GYNÆCOLOGICAL

ELECTRO-THERAPEUTICS

BY

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WITH AN INTRODUCTION

BY

DR. GEORGES APOSTOLI

WITH ILLUSTRATIONS

PHILADELPHIA

J. B. LIPPINCOTT COMPANY

1889

To

Prof. WILLIAM GOODELL, of Philadelphia;

Dr. SÄNGER, of Leipzig; Dr. A. MARTIN, of Berlin;

Dr. GRÜNBERGER, of Carlsbad;

AND TO

Dr. GEORGES APOSTOLI, of Paris;

I DEDICATE THIS BOOK,

IN GRATEFUL MEMORY OF MUCH KINDNESS.

PREFACE.

THIS book is an attempt to record what I have seen and what others abler than myself have done. If I have originated nothing of great merit, I may, at least, with becoming modesty, claim a share in the great movement of conservative gynæcology that has characterized the last few years of the history of surgical progress. In a personal association with Dr. Apostoli the impetus has been found necessary to inaugurate a work such as this. His name will ever be indissolubly linked with gynæcological electro-therapeutics. Many of the ablest of to-day carry with them the delightful souvenirs of individual contact with one who was always courteous, obliging, and honest, who is as free from the dross of life as a man can be, and whose extensive observation, patient investigation, and research are sources of wonder. I have had the free use of his clinic, of his records, of his library and instruments since October 1888; and during the days of treatment in the Rue de Jour, I have

been in contact with medical men from all parts of the world. They know that whereof I write is true, even were there no other facts of record. The literature of the subject is scattered and not easy of access. I have endeavoured to gather it all into a convenient whole. Some scientific technicalities are unavoidable. No one is competent to an intelligent practice of electro-therapeutics unless he knows something of the fundamentals of electricity. The three first chapters are taken almost entirely from the writings of Joubert, Hospitalier, and Onimus. The handiwork of Apostoli (largely and chiefly), of Mundé, of Engelmann, of Grandin, of Rockwell, and of Massey will be recognised in these pages. I give publicity to this book with some hesitancy. I am conscious of its shortcomings. The questions of resistance, of tension, and of electro-motor force are puzzles to many, and perhaps they should have been discussed more fully. In a general way it may be said that the greater the resistance the greater will be the tension required, and the larger the electro-motor force necessary to furnish it. This resistance may be in the conducting wire, in the pile, the body, the tumour, or at the point of the needle used in puncturing. A steel needle becomes quickly oxidized, thus resisting the passage of the current, and more couples must be brought into the circuit to raise the tension to the number

of milliampères required. Again, with a large abdominal plate for the inactive pole, there will be a greater distribution of the current, so that a greater tension can be supported than would be otherwise tolerated.

However much it may be disputed, I am convinced that the distinction between a Faradic current generated by the short thick wire is a marked one from that called forth by the long thin wire. A. Tripier pointed out that the first was a current of *quantity*, and the second one of *tension*. The first provokes muscular contraction, and is more or less painful. The latter is an exciter of sensibility. It is calmative of pain, and should be used in all pelvic neuralgias. Why is it that when the bipolar Faradic electrode is in the uterus, and pressing, say, against the left side, the patient should relegate the sensation to the opposite side? Because the current of tension disperses freely and follows the periphery of the uterus until exhausted. As to the class of cases in which the electric treatment stands us in good stead, I should specify :—

Fibroid tumours of the uterus.
Hypertrophy of the uterus.
Non-suppurative salpingitis.
Metritis.
Endometritis.
Subinvolution, superinvolution.
Disorders of menstruation.

Ovarian pain.
Chronic Oophoritis.
Peri-uterine Inflammations.
Displacements.
Hæmatocele.
Some hystero-neuroses.
Stenosis of the cervical canal.
Erosions of the cervix.
Nausea of pregnancy.

It may be urged, and justly, that this book is a mere compilation. If it be a good one, and subserve a useful purpose, I am amply repaid. Since no other author has written as clearly or as definitely as Dr. Apostoli upon many of these points, since no one that I know of has written upon some of them, it would have been mere impertinence for me to obtrude my own unformed ideas upon men anxious to learn. I do not desire to claim for electricity more than of right belongs to it. Cases there are, and ever will be, hundreds of them, which will demand the surgeon's interference. Reports from many climes, and in many languages, emanating from sources of authority, have placed electro-therapeutics beyond the reach of cavil. The field is full of ambitious, intelligent workmen, who are adding daily to our knowledge. It holds of right a prominent place in gynæcology. It demands respectfully hearing. Those who have not given it the careful study and investigation which are the

absolute pre-requisites of success, or who have worked with faulty methods or bad tools, are incapable of giving a sound opinion. With cases, plenty of them, of record of its beneficent action upon tumours, it simply recoils upon the writer to deny these facts or to dispute them. They are as patent as are any of the statistics of abdominal surgeons. Dr. Baldy thinks that the hæmorrhage can be treated better or more safely by other means, but he fails to mention the means. Pascal said: "Rien n'est plus étrange dans la nature de l'homme que les contrariétés que l'on y découvre à l'égard de toutes choses. Il est fait pour connaître la vérité il la désire ardemment, il la cherche; et cependant, quand il tâche de la saisir, il s'éblouit, et se confond de telle sorte, qu'il donne sujet de lui en disputer la possession" (*Pensées*).

Should one desire to acquaint himself more thoroughly with Apostoli's writings upon this subject, I would commend with much emphasis the following:—*Am. Journal Obstetrics*, September 1884, article, "A New Method of Uterine Faradization;" *Bulletin Général de Thérapeutique*, June 15th, 1885, article, "Sur un Nouveau Traitement Electrique de la Douleur chez les Hystériques;" the same journal, November 15th, 1882; *Gazette de Gynécologie*, August 15th, 1887, article, "Sur les Applications Nouvelles du Courant Continu à la Gynécologie;'

Archives de Tocologie, December 1888, and January and February 1889, article, "Fibromes Utérins; Leur Traitement,—Méthode Apostoli," by Dr. La Torre, of Rome; *Union Médicale*, October 16th and 19th, 1886, "Bi-polar Galvanization;" same journal and same number on "Chemical Galvano-puncture."

It seems ignoble to refer to the fact that charlatans and charlatanism contaminate any medical effort of merit in its infancy. This has not militated against the recognition of methods in other departments of medicine, and it certainly will carry no weight in the proper estimate of the value of electricity.

PARIS, *July* 1889.

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INTRODUCTION

BY

Dr. GEORGES APOSTOLI.

THE work that you have undertaken, my dear Bigelow, is most praiseworthy, and no one is better prepared than yourself to carry it to a successful termination. It is now ten years or more since you first had the courage to raise the flag of conservatism in gynæcology in America, the land of fearlessness and progress, and to protest in the face of much personal abuse against the uncalled-for use of the knife. You then stood alone; to-day you are a host, and electro-therapy has come like a miracle to endorse your authoritative protestations. You have said, and with much truth, that the greatest factor of conservatism is this tractable force, which can be *dosed* and *localized* at will, a force which has made such wonderful advance in all industries, and which, it is hoped, may obtain the

same preponderance in gynæcology. Empirical at first, the method has become methodical and reasonable, and is now an exact science, thanks to the labours of *A. Tripier*, with whom I worked ten years. It is important to bring it within the reach of all; and you do well to bring into a compact whole what has been written of the ways and means, by giving to the medical public a book, on "Gynæcological Electro-therapeutics." You ask me to give the exact status of this new science, which has never ceased its upward march. I can simply refer to my *brochures* already published. I will merely bring into a clearer light a review of some of the more salient points which are not well understood. In its medical applications electricity presents itself under three forms, which I may rapidly outline—describing, first, essential attributes and modulations which should be known to the doctor; and then will review the chief gynæcological diseases for which electricity should be used.

I.—The Induced, or Faradic, Current.

This is essentially an exciter of muscular action and of the nervous system, both sensitive and motor, applied to organic tissue. It causes sub-adjacent muscular fibres, smooth or striated, to contract, and awakens cutaneous or mucous sensibility. The

physiological response to the same dose of faradic excitation (the inductive source being the same) is not identical, and varies with certain conditions; such as the duration of the application, the number of the interruptions per second, and chiefly according to the physical source generating the induced current, whether the wire of the second helix be short and thick or long and fine. The different modifications thus obtained have received specific names, which it would be wise to retain; the current generated by the thick wire is called the *current of quantity*, and that of the fine wire is called a *current of tension.* That is to say, in common parlance, that the longer the wire generating the current, and the more complicated its spiral arrangements, in direct proportion will its force of propulsion be augmented, either as regards tension or penetration; on the contrary, the shorter and thicker the wire, and the less complicated its number of spirals, the less will be the tension and the greater the outcome of the current, which is therefore called a current of quantity. This is no mere physical abstraction, as its immediate value is found in therapeutics. Apply the induced current to the skin, other things being equal, it will be more painful if furnished by the long, fine wire (a current of tension) than when generated by the short, thick wire (a current of quantity). But now

if the same current be applied to the uterus, bladder, or rectum, whose innervation is different, the result will be just the reverse, and the current of quantity becomes the most painful and more excitant. Again, muscular contractility is more energetically called into action by the current of quantity. From these observations we can draw general therapeutic conclusions applicable to gynæcology. Whenever the muscular fibre is inert or lazy, be it striated or smooth, the current of *quantity* must always be used. Whenever, on the contrary, the painful element predominates, the current of *tension* is the one indicated. A. Tripier had the great merit of placing upon a precise footing the indications for the use of the current of quantity in gynæcology; I have endeavoured to do the same thing for the current of tension. The *puerperal state* is the prototype for the applications of the current of quantity, either occurring after miscarriage or term, when the muscular fibre is not responsive, whether due to a long, tedious labour, or to hæmorrhage, or to an enfeebled constitution. Every woman faradized under any of these conditions will be benefited; involution and uterine circulation are immediately accelerated, convalescence is hastened, and the lochial discharge diminished. Every uterine faradization, *post-puerperal*, well and intelligently made, is at the same time *curative* and *preventive*—curative in rapidly restoring

the physiological equilibrium, temporarily disturbed, and preventive, although not at all antiseptic in action, in giving to the uterus greater power to protect itself against an invasion of microbes, which find their favourite domicile in the uterus of the puerperal woman. Later on, the induced current, in experienced hands, is an excellent weapon to combat uterine and peri-uterine circulatory troubles, which are frequently observed. Here I differ from the advice of Tripier, who devoted thirty years in a glorious scientific struggle to seek a panacea for metritis in the induced current of quantity. If metritis, or uterine engorgement, consisted simply, as he believed, in a circulatory derangement, his theory would be unimpeachable, and the induced current would be a *specific* for *metritis*. But I have shown that this current, which possesses no chemical action, is of course not germicidal, and is hence powerless to operate against the invasion of the *microbe*; and that, in consequence thereof, the induced current should be replaced by an antiseptic current such as is the continuous or galvanic current. The *rôle* of the current of quantity, although modest and of the second rank, is of great importance in certain cases; if not a specific for endometritis, it often combats successfully other troubles associated with it. If a woman suffer with *amenorrhœa* it will suffice often to give a few *séances* of a current of quantity to

stimulate the uterine circulation, to bring about an immediate appearance of the hæmorrhage, and to accentuate the normal evolution of menstruation. The induced current of tension, on the other hand, is chiefly valuable in the treatment of pain, especially when not associated with any organic or inflammatory lesion. *Pain* and *hæmorrhage* are two all-powerful points in gynæcology. For these symptoms abdomens are opened every day; women are mutilated by removing their ovaries, and are made to assume unjustifiable risks in the face of such abuses, and of the needless use of the knife. Electro-therapeutics, in many cases, is the method of choice, because very often by its own resources it will symptomatically cure these women. Ovarian pains of nervous or hysterical origin, and very often pains of an inflammatory nature, are cured by this means. Whenever the element of *pain* in gynæcology confronts us, the current of tension may render good service, variable sometimes, now sovereign, now weaker, and of less value the greater the amount of inflammation. In 1883 I showed all that one could hope for in the *ovaralgia* of hysterical women by using a current of tension. Since then my experience confirms me in the belief, and to-day I maintain that many women conceal within them an hysterical condition, either present or to become operative in the future, in whom a

faradization of tension for the smallest ovarian pain will produce immediate relief, and sometimes a cure. In these cases we have a true therapeutical triumph which usually follows at once after the first sitting, if one will adhere strictly to the rules which I have formulated. I have for a long time made use of *bi-polar* faradization instead of *mono-polar*, in order to avoid all action upon the skin, and to make the application more simple, easier, and more tolerable, thus enhancing the efficacy by being masters of the intensity. But, it may be objected, you arrest all peripheric action, thus diminishing the therapeutic effect by closing the circuit upon itself, at a short distance, by reason of the sound which holds the two poles almost side by side. My only reply to such an objection is, that, instead of holding the sound on the median line I carry it to the sides by depressing the lateral surface. Very often women complain of a greater or less pain in the contraction of a limb on the same side, showing that the sciatic nerve is feeling the influence. Now is this not a proof that the current has passed around the uterine periphery to act upon the whole periphery of the basin? and could a current so diffuse, so powerful, and which is far from taking the most direct route from one point to another, do otherwise?

II.—The Galvanic Current.

This current, also known as the continuous, differs entirely from the induced, or faradic, current. While the one is purely mechanical, exciting muscular and nervous action by a physical force of pounding at intervals, the galvanic current is at one and the same time physical, chemical, calorifacient, and trophical, bringing each of its attributes successively or simultaneously into action. Every galvanic current traversing an organized region carries a definite amount of energy, which it expends in a variable manner according to the nature and the resistance of the intermediate circuit, in physical or heat work, or in chemical or electrolytic work. All binary compounds and those above tend to decomposition, and this dissolution, called *Electrolysis*, will be proportional on the one hand to the electric energy given out, and on the other hand to the duration in time of the application. This interstitial dissociation of elements, which always accompanies a different orientation in the polarization of organic molecules, causes the acids to be set free at one end—oxygen at the positive pole—and at the other end—negative—bases and hydrogen. This profound molecular action, following galvanic action, developed certain theories which to-day have become classic.

