6) In cases where inflammatory mischief existed in the pelvic organs the result is not likely to be good. In such cases vaginal electric applications have given the best results.

(7) Where septic endometritis exists only a very temporary improvement will follow, although this may be made a permanent one if the treatment is resorted to after curettage has removed the septic condition from the uterus.

(8) Epileptics are likely to derive no benefit from the treatment. I had two cases of angina with no apparent evidence of organic disease. As the table shows, recovery ensued in one, but the treatment in the other appeared to have no influence, or rather seemed to make the symptoms worse. Perhaps in the successful case the success was due to the anterior electrode having been placed during part of the treatment over the cardiac region, and in the case of failure I suspect the dose given was too large. This patient had a somewhat alarming collapse during one of the applications.

The title of my paper shows that these favourable results, where such has been the case, have, in my opinion, arisen from the action of the currents on the sympathetic system of the abdomen. You may, therefore, expect me to say why I think this has been so.

(1) There are anatomical reasons, the electrodes, as I shall afterwards explain, being placed one behind the origins of the splanchnic nerves and the other in front of the pre-vertebral plexuses of nerve fibres and ganglionic cells of the abdominal sympathetic system.

(2) While Professor d'Arsonval points out that no influence is made on nerve by currents having a frequency of over 5,000 alternations per second, it must be otherwise with these currents we are now considering, since they have as low a frequency as about forty per second. Here the fibres and cells of the nerve are probably influenced by something of the nature of rhythmic molecular massage or by vibrations of such frequency as they can respond to.

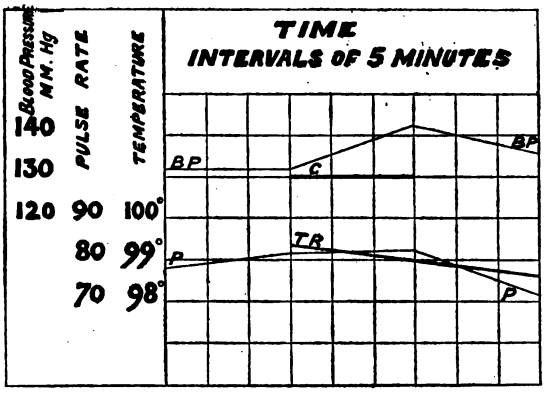
(3) Whereas in high frequency currents the main influence of the currents is on the skin, with these we are considering the easiest path is by the soft deeper tracks.

(4) Whilst, as I have elsewhere pointed out, in faradisation of the head even therapeutic doses cause more or less psychic phenomena, showing that there is faradisation of the brain as well as of the scalp, the effect on the other hand of dorso-abdominal faradisation is to produce exactly what physiologists point out as caused by stimulation of the sympathetic system—namely, exhaustion, for after almost every application of the current there follows decided, often great, sometimes profound, exhaustion. This, however, I have noticed, is within—it must be—certain limits a favourable sign if followed by a sufficient rest, for after a proper amount of rest there follows the opposite condition of a comfortable sense of vigour and well-being, but only when the rest obtained is proportioned to the exhaustion felt. I may add here that I have never known a patient in the least degree afterwards the worse for this treatment. Query: Is this constant after-exhaustion not due to sudden absorption of toxins from the alimentary canal, caused by stimulation of absorbing power due to stimulation of the ganglia of the sympathetic system? The fact that this period of exhaustion and its amount diminish as the case favourably progresses, may be due to the amount of toxins diminishing by improved nutrition of the digestive organs, for the dose of the current is generally increased later in the course of the treatment and then with generally slight fatigue only.

(5) I have made some experiments on blood-pressure, pulse and temperatures before and after the applications, taking care to employ control tests at the same time. These show a practically constant rise of from five to thirty or more units in the blood pressure, without, as a rule, any change in the pulse-rate, but with a slight fall of the temperature in the mouth and in the rectum. If there is a fall of the pulse-rate there is less increase of the blood pressure, but still some. This shows that the rise of blood pressure is not due to an increase of cardiac rate, which is often rather considerably reduced, so I infer that it is due to a mild stimulation of the sympathetic system, causing a diminished relaxation of the arterioles of the splanchnic area. This, I take it, is also

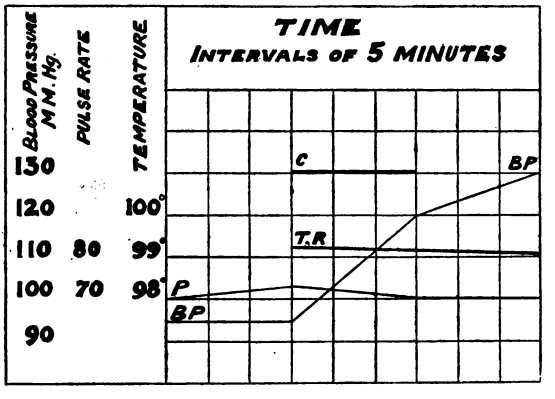
evidence in favour of the direct action of the current on the sympathetic ganglia, since a paresis of these ganglia causes, pathologists tell us, a congestion of the abdominal organs. I submit charts of two of the cases which will explain perhaps more clearly what results I obtained.

CHART 1.



B. P., blood pressure; C., current, the amount being 4 milliampères; P., pulse; TR., temperature.

CHART 2.



B. P., blood pressure; C., current, the amount being 4 milliampères; P., pulse; TR., temperature.

(6) As a negative reason, I feel sure that the element of suggestion may be eliminated for the following reasons: (*a*) No rash promise is made to the patient beforehand; (*b*) the current is so weak, compared with the large size of the electrodes, that the patient often complains of getting nothing at all; (*c*) the after-exhaustion is certainly an argument against

suggestion; (*d*) some of the experiments, specially two of them which were made on medical men, were on those little likely to be influenced by suggestion; and (*e*) there has been an absence of early or sudden benefit; this having been rather slow and somewhat delayed, especially in finally successful cases.