But this is not all. My friend Laguerrière and myself, by a series of carefully conducted experiments, have proven the theories which I advanced years ago to be true, namely, that the galvanic current in large doses is *powerfully antiseptic*, and that it sterilizes and attenuates *pathogenic microbien cultures*. Applied in any given region, the galvanic current acts locally and generally. First, it sets up a different caustic action at each pole—acid at one and basic at the other. By the intermediate chain which closes the circuit between one pole and the other, the galvanic current sets up changes of nutrition, which may or may not be retrogressive according to the dose used, and which results in a trophic action that tends to the resolution of certain pathological processes. These synthetical premises once fixed it is not difficult to understand the advantages of intra-uterine electrolysis, or, better, of chemical-galvano-caustic, which engages the whole or only part of the lining membrane of the uterus.

To-day much honour is being given to "raclage," which, born in France, has been dormant for many years. Without wishing to reflect upon a surgical procedure of great merit in certain cases, I wish to draw attention to the superior and similar advantages of the raclage by chemical-galvano-caustic intra-uterine.

(*a*) It is a method so simple of application, that

any physician, no matter how little skill he may have as a gynæcologist, can employ it with success; it requires no assistant.

(*b*) In general it is so bearable that chloroform will not be called for, which indeed is only needed in certain cases of punctures.

(*c*) Only a few hours of repose after the operation are needed; and it does not demand, as does curetting, that the patient go to bed. Working women can continue their daily avocations without interruption.

(*d*) It is a less brutal operation, since the doses are progressive, and increased only with the tolerance that is also progressive. It is not instantaneous.

(*e*) It is not contra-indicated in any acute inflammatory state, and only needs a more strict observance of detail to render it tolerable in different doses, according to the case, and according as well to the patient,—for different doses at different periods may be demanded in the same person.

(*f*) It is an action which obeys with precise and mathematical obedience the hand controlling it. One can dose it and measure it exactly—the general intensity used, the density of the electrode, and the duration of the application being the three factors concerned.

(*g*) It is an active force producing an action as pronounced as one wishes, which can be localized at

will, and which can be confined to a very limited portion of the uterine mucosa if one wish.

(*h*) It is an absolutely harmless cauterization if one make use of the antiseptic or rather aseptic precautions that I have indicated.

(*i*) According to the duration of the *séance* and the intensity used changes may be wrought at will, just as especial effects may also be engendered according to the pole made active. Remember that bases are negative and acids positive.

(*j*) But apart from its action above cited, it has a much more profound trophic and vital action, which is felt along the whole inter-polar tract of organic tissue between the poles. It thus has an action of much wider extent than surgical raclage since the whole uterine parenchyma and the adnexæ are affected.

(*k*) If surgical raclage is often followed by a return of the disease, and by bad functional results which it was destined to eradicate, I can affirm that such things are much less frequent after this galvanic treatment, which usually requires several *séances* to bring about the desired results, but which results are usually permanent—as I have observed at the clinic in many women, in whom after many years' cessation of treatment there had been no return of the complaint.

(*l*) Finally, in addition to these advantages of

intra-uterine electro-therapy, which justify its employment, it is the marvellous antiseptic and sterilizing power of the galvanic current which is destined to play the preponderating *rôle* in gynæcology, since the modern teachings of micro-biology give to pathogenic microbes a controlling power.

III.—Uterine Fibromas.

The question of the electrical treatment of uterine fibromas is the one which I have studied most thoroughly and observed most patiently. I have nothing to retract from that which I have written, and it is necessary only for me to touch upon a few mooted points. For the hundredth time I will repeat that my treatment has nothing to do with the unvarying radical cure of fibromas; if such result is sometimes observed, it is the exception, and electro-therapy up to the present time has for its sole ambition the *symptomatic cure of the patients, and the parallel, but limited, retrogression of the fibromas.* Jealous and evil-minded persons generally exact of any new departure in therapeutics, which does not owe its origin to themselves, universal qualities. Despite itself, one would create a panacea out of it in order the more surely to show up its weakness or to demolish it altogether. I have not escaped the general rule. At the very outset I

disclosed their batteries, and set forth myself the entire process in order to do justice to their arguments. It is true that the method has not been successful in all hands, and we must find out the reasons. They may be classed under three heads: causes relating to the *operation;* causes relating to the *patient;* causes relating to the *treatment.*

(*a*) *On the Side of the Operation.*—I have sometimes seen, and have many times read, of reasons more than sufficient to kill all operative success. *Inexperience* in *gynæcology*, *want of operative dexterity*, and *complete ignorance of physical laws*—these, unfortunately, are some of the reasons that have been brought to my notice. Many foreign doctors have attended my clinic; some of the highest intelligence, and others simply novices in the practice of gynæcology. These latter are they who generally examine badly, who know nothing of electro-physics, and who invariably tell me at the termination of their first visit that they are about purchasing a complete apparatus in Paris in order to practise the method immediately upon their return. What can I do with such falling stars? Little or nothing. This is the more to be regretted because even among the ablest gynæcologists errors of diagnosis are possible which involve the most serious consequences. The chief error, the gravest of all, consists in mistaking an *ovarian cyst*, or a

tumour of the tube, for a fibroma, and then applying the electrical treatment, which is, of course, absolutely contra-indicated. Four cases of such are within my personal knowledge, two at Liverpool, one at Glasgow, and the fourth at Paris, in all of which the patients died. Instead of fibroma they were ovarian cysts, and the electricity set up suppuration.

(*b*) *On the Side of the Treatment.*—Mistakes equally grave are made in administration. First the *dosage*, in regard to which a double danger is to be avoided: *timidity* or undue *temerity*. *Timidity* hinders all therapeutic results, and exposes the patient to a return of the disease. *Temerity*, which is useless and dangerous, especially if brusquely manifested at the outset, without being guarded in all of the rules which I have formulated. The *séances* may be either *too frequent* or of *too long duration*, and the repeated congestions may set up uterine or peri-uterine congestions with inflammatory sequelæ. The *neglect of antiseptic precautions*, which should precede and follow each application, is a grave fault, especially after vaginal *galvano-puncture*, which is always followed by a discharge, continuing for a varying length of time, and exposes the patient to consequences that may be serious. The *localization* of the treatment may be *insufficient* or *incomplete*, especially in cases of fungoid endometritis or of hæmorrhage connected with fibromas. The uterine

cauterization may be insufficient by reason of the electrode, so that a carbon electrode which embraces exactly the uterine cavity should be used. Another cause of failure is the objection to the use of the *galvano-puncture* when indicated. Its action of denutrition and its efficacy I have very often seen. The most frequent cause of all, however, of this want of success is that the treatment has not been kept up long enough. After a few *séances* one is apt to pronounce a judicial opinion that the method amounts to nothing, when a few more sittings would have given the desired result.

(*c*) In regard to the *patient* the causes of non-success are not less important. It is necessary to consider the *nature* of the fibroma, its *seat* and its *topographical situation*, which are always different, and upon which the current has different effects. In a general sense it may be said that, other things being equal, the best results will be obtained when the tumour is interstitial, and that the action decreases in intensity in proportion to the sub-peritoneal tendency of the tumour. Soft tumours are much more prone to rapid retrogression than hard ones; but, whatever may be the nature of the tumour, the electrical treatment carried out for a sufficiently long time will produce absolute effects, always symptomatic, and generally anatomical. On the other hand, I have seen the method fail in

fibro-cystic tumours complicated with *ascites*, in which a malignant condition might be inferred. An unrecognized *lesion of the adnexæ* may also be another cause, since in certain cases this may occasion the uterine hæmorrhage or congestion, or may cause a more or less serious peritonitis. Cases of *pyo-salpingitis*, or of *suppurating tumours of the tube*, escape the action of the intra-uterine current, but are often well treated by *galvano-puncture*, which creates an artificial opening and permits vaginal drainage. These are the cases in which the cause of the sudden death following upon a simple examination, the introduction of the speculum or the least gynæcological operation, has only recently been determined. They were suppurating cysts of the adnexæ, bursting into the peritoneum and setting up rapidly fatal peritonitis. Intra-uterine galvano-caustic is contra-indicated in all cases of pus-collection in the female pelvis; the first and most urgent indication is evacuation. *Galvano-vaginal-puncture* in the *cul-de-sac* serves the double purpose of draining the pocket by making an artificial opening and of aiding resolution by the trophic action of the current. In cases of doubt, or where the explanation is insufficient or incomplete what means have we to aid diagnosis and to outline the treatment? The thermometer is the most valuable. If, after the first intra-uterine application in a case which we suppose to be simple, a febrile

movement accompanied by pain is observed, which is not promptly dissipated if the temperature keeps at 39° or 39·5° (C.), temporary and most generally all intra-uterine therapy must be discontinued. A fresh examination under chloroform should be made, and one will often find by the side of the fibroma an unrecognized tumour of the tube. Under such conditions as I shall describe farther on, two things demand attention: either the tumour is near the vagina, easily reached by galvanic puncture (evacuant), which should be done at once; or it is beyond the reach of vaginal interference, and laparotomy is demanded. Another cause of unsuccess is, that the necessity of *rest* after the operation has not been enforced. Very serious results may follow upon negligence in this particular,—peri-uterine phlegmon more or less intense.

IV.—Salpingo-Ovaritis.

Salpingo-ovaritis is a disease which has long been known under the different names of *Phlegmon*, *Pelvic-peritonitis*, *Cellulitis*, *Peri-metritis*, *Para-metritis*, *Lymphitis*, *Adeno-lymphitis*, *and Peri-uterine Phlegmasia*. All of these terms were used as the disease was supposed to be in the lymphatics, in the cellular tissue, or in the peritoneum. Laparotomy fixed the

diagnosis precisely, by demonstrating that lesions of the ovary or of the tube were almost always present, and that the point of departure for the disease was the uterine mucosa, from which it spread to the uterine adnexæ, the surrounding cellular tissue, and the peritoneum. At the commencement of my practice I was guilty of the common pathological error, which I hasten to correct to-day; but one fact remains, and that is, that the cases which I treated as *phlegmon* or of *peri-metritis*, and which were really cases of *Salpingo-ovaritis*, do not interfere with my claim of priority in advocating the use of electricity in their treatment. My claims are as follows. In 1882 I treated with electricity at my clinic all cases either of fibroma, of endo-metritis, of peri-uterine phlegmasia, which presented themselves. In the thesis of my assistant, Dr. Lucien S. Carlet, which appeared in July 1884,* which was inspired and thoroughly revised by me, there are the following passages: "This is the pole (the negative) par excellence of *denutrition;* it is useful, therefore, not only in the resolution of fibromas, but also in *sub-acute peri-uterine inflammations* (circumscribed) without fever, which are more or less attached to the uterus, interfering with its functions." Further on, one can

* *Du traitement électrique des tumeurs fibreuses de l'uterus d'apres le mèthode du Docteur Apostoli, par le Docteur Lucien Carlet, Paris. Octave Doin. Editeur,* 1884.

profitably read the clinical histories of twenty cases of peri-uterine phlegmasia,* which co-existed with fibromas, and which were treated with electricity. I quote as follows (*Thesis Carlet*, p. 110): "This observation is one of the greatest importance, since it is a clinical demonstration of the great value of the *intra-uterine galvano-caustiques* in moderate doses for the resolution of sub-acute peri-metritis." Further on I write (p. 117): "This observation ought to be most instructive. It proves first that *intra-uterine galvano-caustiques* badly made, or in too high doses, may give rise to many accidents, and here the peri-uterine phlegmon is clearly due to the *galvano-caustiques*. On the other hand, this observation also shows that hysterometry badly done is dangerous, but when well done is never so, not even in sub-acute stages of peri-uterine phlegmons; this disease, indeed, being treated by uterine faradization (which is another form of hysterometry) with the best results in regard to amelioration, and to cutting short the period of convalescence." At the same time (August 1884), I wrote a treatise on the electrical treatment of peri-metritis for the Congress at Copenhagen. From 1884 to 1887 my experience enlarged with operative temerity, and at the Congress at Dublin (August 1887) I took up the same question under a new

* See pages 74, 81, 85, 94, 108, 114, 120, 124, 125, 151, 169, 196, 205, 214, 216, 225, 227, 232, 236, 241.

name.* To-day names have changed, but the ideas remain about the same. I shall speak no more of *peri-metritis*, but of *salpingo-ovaritis*, whether complicating a *pelvic-peritonitis* or not. It is curious to observe the attitude of the doctors who are opposed to each other: the one, and by far the larger number, inheriting the sage and classic teachings of our ancestry, when confronted with a salpingo-ovaritis cry out, *Leave it alone.* Repose in bed, revulsives, and poultices are their favourite weapons; they forbid all intra-uterine medication, and their results are variable. For them the uterine cavity is a *noli me tangere*, which they blindly respect. The others—and their camp is the smaller—who are the surgeons ambitious of statistics, see in every woman that suffers, or who has a pain in the adnexæ, a proper field for abdominal exploration, and should the disease exist, a justification for castration. Here the abuse cries out for reform, and if under some circumstances the services of the surgeon are indicated, one cannot but regret that many women are doomed to sterility simply to gratify the ambition of the surgeon. The true course is between the two. If, on the one hand, doctors are over-timid, and trust over-much to the efforts of nature to cure certain diseases, which are

* See *Bulletin Général de Therapeutique* of September 30th, 1887, and *British Medical Journal*, November 19th, 1887.

rarely cured spontaneously, the surgeons commit a great fault against humanity by operative haste, and their ignoring of clinical fact; for we know that castration sometimes kills, that it does not always cure, and that to cure a disease they create in the woman an irreparable moral and physical shock, when more simple and more conservative practice might cure their patients. To counteract the excess of both sides, I founded the method which I shall briefly now discuss. At first my medication was solely *intra-uterine*, notwithstanding a bitter opposition from all sides; the idea, at first theoretic, has found its fullest pathological defence since then, because it confirms the theory that almost every peri-uterine phlegmasia or better *salpingo-ovaritis* started as an endo-metritis, which was the posthumous witness of a secondary lesion of propagation. Cleanse the uterus, make careful intra-uterine anti-sepsis, cure the endo-metritis, and induce healthy intra-uterine derivation—these are the considerations which guided me to success. For these reasons at the very commencement I swept away the prejudices which would have us respect the uterine cavity, and for these reasons I have never failed to apply my method, no matter what the nature or condition of the state of inflammation. I have used three methods of application, which are, in reverse order of merit, the faradic currents, the intra-uterine galvanic current, and the peripheric

vaginal galvano-punction. I will pass them briefly in review.

1. *Faradization*, under the unique form of a current of *tension*, engendered by the long thin wire, calms the nervous system, moderates its excitability, assuages or dissipates pain, but is often of itself alone powerless to abort or resolve an acute phlegmasia; its action—purely mechanical—produces a soporific effect in the inflammatory stages of the beginning, but is impotent against the evolution of the inflammatory process. The current of tension is only indicated in the acute and sub-acute periods, and should always be used, to the exclusion of the current of *quantity*, except in the old and rare chronic cases, in which, by acting upon the intestinal circulation, absorption may be aided. The electrode should always be bi-polar, in order to localize the electric current to the best advantage, either in the vagina or in the uterus; and of these two, other things being equal, the uterine application is much the more valuable. The application should be made gently and moderately, and especially in acute cases should all brusqueness be avoided at the commencement; the *séances* should be daily, and from five to twenty minutes in length; the dose should be progressively increased, but never beyond individual tolerance.

2. *Galvanization*, or *chemical intra-uterine galvano-caustic*, much more powerful than faradization, is often

sufficient of itself to cure many cases of salpingo-ovaritis. It is indeed an excellent way of destroying, in whole or in part, the uterine mucosa, of cleansing its cavity, and of established peripheric derivative changes. In my brochures upon the electrical treatment of fibroma and of endo-metritis, I have already explained with sufficient exactness the technique. I will content myself now with citing the chief and essential points in the actual therapeutics of salpingo ovaritis. The *positive pole* always causes less congestion than the *negative*, but the latter is more powerful to cause resolution. The positive pole should generally be used at the commencement, and once the patient is thoroughly accustomed to it, the negative should be used. The dominant idea which should guide us in the treatment of every case of salpingo-ovaritis is to make sure, so far as we possibly can, that we are not dealing with a *pyo-salpingitis*, which a large dose of electricity might intensify. If a doubt exist, commence very gently with a small dose, in order to test the uterine and peri-uterine susceptibility; the dose may be increased if the patient shall bear it well, and if clinical data justify it. One may commence with twenty to forty milliampères; if intolerance persist, respect it, and do not increase; but if all go well, raise gradually to a hundred or a hundred and fifty milliampères. Here the clinical experience of the doctor comes in to establish the difference between

the hysterical intolerance which we need not mind and the inflammatory intolerance which we should respect. The *séances* should not be too frequent, and as in the commencement they are frequently followed by a re-action more or less intense, which may last a day or two, the next *séance* should not take place until calm is established. Sometimes the applications may be made twice a week, and sometimes only once in two weeks. The same considerations should guide the physician as to the length of the *séance*. Sometimes, especially to commence with, three minutes will be sufficient; later on we can prolong them to five or eight minutes.

3. The third division is the most important of all, *vaginal galvano-punction*. Two clinical indications govern us, the one of *choice* and the other of *necessity*. The indication of *choice* is when a salpingo-ovaritis has not been sufficiently relieved by the intra-uterine applications; we must then penetrate the mass with the current at the point the nearest possible to the diseased mass, in order to lose nothing and to have a maximum utilization of the current which will be felt forcibly in the entire diseased region. Theoretically such an application, well made, should be very efficacious; clinically no doubt remains in my own mind, because of the answer which my patients invariably give me. They all affirm that, although the punctions are more painful, they are much more

efficacious, because one punction alone often gave more comfort than many intra-uterine galvano-caustic applications. The indication of *necessity* for galvano-puncture is when a fluctuating tumour presses into the vagina and demands rapid evacuation, by creating an antiseptic vaginal drainage. It is only necessary to touch briefly upon the points in the technique, as I have already given them in full.

(*a*) Here, as in all other forms of electrical treatment, faradic or galvanic, a perfect antiseptic irrigation should precede and follow each application. It will be also well to pack the vagina between the periods with gauze (iodoform, salol, or sublimate), to keep up asepsis and to prevent as far as possible all sexual relation, which should be entirely suspended during the treatment.

(*b*) The patient should stay in bed one or two days after each punction.

(*c*) The trocar should be the smallest possible, but of a consistence sufficient to prevent its breaking. It should pierce without effort, and is best when made of steel.

(*d*) The depth of the penetration is the chief point. One-half a centimètre on the average will be sufficient to open a way for the current into the region which it should traverse. Deep punctures, as I have seen in some cases, are dangerous. I never make a puncture exceeding one centimètre in depth.

(*e*) Where make the punction? *Choice* and *necessity* also come in here. *Choice* leads us to penetrate as near the disease as possible; but *necessity* teaches us to avoid the anterior cul-de-sac in order to avoid the bladder. The lateral regions, and above all the posterior cul-de-sac, are favourable places. I have the most frequently made mine in the latter, in the middle of Douglas, and carrying the axis of the trocar toward the uterus in order to avoid the rectum.

(*f*) If made with high intensity chloroform should be used, though certain women support all forms of galvanic treatment without it.

(*g*) The use of the speculum in this operation I proscribe. The steps I take are as follows. First fix in the celluloid sheath the needle to the depth of the punction to be made; then, having ascertained with the index finger that there is no arterial pulsation, allow it to rest upon the point to be pierced; then slide underneath this finger the celluloid sheath which is to carry the trocar until its open mouth shall rest upon the exact spot; then push the trocar home, its penetrating depth having been properly adjusted.

(*h*) The number of punctures demanded varies. One puncture is sufficient in some cases of hydro-salpingitis or of catarrhal salpingitis; others demand three or four, and tubercular salpingitis a greater number

still. Since the punctures are sometimes followed by an active re-action, a longer rest in bed is demanded than in the other forms of application, and the second *séance* should not follow until all the excitability following the first has subsided.

(*i*) In regard to intensity and choice of poles I call attention to what I have already said under the head of intra-uterine galvanization. At first the dose will vary from twenty to fifty milliampères. To go beyond this without anæsthesia is risky. When a current of one hundred to two hundred and fifty milliampères is demanded for a temporary vaginal fistula, chloroform should always be used.

(*j*) The punction should generally be positive at the beginning, because it is less painful and causes less inflammation. The negative may be used when we seek to create a vaginal fistula to drain a fluctuating tumour, pointing into the vagina, or when, after having used the positive, we need the peculiar effects of the negative pole.

(*k*) If a prolonged high fever supervene all electrical treatment must be suspended. One may believe himself in presence of a pyo-salpingitis, but if it is easily accessible by the vagina, galvano-puncture is indicated; but if it be high up, not easily reached, and far from the vaginal cul-de-sac, avoid a deep punction, which may cause rupture of a pus-pocket into the peritoneal cavity. Here surgery takes up

the operation. My clinical experience, which is now seven years old, has permitted me to treat many cases of salpingo-ovaritis, whose exact histories I shall publish very soon. I shall merely formulate the synthetical results of my practice now. Every case of salpingo-ovaritis may generally, or very often, find appropriate treatment in electricity, which should be the leading remedy of choice in conservatism: in the *catarrhal* forms it is sovereign, only calmative in *tubercular* forms, and of great service in certain cases of *purulent salpingo-ovaritis.* No electrical treatment once commenced should be terminated until the patient pronounces herself to be symptomatically cured, and until a considerable anatomical resolution can be made out. Surgery should not be demanded in salpingo-ovaritis until electricity in its various forms has proved to be of no avail after a sufficiently long trial. Castration, which morally and physically deforms a woman, which sometimes kills, and which only permanently cures in two-thirds or a half of all the cases, should be the operation of necessity and never of choice, and the ultimate resource of the therapeutics of the adnexæ. The electrical therapeutics which I advise is conservative, inoffensive, easily applied, and which if it does not presume to cure radically all cases of salpingo-ovaritis, finds its amplest reward in the fact that a normal subsequent impregnation is

possible, as I have seen in many of my patients. To conclude.

Within the last ten years gynæcology has undergone a transformation, thanks to the germ-theory and the anti-septic teachings. Surgery has made grand and legitimate advances here, which still abide, by the temerity, born of success, of certain operators ; but this very boldness has made cheap that which morally we should respect. The statistics of such or such a surgeon are to-day so favourable, for so one may urge, that the surgical intervention should *always* be the one of *choice*. I deny this fallacious and erring sophism, for the following reason : certain statistics are brilliant, but go back three or four years, and one will find these same surgeons with a success much less noteworthy, and that their dexterity has been reached at the cost of many victims. This is especially the history of all young surgeons, who, in the operation of hysterectomy, for example, begin with a gloomy mortality. How greatly does the example of Thomas Keith, a man illustrious for his surgical ability and scientific accuracy, merit an ample following, in the decline of his life, at the summit of a world-wide surgical reputation. Like that King of France, he burns that which he admired, and declares with energy and conviction that from henceforth he has something better to do than hysterectomy. It is my

duty to proclaim that electro-therapy does not pose as sovereign, or seek to supplant the knife in all cases, such as ovarian cysts, where its efficacy is recognised. Electro-therapy demands only a hearing, and applies to itself the celebrated formula :—

"Qu' etais-je hier ?—Rien.
Que dois-je être ?—Beaucoup."

I hope, then, my dear Bigelow, that your book will meet with all the success it merits, having the good fortune to find the field of conservative gynæcology in your country already well planted by the hands of Englemann (of St. Louis), of Mundé (of New York), and of L. Smith (of Montreal), and of twenty more whose names are in all mouths.

PARIS, *June*, 1889.

GYNÆCOLOGICAL ELECTRO-THERAPEUTICS.

CHAPTER I.

DEFINITIONS—LAWS—ELECTRIC UNITIES.

THE physical phenomena generally embraced under the heads of *electricity* and *magnetism* are:

1. Magnetism. The action of magnets upon magnetic bodies, and of magnets upon each other.
2. Electrostatics. Action of electric discharges.
3. Electric current. Laws. Chemical and thermal action.
4. Electro-dynamics. Mutual action of currents.
5. Electro-magnetism. Magnetic action produced by the currents.
6. Induction. Currents developed in close circuits by outside electric or magnetic action.

The Electric Current is the dynamic result, or a result of motion, from the destruction of an electric equilibrium in a conductor, and is the effort it makes to restore the equilibrium by the intervention of another conductor. If the primary cause engendering this disturbance of equilibrium is momentary, we have resultant a *discharge*. Should the cause continue, however, the discharge is continuous, and the result is the *electric current*. By *circuit* we mean that the two free ends of the system shall be united, in such wise that the effort at restoration of the equili-

brium may go on, forming a circle, as it were, which is always made up in the same manner. The force producing the disturbance of equilibrium is the *electro-motor force.* This is the cause producing the difference of *potential* by which a true current is generated. The apparatus exciting this force is called a *generator.* The *resistance* is the measure of the value of the *obstacle* in the conductor, made up of its material particles, to the free transmission of the fluid. It *is the inverse of its conductibility.* This resistance depends upon the nature and dimensions of the conductor. Ohm showed that the resistance, in conductors of similar nature, was *inversely proportional to a section of the conductor* at the surface, obtained by cutting the conductor perpendicularly to its length. As a circuit is generally made up of conductors of different kinds, having different resistances for the same dimensions, it becomes most important to have a common *unit of resistance.* Hence *Ohm's* law, which will be discussed under the head of electric unities. It must not be forgotten, however, that the *electric intensity of a current is the same in all parts of the circuit, but with different tensions in each part,* no matter how different may be the parts of which the circuit is composed. The *potential* characterises the electric condition of a body, just as *temperature* does its heat; in a certain sense it may be said to measure the *quality* of the electricity, and not its *quantity.* It must never be confounded with *tension.* Take two conductors, A and B; if they give the same reading at the électromètre they are of the same potential, and if a communication be established between them there will be no change in their respective conditions. But if the potentials be different, and a communication be established, *positive* electricity will pass from the potential of greatest absolute value to the weaker potential, until the two bodies are of the same intermediate potential between the primary potentials. This potential may be positive or negative according to the values of the primitive potentials, and according to the form and dimensions of the body putting them into communication. The difference of potential in an electric circuit may be measured *directly* or *indirectly;* électromètres for the direct method and the galvanomètres for the indirect method.

These latter, which are usually employed to measure the intensity, serve equally well for the measure of potential or electro-motor force. Electroscopes simply define the difference, électromètres measure it. The *tension* of a current is the property of the electric fluid to give impulse to the electric movement, and to produce effects similar to those of Franklin's electricity. It is the quantity of electricity set free when the poles of the pile are not united, and which escapes during the period of recomposition. The *electric intensity* is the maximum of effect of the electro-motor force. It is always in relation with the quantity circulating in the conductor, and should depend upon the value of the electro-motor force and the resistance opposed to the passage of the current by the conductor. The intensity is the same in all points of the circuit, and is really the quantity of electricity passing any part of the circuit in a second. The *conductibility* of a body is the property it possesses of transmitting the electric current with more or less ease.

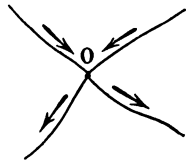

Fig. 1.—Kirchoff's Law.

LAWS.

Ohm's Law.—$I = \frac{E}{R}$, *i.e.*, the intensity of a current is proportional to the electro-motor force, and inversely proportional to the resistance of the circuit.

Kirchoff's Law.—1. The sum of the intensities of currents passing through many conductors is nil at any point to which they run, if those are considered as positive (+) currents which are directed to this point, and as negative (−) those which depart from it.

2. If many conductors form a closed polygon, the sum of the products of resistance of each conductor by the intensity of the corresponding current is equal to the algebraic sum of the

electro-motor forces acting upon the given contour, and consequently O, if there is no electro-motor force. The first theory is evident. There could be no accumulation of electricity at O. The second point in Kirchoff's law involves a consideration of the variation of the potential in the course of the circuit. (See Fig. 1.)

Joule's Law.—The heat energy disengaged on a conductor during a given time is equal to the product of the square of the intensity by the resistance of the conductor; or the quantity of heat (H) set free in a conductor is proportional to the resistance of the conductor (R) by the square of the intensity (I), and by the time (t) during which the current passes. $W = R I^2 t$. Combining this with Ohm's law, and we have

$$W = E I t = \frac{E^2}{R} t,$$

in which E is the difference of potential between the two extremities of the resistance (R). Let Q be the quantity of electricity going through the conductor in a given time (t), by Faraday's law we have $Q = It$, and the law of Joule becomes $W = QE$.

Another application of Joule's law is the work produced by currents. W being equivalent to the passage of a current in a conductor and representing work, we have

$$W = I^2 R t = E I t = \frac{E^2}{R} t.$$

Now by Faraday's law, $Q = It$, we have $W = QE$.

This special form of electric energy may be *chemical* (electrolysis) or mechanical (work) or heat energies.