I need not dwell much on the method of administering the currents. Two large moist clay electrodes, warmed, are applied. The one, about 9 inches by 6 inches, is placed, attached to the positive pole, between the shoulder-blades; the other, attached to the negative pole and measuring 9 inches by 10 inches, is placed over the abdomen, especially over the epigastric region. The current is from a secondary coil of about 8,000 turns of fine wire, and the dose is carefully measured by my faradimeter which I exhibited before the British Electrotherapeutic Society in 1902.[1] When the sinusoidal current is used the alternations are about 1,800 per minute, the voltage being much the same as that of the secondary coil. The dose at the first *séance* is from 2 to 3 milliampères. As the case progresses this is raised till a dose of 7 or at most 8 milliampères is administered. The *séance* lasts each time about fifteen minutes. Should the coil have a larger number of turns on it than 8,000, the current may be given in larger doses than those stated. If a smaller coil is used a smaller dose must be given. The patient, at the early sittings especially, should be made to rest for at least fifteen minutes before going home and should then go to bed for an hour or longer, or recline for that time on a sofa. The applications are given every second, third, or fourth day; and the number which usually suffices is from six to eight. If a longer course seems to be required on account of the chronic nature of the complaint a gradually decreasing size of coil should be used and the former dose maintained.

The following few notes of three illustrative cases may prove interesting as a finish to my remarks.

Case 1.—The patient was a single woman, aged about 40 years. Till a few years ago she had been a person of great mental capacity and with the normal amount of self-control. The abrupt news, however, of her mother's sudden death quite altered her nature and she gradually became a chronic alcoholic. When first attended by me two years before, her principal complaints were præcordial and epigastric pains of great severity, with a "gone" feeling in those regions which made the craving for alcohol irresistible. After three applications of the sinusoidal dorso-abdominal current she volunteered the remark that she was less easily worried or

[1] The *Lancet*, March 22, 1902, p. 830.

fatigued and that she felt less craving for the brandy. Improvement was steady. The treatment, however, was kept up for several months, at intervals of about a week, at her own request, as she said that she was persuaded that if the treatment stopped the desire for alcohol would again become irresistible. Recently she informed me that for eight years she had had agonising pains every night, for which she had always to remove her stays in the early part of the evening, and that she had had no distress of this sort during the past year. The mere presence now of a lady companion suffices to enable her to maintain almost a normal amount of self-control.

Case 2.—This case, though one probably of malignant tumour of the abdomen, which has since ended fatally, was one which owed a great deal to this treatment. It was that of a male patient, aged 55 years, resident in the south of England, but formerly a patient of mine in Glasgow. When he came to me in August, 1901, I was shocked at the change in his appearance, though I had heard that he was considered to be dying. His weight about four years previously had been 12 st. 5 lbs.; it was at his first visit to me 7 st. 13 lbs. His principal complaints were of frequent and copious vomiting with constant diarrhœa, the motions being watery, slimy, and putrid. He had become exceedingly nervous and irritable, his natural temperament having been a placid and amiable one. The abdomen was full and tympanitic throughout, but no fluid could be detected, nor was there any evidence of a tumour. As he had been frequently examined by various medical men and no evidence of organic disease had been detected, I hoped that what was evidently mainly a paresis of the abdominal sympathetic system might be the primary and not the secondary condition. On this hypothesis I suggested electric treatment. He was so ill and the case seemed so hopeless that I proposed a fortnight's trial only of the treatment. Of the five medical men who had seen him no one had spoken of treatment by electricity. After six applications the improvement was so great that no question as to its beneficial influence had to be entertained. At the end of four weeks I note in the patient's own words as follows: "Decided improvement, don't feel the same at all as I was when I first came to you." I sent him now to Yorkshire for a change from city life. During that month he was only once sick, and that was after eating cheese, and he had gained half a stone in weight. The electric treatment was resumed and continued for two months. He then went home feeling better than for two years. Six weeks later he wrote as follows: "My improvement is still maintained. I feel better than I have been for the last four years." During the following summer he gradually lost in health; fluid was detected in the abdo-

minal cavity, and the suspicion of tumour, though never confirmed, seemed to have been strong in the mind of his medical attendant. He died in October, 1902. There was no *post-mortem* examination.

Case 3.—This patient was married and was about 30 years of age. She was of good constitution, though with slight glycosuria during her pregnancies. During the summer of 1901 she had an attack of influenza when in London. Severe neuro-muscular asthenia supervened and in spite of medicinal treatment by several medical men and a residence in Homburg during the autumn this condition persisted till the following April, when I decided to stop all medicinal treatment, which seemed only to upset her, and to try dorso-abdominal faradisation. The first dose was 3 milliampères, the patient being quite unconscious of the presence of the current. Severe fatigue followed, lasting for thirty-six hours. The dose at the next visit was reduced to 2 milliampères and little fatigue followed. Gradually the quantity was increased up to 5 milliampères. No fatigue whatever followed. Three weeks from the first application the note is : "Less depressed, digestion perfect, in every way much better." She became pregnant in June following, passed through the period of pregnancy in excellent health, was confined recently, and has made a perfect and an unusually quick recovery. She informed me a few days ago that she had had no return of the nervous exhaustion.

Drs. BATTEN, HERSCHELL, MANDERS and the PRESIDENT discussed the paper.

A special meeting was then held, duly convened, to add to Rule 9, line 6, after the word *together*, "with the Past Presidents" shall constitute the Council.

Carried unanimously.

MAY 22, 1903.

The Fourteenth Meeting of the Society was held at 11, Chandos Street, Cavendish Square, W. The President occupied the chair.

Nineteen members and two visitors present.

The ballot was taken and proved unanimous in favour of: Drs. A. H. Greg, London; J. Elliott, Chester; F. Coke Squance, Sunderland; J. R. Levack, Aberdeen; J. Pender Smith, Dingwall.

Dr. MANDERS then read a paper on "Some Further Phenomena of High Frequency Currents."

Mr. President and Gentlemen,—When, on October 3 last, I had the honour of reading before this Society a short paper on "Some Phenomena of High Frequency Currents" I limited myself, in the description of the various arrangements by which high frequency or oscillatory currents are produced,

to those dispositions which were then, and still are, the most familiar to medical electricians on this side of the Atlantic—I mean those coupled with the names of Tesla, of d'Arsonval, and of Oudin.