Faraday's Law.—A simple body cannot be an electrolyte. Electrolysis is only produced when the body is in a solid state. The amount of electro chemical action is the same at each moment in all points of the circuit. The quantity of an ion (a body produced by electrolysis) liberated by an electrolyte in a unit of time is proportional to the intensity of the current. The quantity of an ion liberated in a second by an electrode is equal to the intensity of the current multiplied by the electro chemical equivalent of the ion. The *electro chemical equivalent*

of a body is the relation of the quantity of electricity which traverses an electrolytic tub to the mass of the body set free by its action. The quantity of electricity which traverses an electrolyte within a given time is equal to the mass of the ion liberated, divided by the electro chemical equivalent of the ion.

Ampère's Law.—Two elements of a current (ds, ds'), traversed by currents of intensity (i and i'), attract or repel each other, following the line which joins their centres with an elementary force :

$$df = \frac{ii'ds\,ds'}{r^2}\left(\cos w - \frac{3}{2}\cos a \cos a'\right)$$

in which r is the distance of the centres of the elementary conductors, w = the angle formed by the two elements, a and a' the angles that they form, one with the right which unites them, the other with its prolongation. When f is positive there is attraction, when f is negative there is repulsion. Uniting the intensities in terms of the electro magnetic unities, the formula becomes :

$$df = \frac{II'ds\,ds'}{r^2}(2\cos w - 3\cos a \cos a').$$

If ds, ds', and r are expressed in centimètres, I and I′ in C. G. S. (see "Electric Unities") electro-magnetic unities, f must be read in *dynes*.

Theorem of Coulomb.—The electric force of a point (electrostatics) infinitely near the surface of a conductor in equilibrium, whatever may be the nature of other agitating masses, is equal to the product of the electric density in the neighbourhood of the point multiplied by 4π.

Resistance of a Conductor.—$R = \frac{al}{s}$, in which l represents the length, s a section, and a the factor depending upon the physical nature of the body forming the conductor, *i.e.*, the resistance is proportional to its length, inversely proportional to its section, and proportional to a.

Specific Resistance.—$a = \frac{Rs}{l}$.

Conductibility.—Is the inverse of the resistance or $\frac{I}{R}$.

Chemical Unities.

The greater part of quantities which one uses in physical sciences can be explained in terms of three unities, which take the name of "*fundamental unities.*" All the others are included under the head of "*derived unities.*"

The International Congress of Electricians, which met in Paris in 1881, adopted the British system:—

Unit of length . .	Centimètre . .	Symbol, L.
Unit of mass . . .	Gramme-masse . .	Symbol, M.
Unit of time . . .	Second . . .	Symbol, T.

This system is called the *Système centimètre-gramme-seconde*, and is abbreviated as *Système C. G. S.*

The Unit of Length has the value of the hundredth part of a mètre. The mètre is the ten-millionth part of a quarter of the earth's meridian.

The Unit of Mass has the value of a cubic centimètre of distilled water at a temperature of 4° C.

The Unit of Time.—The second is $\frac{1}{86400}$ of a solar day, *i.e.*, the day of average length between the longest and shortest day.

The Multiples are:—

	Mega	=	1,000,000 units.
	Myria	=	10,000 ,,
	Kilo	=	1,000 ,,
	Hecto	=	100 ,,
	Deca	=	10 ,,
Sub-Multiples. . .	Deci	=	$\frac{1}{10}$ of a unit.
	Centi	=	$\frac{1}{100}$,,
	Milli	=	$\frac{1}{1000}$,,
	Micro	=	$\frac{1}{1000000}$,,

Thus a mégohn means a million of ohms; a milliampère is the thousandth part of an ampère.

Unities of Length. English:—

1 mil ($\frac{1}{1000}$ of an inch)		=	0·00254 centimètres.
1 inch		=	2·54 ,,
1 foot	= 12 inches . .	=	30·48 ,,
1 yard	= 3 feet . .	=	91·44 ,,
1 fathom	= 2 yards . .	=	182·88 ,,
1 statute mile	= 1760 yards . .	=	1609·31 mètres.
1 nautical mile		=	1852·30 ,,
1 furlong	= $\frac{1}{8}$ mile = 220 yards	=	201·17 ,,

Units of Volume. English :—

1 cubic-inch	=	16·3862	centimètres cubes.
1 cubic-foot	=	28·316	décimètres cubes.
1 cubic-yard	=	764·535	,, ,,
1 pint	=	0·568	,, ,,
1 gallon	=	4·543	,, ,,

Unit of Speed.—The unit C. G. S. of motion is that of a body moving in a right line of uniform movement, and moving one centimètre in a second.

Its dimensions are $\left[\frac{L}{T}\right]$ or $[L\,T^{-1}]$.

Angular Movement.—This is expressed by w, which, multiplied by the distance r of a point at the axis of rotation gives $v = wr$, or $w = \frac{v}{r}$. It is there homogeneous with the *inverse* of *the time*. Its dimensions are $[T^{-1}]$.

Units of Weight and Force :—

1 dyne	=	1·01937	milligramme.
1 mégadyne	=	1·01937	grammes.

In English :—

1 grain (troy)	=	64·8	milligrammes.
1 ounce (avoirdupois) . .	=	23·3495	grammes.
1 pound ,, . .	=	453·59	,,
1 cwt. = 112 lbs. . .	=	50·8	kilogrammes.
1 ton = 20 cwts. . .	=	1·01605	,,

Unit of Energy.—This has the name of *Erg*. It is the work produced by one dyne acting through a space of one centimètre. Its dimensions are $\left[\frac{ML^2}{T^2}\right]$ or $[ML^2T^{-2}]$.

Electric Units.

Electro-Magnetic Units. Unit of Intensity.—This is the *Ampère*, and is equal to 10^{-1} unit C. G. S. It is a current of intensity equal to one C. G. S. unit when, traversing a circuit of one centimètre of length rolled in the arc of a circle whose radius is one centimètre, it exercises a force of 1 dyne upon a magnetic pole of one unit of intensity placed at its centre.

Unit of Quantity.—The *Coulomb*, equal to 10^{-1} unit C. G. S., and is the quantity of electricity traversing a circuit during a second when the intensity of the current is equal to one unit C. G. S.

Unit of Electro-Motor Force. The *Volt.*—When a certain quantity of electricity (Q) traverses a conductor under the influence of an electro-motor force (E), the work is equal to the product QE. Its value is 10^{8} C. G. S. units. One volt will send one coulomb of electricity through one ohm of resistance.

Unit of Resistance.—This is known as *Ohm.* Its value is 10^{9} C. G. S. units. It is a conductor with a resistance of one unit C. G. S. when an electro-motor force (or more exactly a difference of potential) of one unit C. G. S. between its two extremities, causes a current of one unit C. G. S. of intensity to circulate in the conductor. The law of Ohm thus becomes :—

$$1 \text{ ampère} = \frac{1 \text{ volt}}{1 \text{ ohm}}$$ } one ampère will deliver one coulomb per second.

Unit of Capacity.—Known as the Farad = 10^{-9} C. G. S. units.

In reality we use a much smaller unit, known as the *microfad*, whose value is 10^{-15} C. G. S. units or 10^{-6} farad. A condenser of one microfad, charged with a potential of one volt, holds a quantity of electricity equal to one micro-coulomb.

Unity of Electric Energy.—Known as the *Joule* or *Volt-coulomb* :—

1 joule	=	10 meg-ergs.
1 joule	=	$\frac{1}{9{\cdot}81}$ kilogrammètre.

Unit of Electric Power.—The *Watt* or *Volt-ampère* :—

1 watt	=	10 meg-ergs per second.
1 watt	=	$\frac{1}{9{\cdot}81}$ kilogrammètre per second.
1-horse power . . .	=	746 watts.

TABLE OF QUANTITIES AND ELECTRO-MAGNETIC UNITS, C. G. S.

Nature of Quantities.	Symbol.	Name of the Unit.	Number of Units C. G. S. enclosed in a Working Unit.	Dimensions of Quantity.
Resistance	R.	**Ohm**	10^9	LT^{-1}
Electro-motor force . .	E.	**Volt**	10^8	$M^{\frac{1}{2}}L^{\frac{3}{2}}T^{-2}$
Intensity	I.	**Ampère**	10^{-1}	$M^{\frac{1}{2}}L^{\frac{1}{2}}T^{-1}$
Quantity	Q.	**Coulomb**	10^{-1}	$M^{\frac{1}{2}}L^{\frac{1}{2}}$
Capacity	C.	**Farad**	10^{-9}	$L^{-1}T^2$

The *Ohm* represents the resistance of a column of mercury one millimètre square and 1^m0486 high at 0^o centigrade. This is about the resistance offered by an iron telegraph wire 4 millimètres in diameter and 100 mètres in length. A *Daniell's* element represents about 1·07 *volts*. The element of *Latimer-Clark*, which is very constant in open circuit, gives 1·435 volts. The ampère is the unit of intensity universally employed.

Electro-Magnetic System.—*Quantity of magnetism* (*m*). The law of Coulomb gives $(m) = (L^{\frac{3}{2}}M^{\frac{1}{2}}T^{-1})$. *Magnetic power* ($\Phi$). *Intensity of current* (*I*). From the above

$$(\Phi)=(I)=(L^{\frac{1}{2}}M^{\frac{1}{2}}T^{-})$$

Quantity of Electricity.—(Q) The quantity being the product of the intensity by the time, we have $(Q)=[L^{\frac{1}{2}}M^{\frac{1}{2}}]$ and so on, for the resistance, electro-motor force and capacity as already given in the table of quantities. By combining the electro-static and the electro-magnetic system of units we find that the latter is *a* times as great as the former. It has been found (method of Weber, method of Kirchhoff, method of Lorenz) that the value of *a* is a velocity of $3\cdot10^{10}$ centimètres per second, which is exactly that of light in space.

CHAPTER II.

CURRENTS.

THE GALVANIC, THE FARADIC, THE FRANKLINIC.

The Experiment of Galvani.—Whenever, in a frog recently prepared, the lumbar nerves are brought into communication with the muscles of the leg by means of a metallic arch made of two metals—zinc and copper, for instance—the muscles undergo decided contractions. Galvani attributed the first cause to the frog; he compared the action to that of a Leyden jar, the nerves forming the interior curvature, the muscles the external, and he believed that the charge engendered by action of the vital forces and the metals was only the excitor creating the discharge.

Volta's Law of Contact.—Volta admitted the electric nature of the phenomenon, but struck by the fact that the contact of two metals was necessary to the success of the experiment, he relegated to this contact the origin of the electricity, the frog being only a very sensitive electroscope. He therefore announced the following law:—

"The contact of two metals and, most generally, of any two heterogeneous bodies, suffices to establish between these bodies a difference of potential. This difference depends upon the nature of the bodies and upon their temperature; it is independent of their dimensions, of their form, of the extent of their surfaces in contact, and of the absolute value of the potential in each of them."

The Pile of Volta.—After many experiments he established

first: that if two metals terminating a pile are identical, the extremities are of the same potential; and second, the difference of potential of metals removed from each other is the same as if they were in contact. Acting upon these ideas he constructed a pile, which is always known by his name.

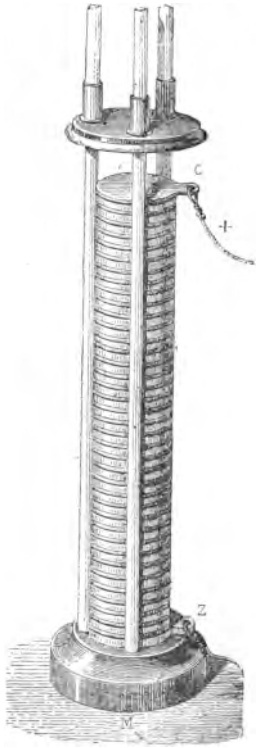

Fig. 2.—The Pile of Volta.

First he placed a disc of copper upon an insulated support upon this he placed a disc of zinc; whatever might be the potential of the copper disc, that of the zinc was $V + a$, in which a is the electro-motor force of contact between the two discs. Then he put a strip of cloth between them, soaked in acidulated water; these, acting as simple conductors, took the potential $V+a$ from the zinc. But a new disc of zinc placed

upon the copper brought the potential V + 2*a*, and so on in such wise that when *n* couples were superimposed, zinc and copper, in the same order, separated by strips of cloth, a *pile* was constructed whose upper extremity had a potential of V + *na*, and which, between its two extremities, gave a difference of potential equal to *na*, this difference being constant and independent of V. So that if the inferior extremity of the pile was placed in communication with the ground its potential became zero, while that of the upper extremity was +*na*. If, on the contrary, the superior extremity was zero potential, the inferior became — *na*. The two extremities of the column are the *poles* of the pile. *The positive pole is at the extremity where the last layer of cloth is followed by a disc of copper; the negative pole at the extremity where the last layer of cloth is followed by a disc of zinc.*

Weakening of the Pile.—The pile is then an electric machine, having the property of presenting a constant difference of potential. If the two poles be connected with a conducting wire the positive electricity, which always tends to pass from the higher to the lower potential, forms a continuous flow from the positive pole to the negative pole, and gives name to the *electric current*. But experience shows that the effects produced diminish rapidly in intensity; on the other hand, if the two poles are left for some time united by a conducting wire, and then separated and connected with an electromètre, the electromotor force will be found to have diminished considerably.

Modifications of the Pile of Volta.—The weakening of the current was attributed to the desiccation of the cloth pressed between the discs; so the *couples* were substituted for the column, which at first were arranged horizontally in a trough, then followed the pile of glass vessels, in which each vase holding the acidulated water received a plate of zinc and one of copper, the copper of one vessel communicating with the zinc of the other. This couple, formed by a vase with a plate of zinc and one of copper, connected by a copper wire, constituted the *couple of Volta*. In open circuit the couple of Volta equals nearly one volt.

Polarization of the Pile.—The true cause of the weakening of the pile of Volta is due to the chemical action originated by the conductor giving rise to the current. The acidulated water is decomposed; the oxygen going to the zinc, forming a sulphate of zinc, and the hydrogen going to the copper. The surfaces being thus changed, one by sulphate of zinc and the other by hydrogen, the electro-motor force at point of contact is changed, and sometimes so diminished as to annul the electro-motor force of the pile altogether. The pile is then said to be *polarized.*

Employment of Amalgamated Zinc.—While the impure zinc of commerce dissolves in acidulated water, giving out sulphate of zinc and hydrogen, pure or amalgamated zinc remains intact

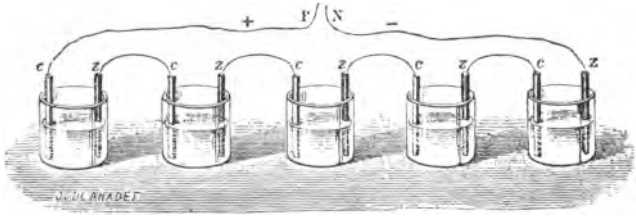

Fig. 3.—The Couple of Volta.

in open circuit; chemical action only takes place when the circuit is closed, and is correlative with the amount of current produced.