This evening I propose to bring before your notice "Some Further Phenomena of High Frequency Currents," and in justice to those who have gone before us, who have preceded us in the medical use of oscillatory currents, and who have devised certain original arrangements for their production, I must set apart a certain portion of this paper for the consideration of "some *further-back* phenomena."

We hear that the shock from the electrified jar of water, experienced by Cuneus in 1746, caused a considerable stir in scientific circles, and no doubt medical men were called upon by their patients to render an explanation of the phenomenon.

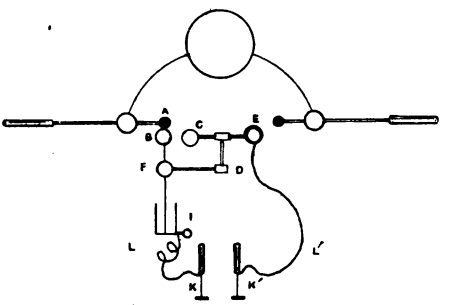


Fig 1.

Questions of this kind would, very naturally, direct their attention to the study of the action of this new form of electricity on the human body, and it would not be very long before the idea would be generated that anything which could and did produce so powerful an effect upon the healthy human system would, in all probability, if used judiciously and in proper doses, be beneficial to that system when diseased. Accordingly we find, some twenty years later, that Cavallo in London and Mauduyt in Paris have already gained sufficient knowledge of the therapeutical effects of the controlled discharge of a Leyden jar to warrant them in recording their experiences in books. Up to this time medical electricity had been limited or confined in its use to the direct application from a frictional machine. The text and illustrations of these books show very clearly that the patient, or that part of the patient to be operated on, was placed in series with the circuit (completed by the spark-gap) which unites the two armatures of a single Leyden jar charged, of course, from a frictional machine. The arrangement was as fig. 1.

The explanation of the figure is, that to the inner armature of a Leyden jar, of a capacity of about $\frac{1}{50}$ of a microfarad, is attached in the usual manner a perpendicular brass rod terminating in a brass ball B, which is placed in contact with the prime conductor A of a frictional machine. On this same rod, but below the ball B, is another brass ball F, which gives support to the horizontal glass rod F D of a Lane's electrometer; at the end D is a cap which holds a perpendicular rod, of sufficient height to correspond with the ball B, surmounted by a collar through which slides the horizontal brass rod C E, having the brass ball C at one end and the ring E at the other. The potential of the discharge can be varied by shifting the position of the ball C either towards or away from the ball B. To admit of accurate record of adjustment the rod C E may be marked with a scale. The outer armature of the jar is furnished with a projecting wire rod I.

From the rod I and from the ring E, conducting leads L L are affixed which are terminated by electrodes K K, or directors, as they were called in those days. These electrodes may be applied to any part of the body of the patient. When the electrical machine is set in motion the jar becomes charged; finally, to such an extent that the dielectric in the air space between B and C breaks down and a spark passes, which is the outward visible indication that a current has passed from one armature to the other through the body of the patient. By continuing the action of the machine any number of these momentary currents may be given of exactly the same strength and of a rapidity of succession proportional to the speed with which the machine is made to revolve.

In the above arrangement the whole of the re-adjustment of displacement of the electrical equilibrium passes from one armature of the jar to the other, through the patient, whether the latter be insulated or not.

According to the illustrations given in these books, the negative prime conductor is alone employed, the other, or positive prime conductor, is not made use of.

Whether the subsequent discoveries of Volta and of Galvani, followed many years later by those of Faraday in another field of electricity, diverted into different channels the inventive genius of medical men practising electrotherapeutics I cannot say, but it is certain that no new dispositions for the production, or utilisation, of the current produced by the discharge of a Leyden jar were brought forward during the next ninety years. Then, in 1872, we find Duchenne, the eminent medical electrician of Boulogne, adopting a different working of this discharge, though still making use of the circuit between the inner and outer armatures of a single Leyden jar.

With Duchenne's arrangement the patient is again in

series with the two armatures and the spark-gap, but in this case the generating machine is also included in the series. His arrangement is as shown in fig. 2.

In this figure we see that the inner armature of the condenser is connected by the rod and ball B to the (negative) prime conductor A of an electrical machine, and also by the branch rod to the ball J, which forms part of the electrometer J C E. The outer armature of the jar is connected by the conductor I to the rod H, which forms the second arm of the electrometer on the insulated upright M. From this point proceeds a conducting lead L, which terminates in the

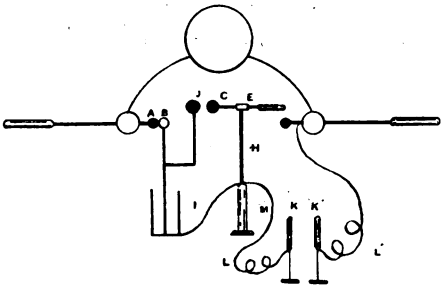


Fig 2.

electrode K. From the positive prime conductor of the electrical machine proceeds another conducting lead L′, which terminates in the electrode K′.

The manipulation of this disposition is that a certain number of turns is given to the plate of the electrical machine, according to the amount of force of discharge (potential) it is desired to obtain. The electrode K is then applied to the skin at the point corresponding to the muscle which it is desired to stimulate or contract. The body now partakes of the positive charge on the outer armature. Next, the electrode K′ is brought near to the skin, but without touching it, on a level with the surface of the same muscle, yet not too near the electrode K′, until a spark passes between the body and the electrode K′, showing that electrical equilibrium has become re-established.

To obviate the possibility of a greater shock being administered to the patient than that intended by the operator, the Lane electrometer is arranged as a shunt to divert a heavy current and prevent a higher potential passing to the patient than is sufficient to bridge the spark-gap J C.

Although of ninety years later date, there is no improvement in the method; rather the reverse, for it is more cumbersome in action, less steady and less regular than the older method.

Nine years later, in 1881, just about one hundred years after the date of the published works of Mauduyt and Cavallo, Dr. William James Morton, of New York, devised an entirely novel disposition of connections, and made use of the circuit which carries the induced current between the two outer armatures of a pair of condensers. Morton's arrangement is shown in fig. 3.