Non-polarizable Couples.—To prevent polarization, it is necessary to suppress the formation of the bed of hydrogen formed at the surface of the metal which forms the positive pole. Instead of the copper plate, one of the oxide of copper was substituted, as hydrogen acts only slightly upon it. In the couples of *bichromate of potash* the acidulated water is replaced by a solution of the bichromate of potash, and the copper plate gives way to one of charcoal. The hydrogen reduces the bichromate at the point of contact, and is not given off as a gas. But a better result is obtained in couples making use of two liquids. Of these *Daniell's couple* is probably the best. This is composed of a vase, separated into two compartments by a porous partition,

either animal or vegetable membrane or china; one chamber holds the acidulated water and a disc of amalgamated zinc, the other a disc of copper and a solution of the sulphate of copper. While the zinc in one chamber forms sulphate of zinc, the sulphate of copper in the second chamber is decomposed and deposited upon the copper disc. The surfaces of the metals are always in the same condition, and the current is constant.

The *couples* of *Latimer Clarke* are composed as follows:—Zinc | Sulphate of Zinc || Sulphate of Mercury | Mercury. The electro-motor force of these couples is from 1·495^{v} to 15°, and varies 0·00078^{v} per degree, the electro-motor force diminishing as the temperature increases.

Fig. 4.—A Daniell's Cell. E = 1·07 volts.

Leclanché Pile.—Amalgamated zinc, chlorhydrate of ammonia, and charcoal surrounded by the peroxide of manganese. E = 1·48 volts, when not polarized. At 15° C. the solubility of the chloride of ammonium is 26·297 per 100, and the density of the saturated solution 1·0766. 1 ampère hour requiring 1·22 gr. zinc and 2·0062 gr. of the chloride of ammonium, 1 litre of the saturated solution ought to furnish 130 ampère hours.

Pile of Onimus.—This pile is composed of an exterior vase of glass (A, Fig. 5) enclosing a small cylinder of zinc (Z), and a stem of copper terminating in a copper disc (*c* in drawing *b*). In the middle of the vase and surrounded by the zinc there is a glass

tube (B), open at both ends, but the inferior extremity being closed by a porous substance (*f*). In this tube B we put crystals of the sulphate of copper until the tube is half full. To start the current ordinary water is poured into the external jar, and in the tube containing the crystals of copper, until it reaches the upper edge of the zinc. This gives an excellent current, very constant, and one that will last for months.

Pile of Gaiffe.—Non-amalgamated zinc, silver surrounded by chloride of silver and a solution of the chloride of zinc 5 per 100. E = 1·02 volts.

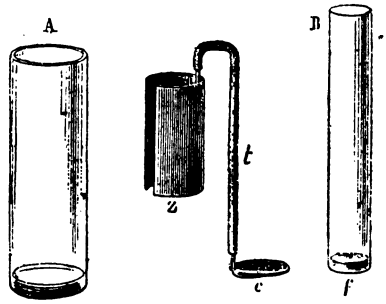

Fig. 5.—The Pile of Onimus.

Theoretic Conditions of a Perfect Pile.—

1. Great electro-motor force.
2. A feeble and constant interior resistance.
3. The electro-motor force to be constant.
4. Cheapness.
5. Practical arrangement of the cells so that they can be easily cleaned.

Faults of Piles.—When a battery refuses to give the proper effects, the cause may be:—

1. The solution may be weak.
2. Bad contact of electrodes, oxidized points, bad application.
3. Elements may be empty or only partially filled.
4. Metallic deposits causing short circuits between the electrodes in the interior of the pile.

Choice of Piles for Medical Purposes.—The Law, Leclanché,

Daniell, Onimus, Trouvé, or those of mercury and the chloride of silver.

Electrolysis.—If the interpolar wire be cut, and both ends be plunged into a liquid in such wise as to complete the circuit by a column of the fluid, two facts arrest attention: either the liquid acts as the air does, allowing no current whatever to pass, or the current passes and the liquid is decomposed. Except when acting upon a simple body, as mercury, a liquid never acts as a simple conductor, and never allows any electric current to pass without correlative decomposition (Fig. 6). This is called

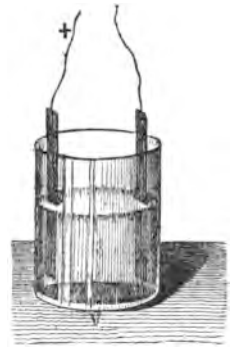

Fig. 6.—Electrolysis.

electrolysis. The liquid liable to be decomposed is an *electrolyte*, and the *electrodes* are the two conductors, one at the entrance and the other at the exit of the current. The one connecting the positive pole is called the *positive electrode*, and the one connecting the negative pole the *negative electrode.* Liquids properly so called, pure water, alcohol, æther, etc., are not true electrolytes. Salts are. A salt is the union of a metal with a simple radical (Cl, Br), or a compound radical (So^4, AzO^6). Under the action of the electric current *the separation is always between the metal and the radical to which it is united.* The elements of decomposition never appear in the liquid, but only in the electrodes, *the metal at the negative electrode, the radical at the positive electrode.* The *polarization of the electrodes* is the difference of potential which exists between them, and is inversely to that

which produces the current. The quantity of electricity furnished by a single couple is the same as that given by a series of couples, united equally, by their opposite poles. Negative electricity is always found at the metal most vigorously attacked.

The *capacity of polarization* will depend upon the conditions and dimensions of the discs.

The Secondary Current is due to the electro-motor force of polarization, and is a current passing through the liquid in an opposite direction to the primary current, and exteriorly from the positive electrode to the negative. The quantity of this current is equal to that which produces the polarization.

Chemical Work of Piles.—In a good pile there is chemical action only when the circuit is open. When the circuit is closed, the chemical action is that resulting from the passage of the current according to the law of Faraday. In Volta's couple the current traverses the acidulated water from the disc of zinc to that of copper. Hydrogen disengages at the copper, sulphuric acid and oxygen, giving sulphate of zinc, are found at the zinc disc. For each coulomb traversing the couple the zinc expended is $33a = 0{\cdot}00034^{qr}$.

Energy of Piles.—If the total of chemical energy is converted into electric energy, q representing the quantity of heat resulting from the reactions equal to a coulomb, the electro-motor force (E) of the couple has for its expression—

$$E = 0{\cdot}0432q.$$

Thus in Daniell's couple there is an equivalent of 25·300 calorics set free, and we have—

$$E = 25{\cdot}300 - 0{\cdot}0432 = 1{\cdot}09 \text{ volts.}$$

The Faradic Current

(*Also known as the "Induced Current"*).

Faraday discovered in 1832 that a wire traversed by an electric current, and brought suddenly near to another wire in its natural condition, developed, in this latter, an instantaneous current of electricity (Fig. 7). If the wire traversed by the

current, instead of approaching the normal wire, is withdrawn from it, the result is the same; but if the wires remain quiescent beside each other, nothing is produced. If, instead of the wire

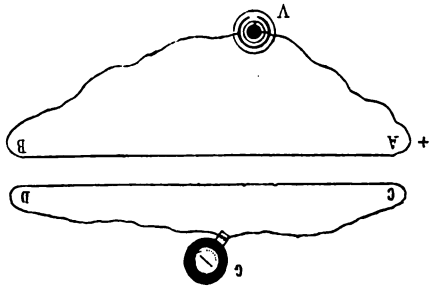

Fig. 7.—Illustrating Faradic Current.

charged with electricity, a magnet is approached or removed from a normal wire, the same effects result. A magnet when brought near to a closed circuit causes a current opposite to

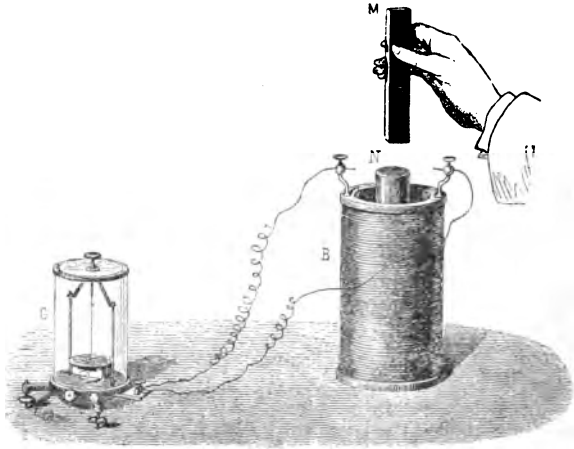

Fig. 8.—Solénoïde.

that of the magnet considered as a solénoïde (a solénoïde is a series of parallel circular currents). A current at a slight distance causes in this a current of the same kind as that of a magnet regarded as a solénoïde (Fig. 8). The inductive action

attains its maximum when the two wires are *parallel*. Hence are derived two important facts:

(*a*) A current started causes in a neighbouring closed circuit a current opposite to it.

(*b*) A current finishing causes in a neighbouring circuit a current of the same kind.

To produce an induced current of considerable energy, instead of acting upon rectilinear wires, the wire may be wound around a wooden cylinder; the wire is covered with silk, so that the spirals are separated from each other. Above

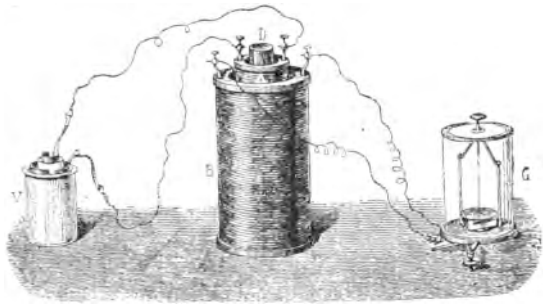

Fig. 9.—Electro-Magnetic Current.

this first wire, a second wire is wound around, also covered with silk. This is what is called a bobbin of induction. The wire in which the current will be started is the *inductive wire*, the other wire which receives the currents so produced is the *induced wire*. By augmenting the number of turns a strong current can be produced. A most ingenious contrivance is that of placing a series of stems of soft iron in the interior of the bobbin. Under the influence of the induced current, this soft iron becomes magnetized, and adds its action to that of the current, considerably augmenting it (Fig. 9). This is the electro-magnetic current of Faraday.

Self-Induction.—A current passing through a circuit produces in it a certain flow of force. The coefficient of self-induction of a circuit is the relation of the variation of the flow of the force embraced in the circuit to the variation of the intensity of the

current traversing the circuit. The self-induction of a current has for its effect the opposition it offers to the variation of the flow of force, and to hinder, for example, the current from assuming its usual value. A bobbin in which the coefficient of self-induction is L, absorbs a certain quantity of energy under an unknown form, an energy which contains a certain potential, and whose value is equal to $\frac{1}{2} L_s I^2$. This energy re-appears at the breaking of the circuit under the form of an *extra current*, more intense and larger than L_s, with a more brusque interruption, that is, the energy manifests itself in a shorter time. In this case the spark which follows the breaking of the circuit is much more pronounced than the spark of closing, and produces physiological effects more exaggerated. The force of currents depends upon the force of the pile, and the size and length of the wires. Their *force* is in direct relation to the size and length of the wires; their *tension*, in relation to their length and tenuity. The inductive wire is shorter and thicker than the induced wire, which latter is long and thin. In the inductive wire at each interruption of the current of the pile, the *extra current* is produced.

Quantity of Electricity.—The quantity (dm) of electricity set free in a circuit during the time (dt) has a value:

$$dm = idt = \frac{dq}{R}.$$

The total quantity (m) corresponds to a known variation ($q_2 - q_1$) of the flow obtained from making the sum of all the expressions alike, and has for a value

$$m = \frac{q_2 - q_1}{R}.$$

Hence the total quantity of *electricity put in movement by induction is equal to the quotient of the total variation of the flow by the resistance of the circuit.*

Law of Lenz.—"The significance of an induced current is always that, which by its electro-magnetic action tends to oppose itself to displacement." Sir W. Thomson and Helmholtz deduced from the general laws of induction the principle of the conservation of energy. This law of Lenz modified by

Maxwell is: "The significance of the induced current in a circuit of a given variation of flow force, is that which opposes itself at each moment to the variation by the flow which it produces itself." If the flow *augment*, the induced current should oppose itself to the augmentation, and be, consequently, inversely to that which produced the flow. If the flow *diminish*, the induced current should oppose itself to the diminution, and hence be of the same definition as that which produced the flow.

Franklinic Electricity.

Electrostatic actions manifest themselves in electrical bodies under the form of charges. The quantity of electrization of a body gives the measure of the charge, and the nature of that charge by its relation to the state of the mean of the ambient determines the sign. The production of a charge of a sign given to a body always determines the production of an equal charge, and of an opposite sign upon another body. So we speak of *vitrous* electrization, positive (+), positive fluids or positive electricity, when the charge is occasioned by rubbing a glass with a bit of silk; and of *resinous* electrization, *negative* (−), negative fluid or negative electricity, when we rub with flannel pieces of resin, of gum, of rubber, or of amber. *Neutral bodies* are those which give no evidence of electrization.

Laws of Attraction and Repulsion.—Two bodies having the same sign repulse each other; those of opposite signs attract each other. The attraction or the repulsion of two charged bodies is proportional to the product of the charges, or inversely proportional to the square of their distance (Coulomb). Let q and q^1 stand for the charges, d the distance, and k a mean constant; the force (f) is:

$$f = k\frac{q\,q'}{d^2}.$$

Electrostatic Potential.—The electrostatic potential (V) at a point, caused by a charge (q), is the relation of that charge q at

the distance (r) from the point to the charge supposed to be active at a point:

$$V = \frac{q}{r}.$$

In considering many different charges both as to size and sign, the formula is:

$$V = \Sigma \frac{q}{r}.$$

Electrostatic Capacity.—The electrostatic capacity (C) of a charged body is its relation of its charge (Q) to its potential (V),

$$C = \frac{q}{v}.$$

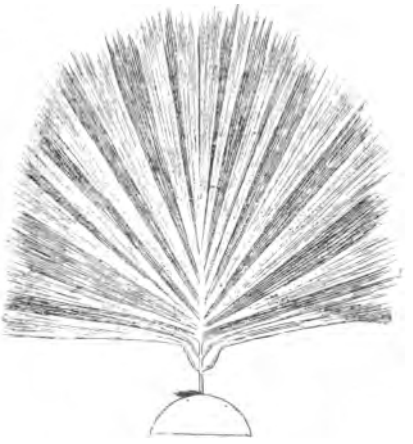

Fig. 10.—The Tuft.

Electrostatic Induction.—This is the action of a charged body upon a neutral body without touching it. In all neutral bodies induction precedes attraction.

Conductive and Disruptive Discharges.—At the instant of establishing a communication between a charged body and the ground, or between the two arms of a condenser (Leyden jar), a spark is always produced. This spark may use up a large or small part of the available energy. In the last case it is *conductive*, in the first case it is *disruptive*.

Disruptive Discharge.—Presents itself under three heads: the *spark*, the *tuft*, and the *gleam*. At short distances the spark is bright, pronounced, and brilliant. As the distance

increases or the capacity of the conductor diminishes it becomes zigzag and less luminous. The tuft has a violet tint, and is accompanied by a characteristic noise (Fig. 10).

The *gleam* is produced by diminishing pressure. This is the principle of Geissler's tubes, in which the pressure is reduced to a few millimètres. Two wires of platinum welded in a glass serve as electrodes. The gleam seems always to come from the positive pole, the negative pole being surrounded by a violet aureole, followed by a space more obscure. The spark is caused by a volatilization of minute particles of the metals, and the gleam by the incandescent gas.

Explosive Distance.—The length of the spark, or the explosive distance, depends upon the difference of potential between the two electrodes. It differs a little according to the form of the electrodes; thus for the same distance the difference of potential is greater with two spheres than with two discs.

Distance of two spheres.	Difference of Potential.	
	In Electric Unities C.G.S.	In Volts.
0·1	18·3	5490
0·5	89·1	26730
1·0	162	48600
1·5	190	57000
2	216	64800
3	256	76800
5	316	94800
10	397	119100
15	426	127500

In the air the explosive distance of the spark and of the tuft is about the same.

The mechanical power (P) of a machine having reached a permanent *règime* is equal to the product E*I* of its storage per second by the difference of the potential of the two poles. The following are the figures given by Mascart. Seven turns of the plate of a double Holtz machine are made to charge a battery whose electrostatic capacity is 22,500 centimètres, so

as to give a spark of one millimètre. The capacity of the battery being $\frac{22,500}{3^2 \cdot 10^5} = 0{\cdot}025$ microfarads and the explosive distance 0·1 centimètre, corresponding to a difference of potential of 5,490 volts, we have for the charge of the battery: $M = VC = 5490 \cdot 0{,}025 \cdot 10^{-6} = 137{,}25 \cdot 10^{-6}$ coulombs, and for the corresponding work: $W = \frac{1}{2} MV = \frac{1}{2} \cdot 5490{,}137{,}25 \cdot 10^{-6} = 0{,}75$ watts.

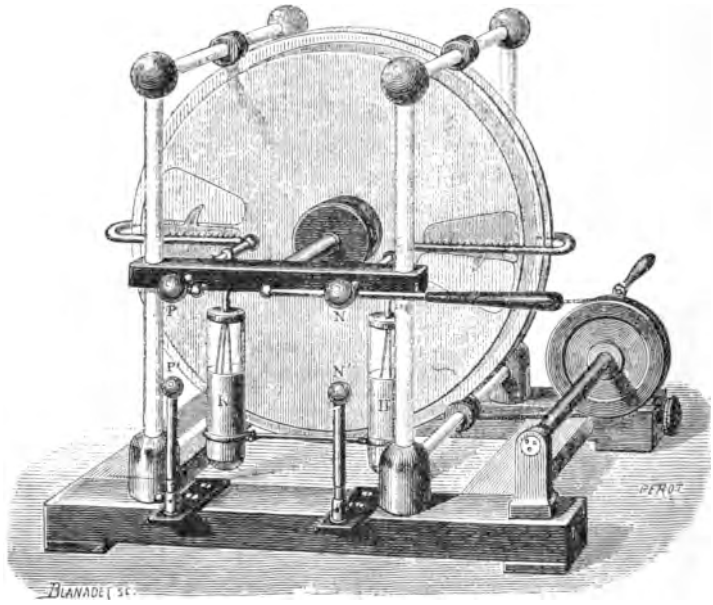

Fig. 11.—The Machine of Holtz.

The storage capacity of the machine is then $137{,}25 \cdot 10^{-6} : 7$ coulombs for each turn; and as its normal amount is ten revolutions per second, we have:

$$I = 0{,}0002 \text{ coulombs.}$$

The machine would then give sparks of twenty-two centimètres, corresponding to a potential of 133,000 volts. If this capacity remained constant for these high potentials, which is not the case, the maximum of the machine would be: $133{,}000 \cdot 0{,}0002$

$= 26{,}6$ watts second, or about $\frac{1}{30}$ cheval vapeur (cheval vapeur $= 75$ kilogrammètres per second $= 736{,}10^7$ ergs second $= 736$ watts second).

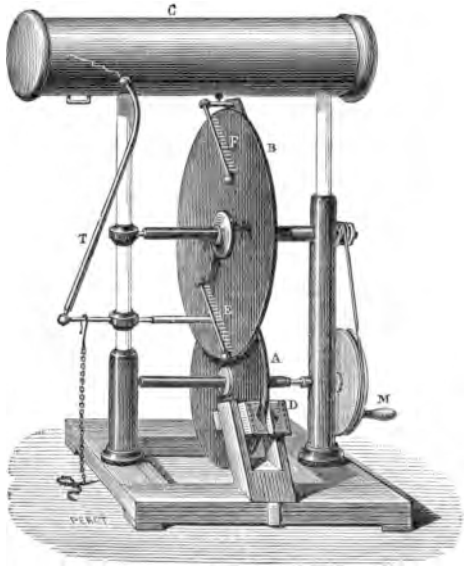

Fig 12.—Carre's Franklinic Machine. With a large plate 49 centimètres diameter we get a spark of 15 to 18 centimètres.

CHAPTER III.

BATTERIES, ELECTRODES, GALVANOMETERS, AND REOSTAT.

The Pile (Fig. 13). — This battery gives an intensity of current within a wide range. Its units may be measured by the galvanometer and its tension governed by the collector, and the current can be reversed gradually or suddenly, *i.e.*,

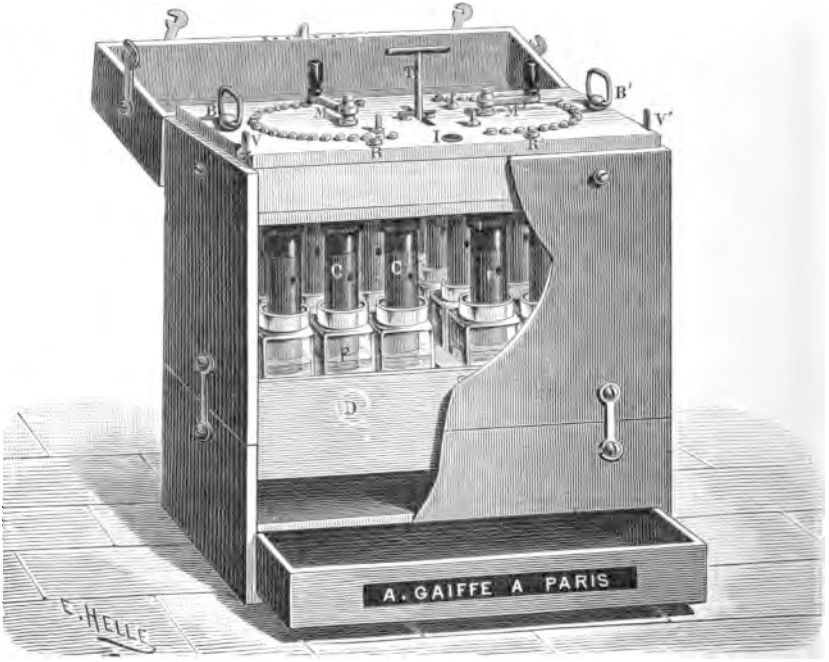

Fig. 13.—Gaiffe's Portable Battery, with Collector.

with or without voltaic shock. The cells can be easily arranged or cleaned. When not in use the zinc should be withdrawn from the liquid. The couples are composed of the sulphate of the bioxide of mercury (portable battery).

1. A drawer at the lower part for reophire and electrodes.

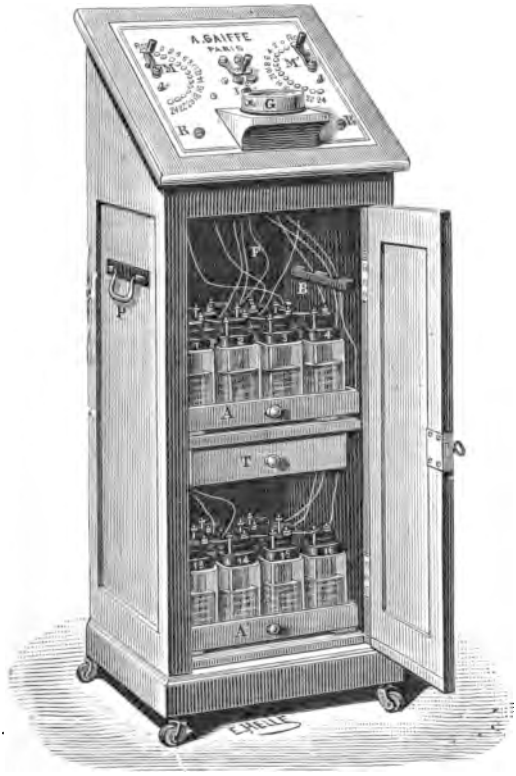

Fig. 14.—Office Battery.

2. At the base is a shelf upon which rests a trough containing (F F′, Fig. 13) the vases that hold the liquid. This trough can be drawn out entirely when it becomes necessary to recharge the jars.

3. The upper part is a shelf, with double sides, which can be displaced, when necessary, by means of the buttons (B B′).

Underneath this table the charcoal (C) and the zincs (Z) of the couples are fixed, while above is the double collector, as shown in the figure. Between the two tables are the conductors which serve to unite the zinc and charcoal of the couples to the collector.

The Couples.—The couples (see Fig. 15) of this battery are formed of a charcoal cylinder, pierced at C. In the middle of the cylinder is a rod of zinc, mounted on a rubber ring (I).

Fig. 15.—Gaiffe's Couples.

When in use this cylinder is dropped into a solution of the sulphate of the bioxide of mercury, which is contained in the vases (F F', Fig. 13). The charcoal and zinc are fixed to the table upon which the collector rests, the first by V V' and the second by the buttons (B B') and the key (in copper), T. This arrangement allows free change of the zinc and charcoal. For the zinc, open the collector table which is closed by V V', turn slightly the knobs B B', then turn the

cross-bar which controls the zinc. This plate is thus withdrawn. The charcoal is controlled in the same way by V V'. The solution is made by intimately mixing 150 grammes of the sulphate of the bioxide of mercury with 90 grammes of commercial sulphuric acid. A litre of water is added until the solution is complete. The liquid should stand until quite clear before being used. Gaiffe prepares a mercuric salt, containing the necessary quantity of the acid, which only requires to be dissolved in water to render an exciter nearly as active as the above. The cross-bar (T) permits the elements to be immersed to any required distance in the fluid.

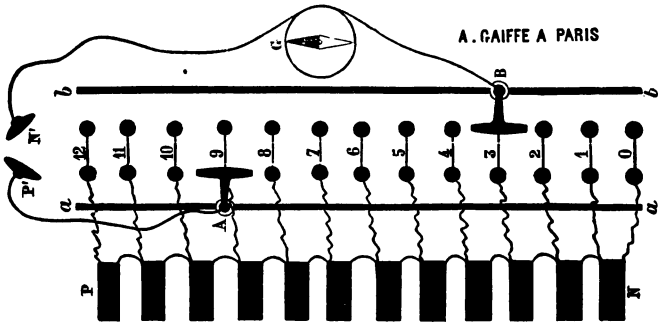

Fig. 16.—Coupling.

Double Collector.—This permits :—

1. Couples, one by one, or two by two, to be introduced into the circuit (see Figs. 16 and 17), according as the battery is arranged for single or double coupling, without any variation of condition, save that which is caused by the increase of tension due to the coupling of additional cells.

2. Any segment of the pile can be introduced into the circuit, so that the same cells need not be constantly used.

3. The current may be reversed without causing voltaic shock.

By pressing upon the button (I), voltaic shocks, more or less rapid, may be produced at will, or the commutator (C C), moving in both directions, will give voltaic shocks by inversion.

Fig. 18 will explain the mechanism of interruption. If the

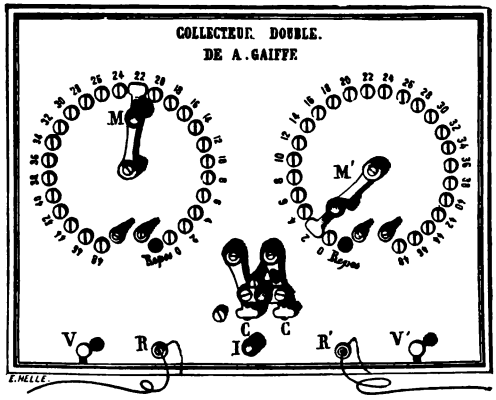

Fig. 17.—The Double Collector.

lever (L) rest upon *a*, the current flows from the pile (P) to

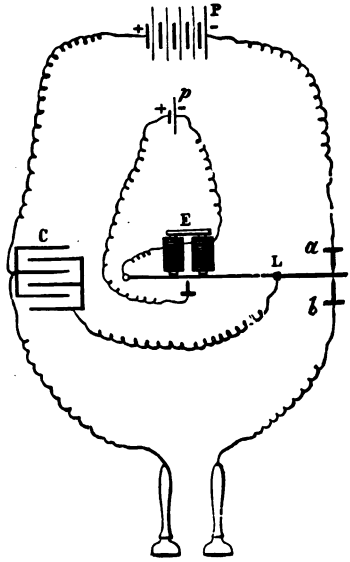

Fig. 18.—The Circuit.

the condenser (C); but if L be in contact with *b*, the current is discharged upon the patient.

Galvanometer (Fig. 19). — D is the pedestal, V V′ screws, S S′ screws for holding the wires, B copper cage holding the apparatus, C ring fixing the galvanometer, and which can be turned for purposes of orientation; M, multiplying frame; G, graduated circle; I, needle; A, needle balance: by pressing the button (V) the balance lifts the needle, and prevents it being moved on its pivot. This is the position always to be insisted upon when the instrument is not in use. This galvanometer is nearly *a periodic*, and having been tested at the Sorbonne, pronounced to be the most reliable one made.