In this we see that the inner armatures of two condensers of the same capacity are connected by rods B B′ to the two prime conductors respectively of an electrical machine. The brass balls A A′ at the termination of the prime conductors are used as the spark-gap, which, being adjustable, is used as an electrometer. The two outer armatures I I′ are each furnished with a rheophore, to which is attached an electrode

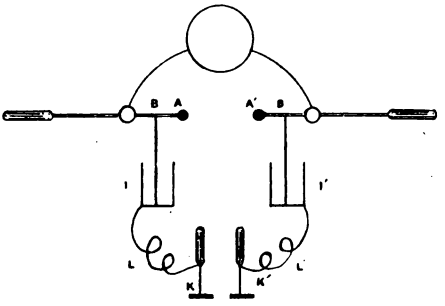


Fig 3.

K K′. When these electrodes are applied to the patient, and the machine is set in action, the charge induced in the outer armatures passes from one armature to the other through the body of the patient, which is in series with the rest of the circuit.

During the last year or two we have dealt so much with high frequency currents in the treatment of disease, that we are apt to think that high frequency and oscillation in electricity are synonymous terms, and to forget that the discharge of a condenser is not invariably of an oscillatory nature. A reference to the mathematical formulæ given by Lord Kelvin, and the practical explanation of the discharge by Feddersen, teaches us that the character of condenser discharge depends upon the ratio of the capacity of the condenser, the impedence and the self-induction of the circuit. If the resistance, or impedence rather, of the circuit be large, the discharge is of an intermittent character, consisting of a series of partial discharges following each other at irregular intervals, and being all in the same direction. In fact, the discharge is

virtually an interrupted unidirectional current, exactly resembling that from the secondary of an induction coil provided with a very rapid, but unsteady, break. If the impedence be reduced it is found that, at a certain critical point, the discharge becomes continuous (this is very difficult to obtain). Lastly, if the impedence be very small, the discharge becomes truly oscillatory.

What, then, is the nature of the current used by Cavallo, Duchenne, and Morton respectively ?

This question Mr. Sharman, an expert in wireless telegraphy, and I set ourselves to answer. Instead of using a static machine of any kind, we employed a 12-inch induction coil and small condensers of a pint capacity each.

We ascertained definitely that, in the direct discharge which occurs between the inner and outer armatures of a single Leyden jar, the current is truly oscillatory when the circuit is completed by a short wire of little impedence. There is no doubt about it. On the other hand, we found that directly the impedence, offered by the body of a man, is intercalated in series with the rest of the circuit, the whole character of the discharge is changed.

On account of the severe tetanus produced in the muscles, we can only use a very low potential, and must therefore keep our spark-gap very small : hence it is almost impossible to tell the character of the discharge by ocular study of the spark alone, and other means have to be adopted.

The phenomena attending our experiments point out that, when the body is intercalated, the current is intermittent and occurs in a series of jerks, as we have already said. The reason of this is that the terminals discharge the electricity faster than the circuit can supply it, so that the flow is constantly being stopped and then begun again. To these electrical jerks the muscles respond in a series of tetanic spasms.

As a conclusion to be drawn from our experiments, I think we may safely say that neither Cavallo, Mauduyt, nor Duchenne ever made use of the purely oscillatory current in the treatment of disease. Certainly the claim has never been put forth on their behalf.

But how about Morton's current, which is conveyed by an entirely different and original disposition of circuit ? In 1881 Morton claimed that his peculiar disposition "renders a static machine capable of producing all the effects of faradism," doing "all the work of the best faradic machines in addition to the ordinary static effects." "In its general characteristics this current cannot be distinguished from the ordinary faradic current."

In this claim, and as an outcome of our experiments, I cordially support Morton and agree with him entirely, for

when the body of a patient is placed in series with the circuit which conveys what he terms the "static induced current," the latter becomes an interrupted unidirectional current similar to that of a medical coil, as we shall see later on, only differing from it in regard to frequency of interruption and potential, not in character. In 1891, however, Morton announces as his opinion that the static induced current is of an oscillatory nature akin to or identical with those which we nowadays term high frequency currents. It appears to me that this opinion was rather forced upon him by modern writers on electricity, chiefly French, who felt that Morton's discovery had been too long neglected, and that sufficient credit had not been accorded him for his originality. In so late a publication as that of "Electrotherapy," by Jacoby, in 1901, this neglect of his own countryman is marked, for the reference to Morton's current is exceedingly short—almost contemptuously so. A mention is made of it at the end of a very meagre and poor account of high frequency currents in the following terms—"W. J. Morton, of New York, many years ago introduced the use of such discharges under the misleading name of "static induced currents." I cannot understand why the name should be considered misleading; it seems to me to accurately describe the particular current. The electricity is certainly existent on the inner armatures of the condensers as a static charge, and on the outer armatures as an induced static charge which becomes a current when set free. For analogy! The water in a pail exists in a condition of stasis, but if the pail is upset a current is produced slowly along the floor perhaps, but if the housemaid has happened to have left the pail at the top of stairs the current will have an appreciable potential.

Later on in the same work the author says: "The static induced current, so called and elaborated by W. J. Morton of New York, in nature resembles somewhat the current of a medical induction coil, as it is an alternating and interrupted current, but its potential is very much greater than that of any medical induction coil; it is in reality an oscillating current of high frequency." Surely this is an extraordinary explanation of an obscure phenomenon. We are told on the same page that it is one thing, but in reality it is another. It sounds almost like the parliamentary explanations of the leader of the Opposition.

But what, after all, is the real nature of this current? In the course of our experiments to solve this question we met with some curious phenomena. I have already said what happens in the discharge between the two armatures of a single Leyden jar. Well! exactly the same happens in the discharge between the two inner armatures of a pair of jars and in the induced discharge between their outer armatures.