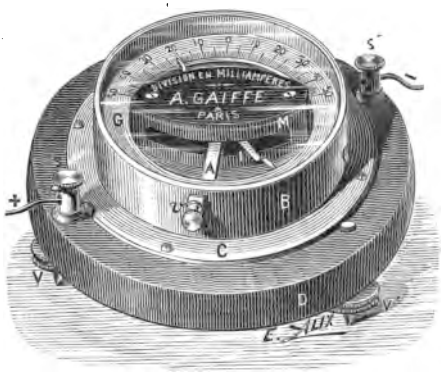

Fig. 19.—Galvanometer.

Rheostat (Fig. 20).—Some physicians, with a view to a more equal current, make use of a Rheostat. With our present means of coupling, carefully managed, there ought to be little or no shock, and since Rheostats entail extra expense, I do not advocate their use. If for any reason whatever the Rheostat (as for example that most excellent one of Massey, for which I confess I have a liking) should get out of order, the whole force of the current would be thrown upon the patient, with, perhaps, fatal effect. This could not happen with the collector. The Rheostat of Gaiffe is one of 40,000 ohms. It is composed of eighteen bobbins having, 1, 2, 2, 5, 10, 20, 20, 50, 100, 200, 200, 500, 1,000, 2,000, 2,000, 5,000, 10,000, 20,000 ohms. The little screws unite or separate the bobbins from their

neighbours, so that a greater or less resistance may be introduced into the circuit. When two neighbours are separated from each other, the bobbin corresponding to them, and whose value is engraved on the top, is in the circuit.

Verification of a Battery.—Connect the galvanometer with the battery. Lift the tray of jars by means of T, until the first cross-bar rests above the collector; then turn T to ninety degrees, letting the tray rest upon the cross-bar which rests upon the two pieces of copper which are guttered out, and which carry the collector table. Then place one of the switches, M for example, upon the 0 of its numbered circle, and M upon the 1 of *its*

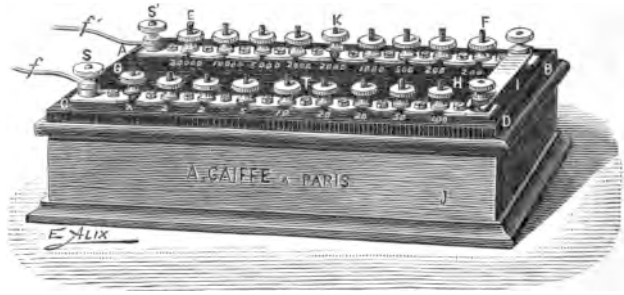

Fig. 20.—Rheostat.

circle; then having noticed the deviation of the galvanometer, push M from zero to 2, and M′ to 3, and so on successively, M to 4, M′ upon 5, etc., noticing at each step the deviation of the galvanometer. If the galvanometer returns to zero, or gives a feeble deviation when the switches are moved, either the jar of the couple communicating with the two switches, which is the one of the highest number indicated upon the switch board, is empty or partially filled, or the conductor connecting the couples with the collector is broken or detached. Having filled the jar, or repaired the conductor, the battery is ready for working. If the battery cease suddenly to function, it is caused by breaking of the carbon, or coating of the zinc, or a bad condition of the rhéophores. If a battery has been a long time out of use, be careful to see, before commencing use, that the

liquid is at a proper height. If the current diminish gradually, the battery must be re-charged, pouring out the used-up fluid, washing the jars and re-filling. If the current pass irregularly, the points of contact of the switches may be oxidized, and the buttons upon which they rest must be cleaned.

How to Work the Battery.—Raise the tray of jars to the height to give a tension current desired. Then unite, by a conductor, one of the pieces (R R′, Fig. 13) of the collector to one of the screws of the galvanometer; from the other piece R R′ and the second screw of the galvanometer, pass the two rhéophores upon which are fixed the handles for the exciters to be used. Then M and M′ (the two switches of the collector) are placed upon the two zeros, or upon the two numbers representing the couples with which one wishes to commence the treatment. If the first half of the battery has been constantly in use, and we wish to give a period of repose to the first twelve couples, for example, place the two switches upon 12, then apply the electrodes, and advance the switch corresponding to the positive electrode, until the desired intensity is attained. There are never any more couples in the circuit than are indicated upon the collector. Yet when an inverse commutator is used, this is not the case, except when the points of contact of the commutator are upon CC. If we wish to reverse the current without shock to the patient, simply transpose the switches by gentle and continuous movement. Voltaic shocks are given by pressing upon I. To produce shocks by inversion of the current, turn CC with greater or less rapidity from left to right, or right to left. To stop the current, turn the switch which is most advanced back to the same number as the other switch rests upon; then remove the electrodes, and turn both buttons back to the buttons of repose.

Shuntage of Galvanometers.—*Shunt* is the derivative established between the posts of the galvanometer in order to reduce the sensitiveness of it to a certain proportion, determined in advance, and to place these deviations within the limits of graduation. In order to reduce the current to $\frac{1}{m}$ of its value, the resistance (S) of the shunt should be:

$$S = i\frac{G}{m-1},$$

G being the resistance of the galvanometer. Generally galvanometers have a box of shunts, three in number, which have for effect a reduction of sensibility to $\frac{1}{10}$, $\frac{1}{100}$, and $\frac{1}{1000}$, and whose values are:

$$\frac{G}{9};\ \frac{G}{99};\ \frac{G}{999}.$$

The Value of *m*.—*m* represents the relation of the current

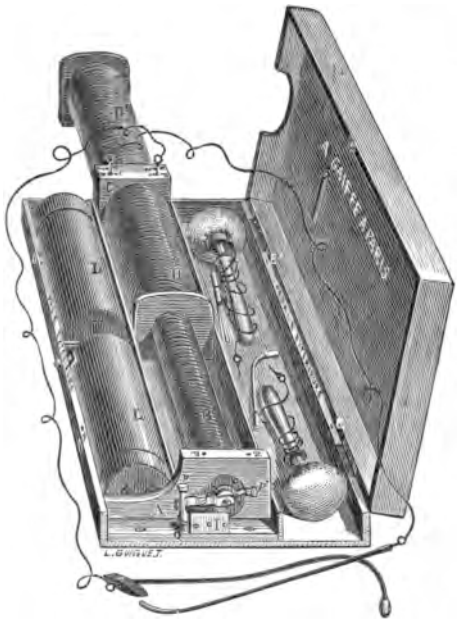

Fig. 21.—Two Couples of the Chloride of Silver. Two Inductive Bobbins.

passing through the galvanometer without shunt to that which passes with shunt:

$$m = \frac{G+S}{S}.$$

Merit Formula of a Galvanometer.—This is the resistance of a circuit which with a Daniell element produces the unit of deviation upon the chart of the galvanometer. A circuit is formed with one Daniell element of resistance (*r*), a rheostat (R),

a galvanometer (G), and the shunt (S); a deviation of d divisions is obtained. The resistance of the galvanometer shunted is G,

$$G = \frac{GS}{G+S},$$

and the multiple derivative (m) of the derivation is:

$$M = \frac{G+S}{S}.$$

The Merit Formula $= md\,(r + R + G)$.

Faradic Batteries (Fig. 21).—All medical batteries of induction are constructed upon a common type (see Fig. 22). In all a pile of feeble tension (A) closes a helicoïdal circuit (B) formed by a wire sufficiently large and short to present no useless resistance to the passage of the current. In all of them there

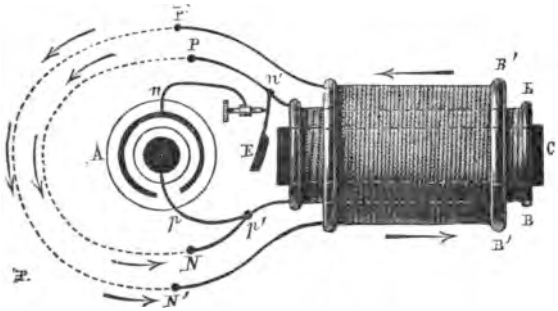

Fig. 22.—The Common Type of Battery.

is, in the circuit, a bar of soft iron, or a fasiculus of iron wires (C), which plays a double *rôle:* by such magnetic or demagnetic currents it acts as an inductor in the circuit, or rather upon the circuits enclosing it, and acts upon the same as does the current of the pile; under like conditions it acts alternately as magnet or as a neutral body upon the hammer of soft iron (E), whose oscillations determine the opening and closing of the circuit of the pile, which thus becomes an automatic interrupter. In all cases the bobbin (B) is covered with a bobbin (B'). The circuit of the bobbin B' is completed by the rheophores attached in P' N', at the end of its wire; while the circuit of the bobbin B is double: closed in an intermittent manner upon the pile, it is completed in P and N by rheophores representing a circuit of

derivation, capable of being closed or opened in a permanent manner. The inverse induced current developed in the circuit B*y* annuls the sensible effects of the pile, which it combats. All induced currents of rupture and demagnetization are direct, and so, in a sense, the *extra current* is in a constant direction. In

Fig. 23.—Small Pocket Battery. Chloride of Silver Piles.

the bobbin B′ the induction of closure and magnetism has its effect, as that of rupture and demagnetism; so induced currents are obtained in directions alternately opposed. The *quantity* of the currents is the same, the *intensity* of the current of rupture—direct current—is greater, and the time during which the variable

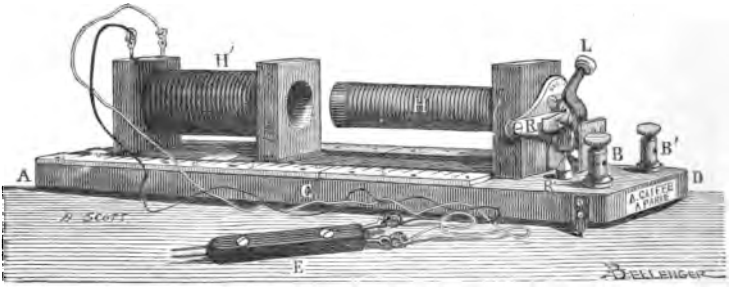

Fig. 24.—Dubois-Reymond.

condition to which it gives rise is shorter than the same condition corresponding to the closed current. The physiological reactions of the induced broken current are much more pronounced than are those of the closed current.

The volta-faradic induced batteries of Dubois-Reymond

pattern are so arranged that the induced bobbin slides in a slot, and can cover more or less, as desired, the inductive bobbin. The maximum of intensity is reached when the induced bobbin completely covers the inductive bobbin (see Fig. 24).

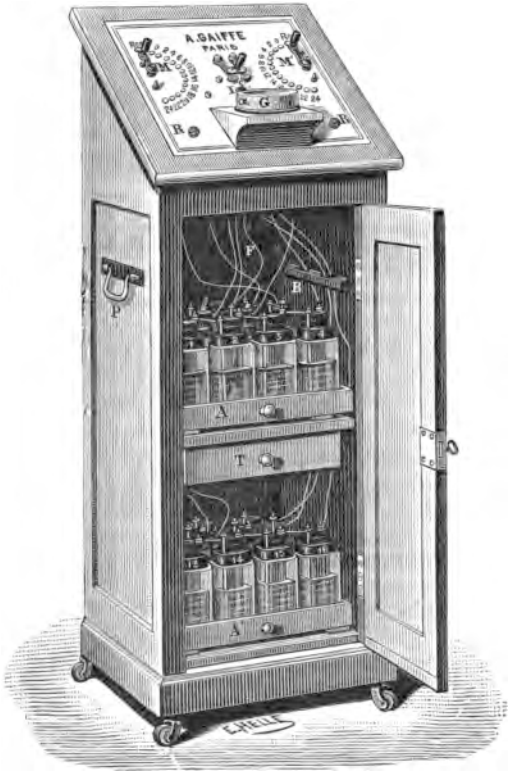

Fig. 25.—Gaiffe's Office Battery.

Gaiffe also makes a convenient cabinet battery with a slanting shelf for the double collector and switches, with the galvanometer on a level. The cells Leclanché are conveniently arranged underneath, and can be easily reached whenever necessary (see Fig. 25, T). Dr. Massey speaks highly of the Law cell, and his description of some batteries made by Otto

Fleming, of Philadelphia, is very inviting. I should think a cabinet battery, such as is presented by the plate in Massey's book, with the addition of the Doctor's rhéostat, would be about as perfect an arrangement as one could wish for. Dr. Massey is known to be a scientific electrician and an honest practitioner, so that one feels perfectly safe in trusting to his judgment in the important matter of the selection of a battery.

Dr. A. J. C. Skene (*Diseases of Women*, p. 372) writes:—"The best modification of the Leclanché battery that has been brought to our notice is the Law battery. Its mechanical construction is of the highest order. It is subject to absolutely no deterioration when not in use—which cannot be said of most batteries, even of the Leclanché pattern. The carbon plate is prepared by a special process, and, with proper care, lasts indefinitely. The only parts that require renewal are the zinc and the exciting fluid, and these but once in two or three years in ordinary office use. This is an important advantage over other forms of the Leclanché cell, in which the carbons as well as the other elements require renewal, from time to time, at an expense little short of the first cost of the cell.

"For cautery purposes, it is not unlikely that a small portable battery of storage cells will be found most suitable. They can be readily recharged during the intervals of use by means of a few gravity cells. The well-known cautery batteries of Piffard, Dawson, and Byrne are extensively employed, but are inferior to a good storage battery in reliability and in convenience of use.

"There is a common misapprehension in regard to the effect of the size of cells upon the current. The electro-motive force of a cell of given elements remains the same whether the size be large or small. The internal resistance of the large cell is less than that of the small one, since the resistance of the column of fluid between the plates varies inversely as its sectional area. Through a low external resistance large cells will give more current than small ones. If the external resistance be very great the current will be practically the same whatever the size of the cells. This may be shown by Ohm's

law. With a battery of fifty cells, each having an electro-motive force of 1·5 volt and an internal resistance of 1 ohm, let the external resistance be 10 ohms. We have—

$$C = \frac{E}{R' + R''} = \frac{75}{50 + 10} = 1{\cdot}25.$$

A battery cell with plates five times as large will have one-fifth the internal resistance, or ·2 ohm. The current from fifty such cells through the same resistance will be—

$$\frac{75}{10 + 10} = 3{\cdot}75.$$

Thus there is a great gain in the use of large cells when the external resistance is small, as is the case in cautery batteries. Not so in case the current is passed through great resistances like those of the human body. Suppose, for example, the external resistance is 1,450 ohms. With the battery of fifty small cells we have—

$$C = \frac{75}{50 + 1{,}450} = {\cdot}050.$$

With the battery of fifty large cells of the same material—

$$C = \frac{75}{10 + 1{,}450} = {\cdot}051 +.$$

There is practically no gain in the strength of current. The only advantage of the large cells for the purpose of electrolysis or galvanization is the greater amount of materials and consequently greater durability.