That is, that when the impedence is small relatively to the capacity the current is truly oscillatory; but when the induced current is made to discharge through a piece of wet string, the length of which is varied from time to time, the character of the discharge also varies and the frequency of the oscillations diminishes as the length of the wet string is increased. With the intercalation of a human body, both without and with varied lengths of wet string, we obtained an interrupted, intermittent, unidirectional discharge upon which was *superimposed* an oscillatory current of low frequency. Low, that is to say, in comparison to the usual discharge of a Leyden jar, but of course infinitely higher than any mechanical interruption. It appeared as if, at times, the discharges were at a critical point, just at the change from oscillation to unidirectional lysis, and that a very little alteration in the impedence caused the discharge to assume either character.

Interesting as our experiments were, they would have been still more so had we then been able to complete them. As it is, our experiments are incomplete, insomuch as they were all carried out upon a seventeen stone subject as an impedence, but if there be a twelve stone and an eight stone scientist here to-night who would like to co-operate, we might succeed in getting some valuable information.

The experience of acting as an impedence is not so pleasant as it is interesting; indeed, if the spark-gap be a little too wide, the celerity with which seventeen stone can project itself is prodigious.

It may be objected that we use a coil with which to fill our condensers, whereas Morton uses a static machine. Had we used the latter, I doubt if we should have detected any oscillation at all in the discharge of the induced current through the body.

After casting an eye over our various experiments, my opinion is that the static induced current as used by Morton is an interrupted, unidirectional current of infinitely higher frequency than can be obtained from any medical coil provided with a mechanical break, and is also of higher potential. There can be no doubt that such a current has its own particular domain in the field of electrotherapeutics.

I cannot ascertain from Morton's writings whether he ever used his pistol spark-gap electrode in series with the circuit of induction, or whether he confined its use to the direct discharge between the two armatures of a single jar. Whether he did or did not, it is certain that he employed the same induced current which was the peculiar feature in the experiments of Hertz; and if he made use of the spark-gap in series with this circuit, he was the first ever to see the manifestation of the propagation of electric waves through ether; that is to say, six years before they were detected as such by Hertz.

In talking over the intimate relation and connection which exist between high frequency currents as used therapeutically, and oscillatory electricity as employed in wireless telegraphy, with Mr. Sharman, the other evening, he drew out a diagram which shows so clearly and so beautifully the harmonious progression of electric waves in ether, with the explanation of their action both near and at a distance, that, with his permission, I reproduce it here before you this evening.

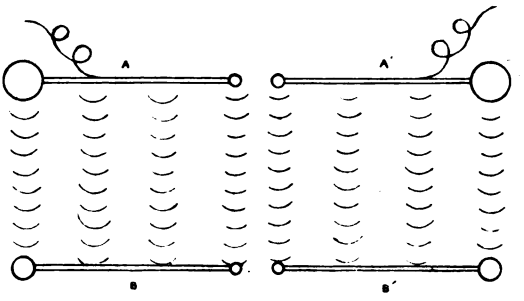


Fig 4.

A A′ represents, in the ordinary manner, a Hertz radiator. It consists of two metal rods, terminating at the ends facing each other in balls, to act as a spark-gap. Each rod or arm is connected to an induction coil by the wires e e′. Along each of the arms slides a metal sphere C C′. These act as capacity, and are equivalent to the inner armatures of two Leyden jars.

When the coil is in action, a spark passes across the gap g, and electrical waves are propagated outwards in a plane, perpendicular to that in which the electricity is passing over the spark-gap. In their travels they will in all probability meet with obstacles, some of which they will be able to overcome, but others will conquer and quench them.

B B′ represents a Hertz receiver, which is a special obstacle, designedly put in the way of these waves for the purpose of intercepting them. It acts in this way—at the moment when a positive wave strikes one of the rods, say B, a negative wave will simultaneously impinge upon the other B′; the difference of potential will be made apparent by a spark at g g′.

The distance between A A′ and B B′ may be feet or may be miles, according to the strength of the coil. If not interfered with, the waves will eventually die away for want of further energy. If the radiator A A′ is adjusted, or tuned as it is called, by the sliding of the spheres along the arms, to the particular period of vibration of the receiver B B′, the latter is much more ready to pick up and intercept the waves

of its predilection than any others. In wireless telegraphy a little instrument known as a coherer is inserted in place of the spark-gap to detect the length of the makes and breaks of the discharge, as it is by these that messages are expressed.

Suppose, now, instead of using spheres as capacity we substitute plates, using the same sized plates for both A A′ and B B′. Suppose also that, instead of keeping B B′ at a considerable distance from A A′, we bring it close up, as in fig. 5.

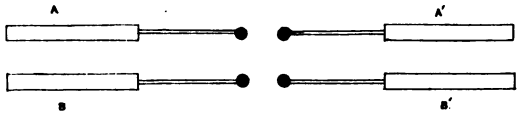


Fig 5.

There is now no chance for any of the waves emanating from the radiator A A′ to escape: they are all caught and retained by the receiver B B′, which consequently responds to every throb of the radiator, and the spark in the gap B g B′ is proportionately intense to that in the gap A g A′.

Although dry air is a very good dielectric, damp air is not, and as the air around dischargers rapidly becomes damp when electricity is in motion, we must insert a more suitable dielectric, such as glass, between the capacities of the radiator and the receiver, to prevent the spark jumping between them instead of across the gap. The glass dielectrics are shown at D D′, fig. 6.

We have now a pair of flat condensers, but if we roll them up in the form of a Leyden jar, then A A′ would represent the inner armatures and B B′ the outer.

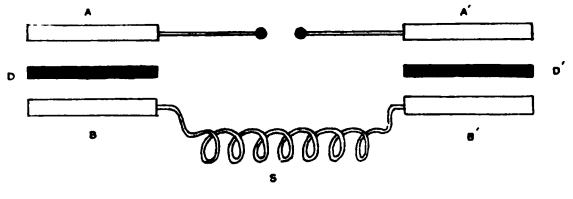


Fig 6.

Finally, if, instead of a spark-gap or a coherer, we place an impedence coil between the armatures B B′, we get at once the well known disposition of d'Arsonval.

We will now pass on to some experimental work on the subject of high potentials, with which we have been occupying ourselves since I last had the honour of addressing you. It would be quite impossible to obtain a sufficiently high

potential directly from the end of the solenoid used in d'Arsonval's disposition, unless we were to employ coils of excessive size with a corresponding spark-gap of inconvenient length. Even then, no condensers hitherto constructed would stand the strain of such a potential, therefore some other means of obtaining it must be sought. There are two practical ways of obtaining the desired potential by a secondary process—one by resonators, the other by transformers.

The following are a few recent experiments on resonance :—

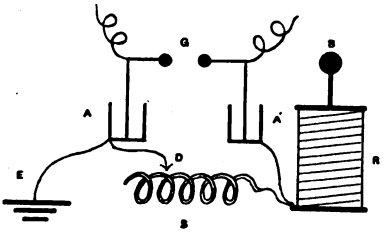


Fig 7

(1) In fig. 7, which we regard as the normal disposition of circuits, we found that when, by shifting the movable connection D along the solenoid S, a point was found which gave the maximum brush at B, the end of the resonator R, the maximum syntony remained on that particular point, no matter to what extent the spark-gap at G was increased or diminished.

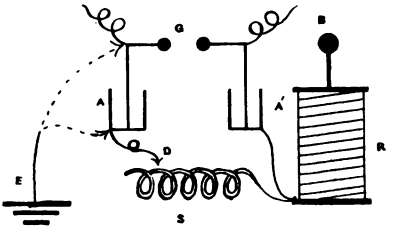


Fig 8.

(2) The earth connection E was made movable and attached alternately to the inner and outer armatures of the jar A (fig. 8). The result showed that the spark at the high potential end C of the solenoid S, and the brush at B, were

much greater when E was attached to the outer armature than when attached to the inner.

(3) The two jars were now placed in parallel, as in fig. 9. The outer armatures are connected to earth, and by the movable connection D to the low potential end of the solenoid. The high potential end is connected to the resonator, which is also connected to the inner armature. The spark-gap is fixed between the two armatures.

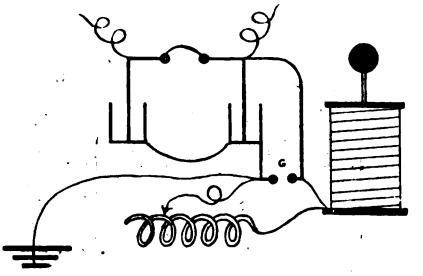


Fig 9.

The result was that no brush was exhibited at B, but an intensely vivid, greenish spark of considerable thickness. Its appearance was so wicked that, to avoid all risk of unseasonable interruption to our experiments, we decided to postpone the personal investigation of its physiological effects.

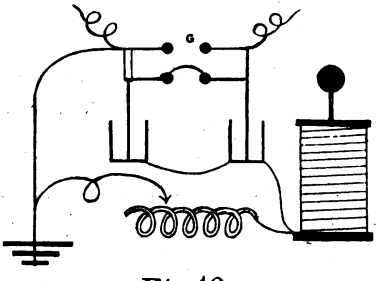


Fig 10.

(4) The jars are again placed in parallel. The spark-gap is connected to earth on one side, on the other to the inner armature. The solenoid is connected at its low potential end to the earth, and to the resonator at its high potential end. The resonator is also connected to the outer armatures.

This arrangement is perfectly safe, but is very ineffective.

(5) We next essayed the result of completely transposing d'Arsonval's arrangement of circuits.

The inner armature of one condenser is earthed and connected by a movable wire to the low potential end of the solenoid. The high potential end is connected to the resonator, which is also attached by a wire to the inner armature of the other jar. The spark-gap is fixed between the outer armatures of the two jars.

We found that there was very little difference in the result from that of d'Arsonval's disposition. If anything, it was not so good.

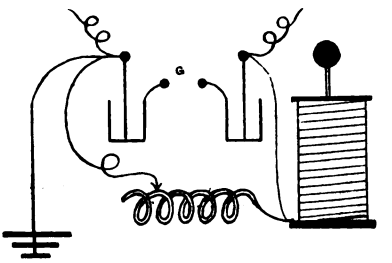


Fig 11.

(6) At one of the recent meetings of this Society there was exhibited a double, or bi-polar resonator, the object of which is the simultaneous production of a maximum potential at the extremity of one resonator and a minimum potential at the extremity of the other. It is the invention of M. Rochefort, who communicated the details and working of his apparatus to the French Society of Electrotherapy, in July, 1900.

When we undertook a series of experiments with two resonators, commencing in February, 1902, we were quite unaware of M. Rochefort's previous investigations; the results of our researches were arrived at independently and confirm those previously found and recorded by M. Rochefort. I can tell you, however, something new and original on the subject of the tuning of two resonators when used in a bi-polar manner. I have no doubt that you will remember that, during the evening in question, good tuning was not obtained without some trouble and loss of time. This difficulty arose from the fact that Rochefort has adopted Oudin's method of tuning a single resonator, that is to say, that the first few turns is made to act as the primary solenoid between the two outer armatures. Therefore, each of Rochefort's resonators is tuned independently of the other, and as each resonator has an influence upon the other, correct tuning of the two becomes rather an intricate and lengthy process.

The method we have devised is shown in fig. 12. We

take two symmetrically wound resonators, and connect them respectively to the two ends of a single primary solenoid, in its usual position between the outer armatures of two condensers. From each loop of this solenoid issue wires which terminate individually in studs arranged in a semicircle upon a switchboard. To the centre of this board is fixed a pivot, upon which rotate two arms of conducting material, provided at one end with a flat contact-piece and, at the other, with a pivot to which are attached movable pieces of the same length as the contact-bearing arms. These pieces are pivoted together on a rod of insulating material, which terminates at the other end in a ring. In the diagram the contact-pieces are depicted covering the third stud on either side, and it will be seen that by pulling out or pushing in the rod, the con-

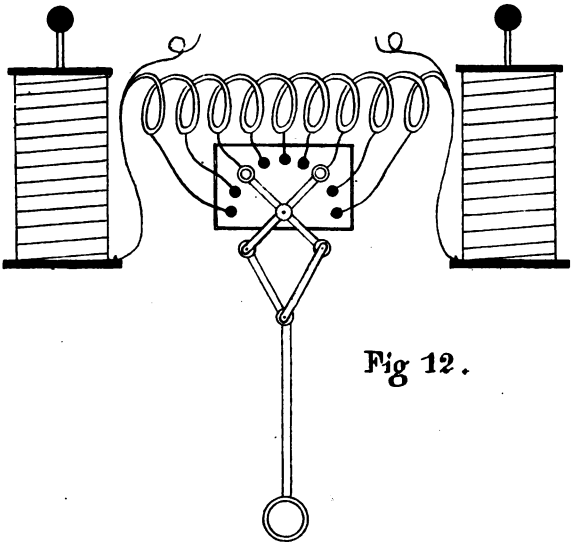


Fig 12.

tact-pieces, by sliding on to the studs, will throw into circuit or withdraw from it an equal number of loops at either end of the solenoid. The complete and harmonious tuning of the two resonators is effected thus both speedily and easily—an important matter when we consider, as pointed out in my previous lecture, that each additional length of wire from the extremity of a resonator alters the tuning thereof at once.

The second means of obtaining the requisite high potential is by making use of transformers, made familiar to us, in oscillatory electricity, by Tesla. I will conclude my lecture with a few words on some of our recent experiments on varieties of transformers.

In the position in which Tesla places his transformer, that

is to say, in the circuit between the two armatures of a single condenser, we placed some modifications of his instrument. We tried placing the spark-gap at either side and at both sides. In this situation, too, we placed a novel form, in which the spark-gap is maintained in the centre of the primary.

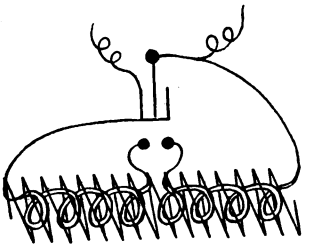


Fig 13.

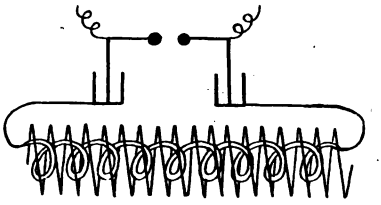


Fig 14.

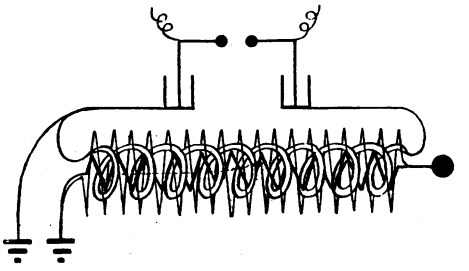


Fig 15.

This is shown diagrammatically in fig. 13. These transformers gave effects different and appropriate to altered conditions, but I must leave the detail of them to a future occasion.

In fig. 14 you will perceive that the transformer is placed between the outer armatures of two condensers, in the

position occupied by the impedence coil in d'Arsonval's disposition. This gave very good effects, which were enhanced by connecting to earth both the primary and secondary at corresponding ends, as depicted in fig. 15. This figure shows an entirely novel form of transformer, the peculiarity of which is that all the lines of force emanating from the primary are utilised, gathered together for the production of the highest potential, and none allowed to waste their energy. We accomplish this by using two secondaries, one within the primary and one without. The two secondaries are joined together at one extremity to form the high potential, and at the other to be connected to earth. The primary is also connected to earth, usually by a separate wire, at the end corresponding and contiguous to the earth end of the secondaries. This arrangement yields quite the best result we have yet obtained.

Drs. HEDLEY, MCCLURE, BATTEN and the PRESIDENT, discussed the paper.

Mr. CHAS. A. CLARK, L.D.S., then read a paper on "A New Dental X-ray Tube.

Mr. President and Gentlemen,—The object of the tube I am about to describe to you and which is to be used in the mouth, is two-fold; first, to facilitate the examination of the roots of the teeth, &c., radioscopically, so that we should be able to examine roots, buried or unerupted teeth, with the same ease as we now examine a mouth with the ordinary dental mouth mirror; and which, I take it, would be a great advantage over the present method. Secondly, as a therapeutic tube. Of the therapeutic value of X-rays in dental diseases we at present know nothing, but I trust that this tube may be of use in ascertaining their value if such exists.[1]

Professor Nutter, of Berlin, in a paper read before the Odontological Society of Great Britain in March last, on "Studies Relating to the Question of Immunity in the Human Mouth," says: "The results thus far obtained from my investigations seem to justify the conclusion that the protective powers present in the human mouth are not to be accounted for by any antiseptic action on the part of the saliva, but rather by the phenomenon of phagocytosis, by the struggle for existence and probably by certain forces residing in the soft tissues which have not yet been investigated. The question of the different susceptibilities of different teeth to caries still remains an unsolved problem, upon which I hope that experiments now under way may throw some light."

Now, as in the opinion of many X-rays act by inducing leucocytosis and phagocytosis, it is possible that they may

[1] *Transactions of the Odontological Society of Great Britain*, March, 1903.

have some value in dental surgery. Pyorrhœa alveolaris (Rigg's disease) is one in which their value is well worth experimenting upon, as this is one of the most obstinate of dental diseases we have to treat.

In July, 1901, I began to make experiments on this tube, and the chief difficulties to overcome were: (1) Danger, to either patient or operator; (2) design; (3) heat; (4) shock of any kind.

Danger and heat are both overcome by using a static spark from a Wimshurst influence machine. But the chief disadvantage of these machines is their size and unreliability of output owing to changes of weather, dust, &c. A coil giving a spark of three inches or so and as static as possible, would indeed be a great improvement if such could be made. The earlier experiments were made with a coil, and the best break for these tubes is, I find, the ordinary hammer break or Vril break, tuned so as to produce a thin blue spark.

With respect to the design of the tube: Mr. A. C. Cossor designed a dental tube about the end of 1896, and which he showed me in July, 1901. This was a tube half an inch in diameter, and about seven inches long, and attached to it from one side near the end away from the electrodes, a tube a quarter of an inch in diameter, connected to a bulb one and a half inch in diameter. At the other end were the electrodes, the cathode being nearest the extremity. He used a one inch spark from an Apps' coil with hammer break, the joint of the return tube (containing the cathode lead from the coil) and focus tube was secured by means of shellac. It gave pure X-rays, and it is my duty and pleasure to say that this was my starting-point. As this tube had no return tube when he gave it to me, and also as tube-making has improved since 1896, he made me another on the same design in July, 1901. This has the point from which the rays are emitted about two inches from the extremity, thus rendering it difficult to see the upper incisors—which should be the easiest—and the molars quite impossible.

In the next tube the position of the electrodes has been reversed, and the anode has its platinum wire brought through the side, which enables it to be placed at the very extremity of the tube, thus saving two inches, which in the mouth is considerable.

In the next tube the inside cathode wire is carried right through the bulb, the size of which is increased to three inches in diameter, so as to increase the life of the tube, and on this design I am unable to improve. Some have been made about five inches long from anode to the bulb, and others longer, and I think the longer ones are better, being easier to handle.

The last difficulty—shock—was most difficult to overcome, and I will not weary you with the description of the experi-

ments—which took some months—that were made. (The shock I refer to is that from the electro-static charge in the glass of the tube, and not from the spark.) The result of the experiments was to cover the entire tube, where liable to touch the teeth, with hard paraffin, as although the soft tissues did not experience a shock, the teeth, or at least some teeth, did so most unpleasantly. The outside of the tube was also connected to "earth." Gutta percha and also vulcanite have been used, the latter looking much better than paraffin, but did not give satisfactory results.

Lead glass with soda glass window has been used and discarded, as it is impossible to get rid of shock, and it also appears to make the cathode stream erratic. The tube is not yet brought to perfection, but I believe it to be designed on correct electrical principles *for the purpose intended*, and also I trust that some advance in this direction has been made.

To ascertain if the tube—being so small—was good in definition, some radiographs have been taken. The eye of a needle in the hand was distinct, and also the milling on the edges of coins placed on a photographic plate. These radiographs also showed that though the definition was quite good if the tube was within even one and a half inches of the coins on the plate, yet if the object radiographed was not quite close to the plate, the definition was lost but was regained on moving the tube further away. Therefore in using the tube in the mouth it is necessary to place it in the opposite side to that being examined, in accordance with well-known principles.

(At the close of the meeting Mr. Clark gave a demonstration, when the mandibular articulation, antrum, and roots of teeth, with their pulp chambers, were distinctly seen.)

Dr. DONALD BAYNES exhibited an Electric Vaginal Douche and a Battery.

BRITISH MEDICAL ASSOCIATION, ANNUAL MEETING, SWANSEA.

ELECTROTHERAPEUTIC SECTION.

July 29.—For the first time at an annual meeting of the British Medical Association a sub-section was devoted to Medical Electrology and Radiology. The attendance was very large, and in point of numbers equal to any other section of the meeting. Dr. Lewis Jones acted as President and Mr. Chisholm Williams as Hon. Sec.

The President opened the proceedings with an interesting paper on "The Results of Electrical Treatment of Malignant Growths," which will be found *in extenso* in a future number of the Journal of the Association. Messrs. Hall-Edwards

and Chisholm Williams, and Drs. V. H. Rutherford, C. H. Allfrey, H. B. Manders, Lovell Dradge, M. Bannister, W. Kenneth Wells, and Preston King took part in the discussion.

July 30.—Again the meeting was well attended. The Hon. Sec., Mr. Chisholm Williams, F.R.C.S., opened a discussion on the "Treatment of Tuberculous Disease by Electrical Methods." The general consensus of opinion proved to be in favour of X-rays and high vacuum electrode for high frequency currents, in place of the older methods of Finsen and ultra-violet light. The following members took part in the discussion: Drs. Phineas Abraham, Joseph Bolton, V. H. Rutherford, H. Hulbert, J. C. Fergusson, H. Hadden, Hall-Edwards, E. B. McVittie. Mr. Hall-Edwards read a paper on "Some Debatable Points in the Application of X-rays."

July 31.—The third and last day was reserved for papers. Drs. W. S. Hedley sent a paper on "Some Points in Practical Muscle Testing"; Dr. J. C. Fergusson on "High Frequency Currents as a Remedy for some Forms of Deafness"; Dr. Donald Baynes presented a paper on "The Treatment of some Cases of Painful Stumps, &c., and Ununited Fractures by Electricity." Dr. Joseph Bolton opened a discussion on "X-rays as a Diagnostic Agent in Pulmonary Conditions." Drs. D. Baynes, W. H. Sellers, W. K. Mills, J. C. Fergusson, J. E. Garner, R. B. McVittie, and Chisholm Williams took part in the discussion. Dr. W. K. Mills demonstrated a new form of ultra-violet lamp.

THE members of the British Electrotherapeutic Society dined together on Friday, June 26, at the Café Monico. It proved to be an altogether pleasant and successful evening. Forty-two members were present; and the services of an enterprising photographer enabled them to possess themselves of a record of the occasion, which in the days to come may be interesting—to themselves.

The health of the President of the Society was proposed by Dr. Hedley and responded to with enthusiasm. The toast of "The Military Forces" was acknowledged by Dr. Horace Manders, and "Our Colonial Empire" by Dr. Baynes. The proceedings were enlivened by vocal and instrumental music. Dr. Haydon contributed materially to the success of the evening by a brilliant violin recital, and Dr. Herschell gave a conjuring display with the finished skill of a true artist. The thanks of the Society are due to Mr. Chisholm Williams and Dr. Donald Baynes for the successful organisation of this, the first gathering of the kind that has taken place in the short history of the Society.

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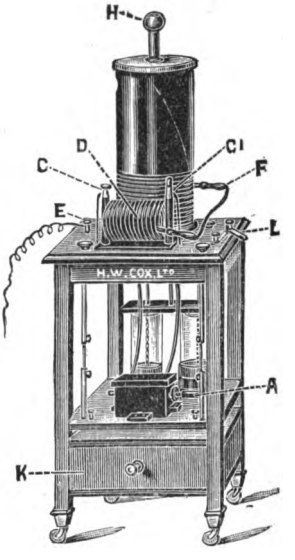

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