"In cautery batteries, however, the resistances are comparatively small, and here large cells are used. Moreover, only a small number of cells is required. If it were possible to construct a circuit having no external resistance one cell would give as much current as a thousand. With a cell having an electro-motive force of 1·5 volt and an internal resistance of ·2 we have—

$$C = \frac{1{\cdot}5}{{\cdot}2 + 0} = 7{\cdot}5;$$

with a thousand such cells we have—

$$C = \frac{1{,}500}{200 + 0} = 7{\cdot}5.$$

It will be readily seen that where very low external resistances are concerned very little gain in current will be effected by multiplying the number of cells. As the external resistance increases a larger number of cells will be required; hence the large number of cells needed when the enormous resistances of the human body are to be overcome."

H. GAIFFE,
Chevalier de la Légion d'Honneur.
GAIFFE ET FILS SUCCESSEURS,
40, RUE ST. ANDRÉ DES ARTS, PARIS.

ESTIMATE FOR A COMPLETE SET OF APPARATUS FOR CHEMICAL GALVANO-CAUSTIC AND FARADISATION AFTER THE METHOD OF DR. APOSTOLI.

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	f.
Battery of 24 cells for bioxide of manganese, No. 43, 225 millimètres high, 10 centimètres sideways, in desk-shaped oak cabinet, with double collector from one to one, and Galvanometer of intensity giving $\frac{200}{1000}$ or $\frac{250}{1000}$ ampères	370
The same, with 36 cells, No. 43	460
Portable Battery, containing 24 cells for sulphate of bioxide of mercury, in mahogany box with double collector, without Galvanometer .	250
Simple portable Battery with 24 cells for sulphate of bioxide of mercury, simple collector from one to one, in black wood box, without Galvanometer	150
Induction Apparatus, with movable helix of Dr. Tripier, containing 2 inducted coils, working by a sulphate of bioxide of mercury battery	90
The same, working by a chloride of silver battery of 2 cells . .	100
Galvanometer of intensity, large size, giving 0 to $\frac{200}{1000}$ ampère . .	55
The same, giving 0 to $\frac{250}{1000}$ ampère	55
Platinum hysterometer with handle, three insulated fittings, and three trocars in steel	80
Double concentrical disked "Excitateur"	14
Double conical "Excitateur"	16
Double-ringed uterine "Excitateur," 2 diam., 2½ mm. and 4½ mm. .	12
Double-ringed vaginal "Excitateur," 2 diam., 10 mm. and 14 mm. .	14
Tin Plates, unmounted, 11 cm. by 16 cm., with conducting wires, soldered, the pair	7
Conducting wires, 1 m. 50 length, the pair	2
Carbon "Excitateur," seven diameters, 5 mm. and 11 mm., to set .	42
,, ,, ,, ,, each . .	7

CHAPTER IV.

ELECTRO-THERAPEUTICS.

Tumours of the Uterus.

History (taken chiefly from the work of Dr. Lucien Carlet).—Legros and Onimus first drew attention to the action of continuous currents upon nutrition, later Cinselli made some communications to the Surgical Society upon the resolution of tumours by electro-chemical action of the continuous current. In 1871 Cutter announced the advantages to be obtained from the electrolytic current. At this time he had only operated upon one case, but with a favourable result. In 1873 Brown published a case similar to this. In 1874 Kimbal published the histories of four cases. In 1876 Gaillard Thomas made this matter the subject of a communication to the Gynæcological Society of New York. Dr. Semeleder, in 1876, was the first to publish exact details of the plan of treatment adopted. He said that Cutter used ten or twelve elements of a Calland pile (zinc and copper), or of a Leiser pile (zinc and charcoal); he used long acupuncture needles to penetrate the tumour, through the abdominal walls, to a depth of three or four inches. Out of thirty-six cases Cutter arrested the growth of the tumour, or diminished its size. In three cases there was complete resolution: four cases died during treatment.

Later in 1878 Semeleder published the results of a certain number of cases which he had treated according to Cutter's plan. But in his fifty cases, Semeleder modified Cutter's original method. He used only one needle through the abdominal wall, while the other was forced into the tumour through

the vagina or through the rectum. He made use of the pile of Leiser, or one of the bichromate of potash: a séance lasted fifteen minutes, and the sittings were repeated at intervals of seven to fifteen days. He used from ten to twelve elements.

His statistics were as follows:—In thirty-four cases the patients were relieved, and in a certain number the tumour entirely disappeared; in sixteen cases the disease was not arrested: there were four cases of death, caused, probably, by peritonitis. In 1877, an Italian physician, Omboni, the pupil of Cineselli, made use of Cutter's treatment with good results. In 1873 Routh and Althaus wrote that they had used continuous currents of high intensity in the treatment of uterine fibroids, which provoked energetic absorption. They asserted that a tumour the size of a man's head had been diminished to the size of an orange. Dr. Routh advised that one of the poles should be placed upon the vertebral column, the other on the neck of the uterus, but he did not indicate the direction of the current; later he proposed to introduce the needles to hasten decomposition. In January 1878 Dr. Everret proposed the following: the negative electrode consisting of a copper disc, covered with a dampened envelope, was to be placed over the sacro-lumbar articulation, and the hand, as a positive electrode, was to seize the neck of the uterus, pressing it downward and backward. Onimus in 1875 says that a doctor of Aix-les-Bains, Dr. Brachet, obtained good results in the treatment of a case of uterine fibroid, by using the continuous current. He applied, for ten minutes, the positive pole over the lumbar region, and the negative pole on the abdominal wall over the tumour; then he gave shocks by changing the poles. In 1879 Doctors Aimé, Martin and Chéron published, almost simultaneously, a study upon the treatment of uterine tumours by electricity. Dr. Martin commenced his monograph by seeking to explain the action of the continuous current upon uterine fibroids. He proposed the word *electro-atrophic* to characterize the special force utilised, "because," said he, "in producing denutrition of tumours, by electricity, I provoke their disparition." He also added, "The electro-atrophic action is inversely to the intensity of the

current." If he had said just the opposite he would have come nearer the truth. He used Daniell's pile, with five to ten elements, never exceeding twenty-five elements. As a positive electrode he used a small olive pointed one of platinum, introducing it, when possible, into the cervix uteri. The negative pole, formed of a metal plate of 5 cent. diameter, covered with skin or moistened cloth, was placed upon the abdomen over the tumour. Dr. Martin said that when more than ten elements were used, an eschar was always formed upon the abdomen. In certain cases he interrupted the current, but the patients did not support it well. Out of thirteen cases, ten were treated with the continuous current. Two complete successes are reported after 85 to 102 sittings; four notable reductions after 83, 92, 97, and 46 sittings, and four negative results after 98, 34, 19, and 12 sittings.

Dr. Leblond, at the Congress at Amsterdam, said that he had the best results in treating the hæmorrhage of these tumours by electricity. Dr. Verneuil, October 28th, 1879, reported to the Academy of Medicine a case of fibroid tumour of the uterus, which he had placed under Dr. Chéron's care for electric treatment. Dr. Bruardel watched the progress of the case, and said he was surprised to see the great diminution that took place in the size of the tumour after a little time. The patient, who could not walk twenty minutes when treatment commenced, was able to make a trip to Russia, although the tumour had not entirely disappeared. In 1881, Gallard commenced an investigation of the subject. A pupil of his, Dr. Pégono, wrote a monograph upon the results of these observations. Dr. Gallard used a long metal stem, resembling a sound, terminated by an olive-shaped platinum point. If possible this was introduced into the cervical canal; in other cases it simply rested at the os, the point being covered with a sponge. Ovoid discs of copper, covered with leather soaked in a saline solution, formed the abdominal plate, thus closing the circuit.* In 1882 Dr. Apostoli

* The great and far-reaching labour of A. Tripier must not be unmentioned. He has written extensively upon the subject, and to him we all owe a large debt of gratitude.

inaugurated the treatment which is now known everywhere as the method of Apostoli.

The Method of Apostoli.—Perhaps the only person who has the right to speak with authority upon the treatment of uterine fibroids by continuous currents of high intensity, is the one who inaugurated it, and whose practice is altogether exceptional. In his paper read before the British Medical Association, Dublin, 1887, Dr. Apostoli said :

You will permit me to ask of you a temporary suspension of the well-merited celebration of the triumphs of gynæcological operative surgery, in which you have held so important a position, while I lay before you my views on a point of conservative treatment.

The surgical measures proposed, discussed, and put in practice for the removal of uterine tumours have of late years occupied a great share of the attention of practitioners, and yet many of the questions connected with this subject still remain undecided, obscure, and perplexing. After all, the dangers of excision are not much less formidable. For this reason I have endeavoured to find out a way, neither strictly surgical nor strictly medical, of dealing with these cases, by which I might avoid equally the reproach of surgical insecurity and the defect of therapeutical inefficiency. By this I mean my electrical treatment of uterine fibroids. It is now five years since I adopted a proceeding which I may define as a *galvano-chemical cauterization of the uterus, vaginal, intra-uterine or parenchymatous and always monopolar.*

For those who have not much experience in electrical manipulations, these few simple words require to be made clear and explained. This I will endeavour to do plainly and shortly.

I may first of all point out what my predecessors had done in the electrical cure of fibromes. Assuredly they had used a current of electricity, but all the attempts made were defective in ways that I may thus recapitulate :

The current of electricity was employed :

1st. In a *vague* and *variable* manner. Sometimes there was

faradization, sometimes there were continuous, sometimes interrupted galvanic currents, but always without a definite object. The current was set in motion in ignorance of its intensity, and with imperfect knowledge of the best means of employing it. The proceeding was purely empirical, discrediting a curative agent, capable of doing much good, or none at all, according to the skill and intelligence with which it was directed.

2ndly. Without *dosage;* that is to say, without any instru-

Fig. 26.—Apostoli's Carbon Electrode.

ment, in the form of a galvanometer, which admitted of measuring the force of the current employed, or of repeating it under the same conditions.

3rdly. In a *dose insignificant*, generally so small as to be useless.

4thly. By a method always *extra-uterine*, in no way directly acting upon the uterine cavity, and but slightly upon the neighbouring parts of the vagina.

5thly. By a method often *dangerous*, from the galvano-puncture being made above the pubes, and through the abdominal integuments.

With these imperfections and dangers in view, it was in 1882 that I originated a *new and rational* way of using electricity for this purpose. I have since *gone on modifying and improving* my mode of operating, and I now propose to give you an account of my method as I practise it at the present time.

I have supplanted the old way of operating by a method which is :

1st. *Precise*—by the introduction of *new galvanometers* of intensity—exact counters and measures of the electric current. It is in this way only that we can estimate the value of the fluid passed and utilised through the uterine tissues.

2ndly. *Energetic*, by an absolutely novel service of *high* intensities of current, which I have progressively carried, according to the necessities of my cases, from 50 to 150 and 250 milliampères.

3rdly. *Tolerable*, in spite of the enormity of these doses, in consequence of the introduction of a new form of electrode, the wetted clay, which renders the cutaneous pole innocuous and permits us to transmit through it easily and without injury a current of signal medical intensity.

4thly. *Better localised*, by a direct application of the active pole, by way of the vagina, to the uterus, either in its cavity, or in the substance of the fibroid deposit.

5thly. *Thoroughly under control*, by the exclusive choice of the unipolar method. In fact, I apply to the diseased uterus a *continuous galvanic current of an intensity and duration sufficient to produce the therapeutic effect required.* Now this application, which is generally inaccurately described as electrolytic, ought to be defined as a *galvano-chemical cauterization*, that is to say, a cauterization purely chemical. In the course of this current through the tissues there are two successive and distinct effects developed :

(*a*) The *tangible* effect, at the points of entry and exit of the current, which, according to the dose and duration, will be a chemical cauterization more or less severe (but not thermic), variable in conformity with the pole, and different in its character at the *positive* pole and at the *negative* pole. This polar

action, at the will of the operator, may be either *monopolar* or *bipolar.*

(*b*) The effect resulting from the circulation of the current from one pole to the other, which is therefore called *interpolar* action. This action follows every electrical application and sets up a subsequent process of disintegration, proportionally wide and lasting, of the morbid products through which it is made to pass.

In serving myself to the utmost of the polar and interpolar effects of the electric current for the treatment of fibromes, I adopt always a galvano-caustic, intra-uterine and *monopolar.* I thus only use directly one active pole, closing the circuit outside the abdomen by a second pole, made as nearly as possible inert. At the same time, I reckon upon the interpolar effects of the current, as it necessarily finds its way through the entire uterine substance, from the internal pole to the external or cutaneous pole. This, as I have explained elsewhere, is the principal reason why I do not place the two poles in the vagina, and why I advocate the method known as uterine monopolar.

6thly. *More scientifically exact;* from the due appreciation of the topical effects of the two poles, and the precise chemical and anatomical indications peculiar to each of them.

I have been able to demonstrate, in the clearest manner, that we have in our hands a double-edged agent, that we can make use of at discretion, to afford us local effects quite different. On the one side, is an *hæmostatic* more or less rapid in its action, and either direct and immediate, or secondary and remote. I allude to the *positive* pole, with which we can arrest hæmorrhage, either instantly, if the cavity of the uterus be of normal dimensions, if the action be relatively intense, and if the hæmorrhage be not excessive; or more deliberately and gradually, after several successive operations, by the formation of contractile cicatrices. The various gradations of the narrowing of the uterine canal are the plain evidence of this secondary and prolonged effect of positive cauterizations.

The *positive* pole will therefore be the "*medicament par excellence*" in cases of bleeding or *hæmorrhagic* fibromes.

On the other hand, with the *negative* pole we obtain a state of *temporary congestion*, without *direct* hæmostatic effect. The interstitial circulation of the uterus, thus momentarily stimulated, will be hurried on, and a regression of the non-hæmorrhagic fibromes is the consequence, either of this state of congestion, or of the supplementary artificial and salutary hæmorrhages which take place. The negative pole will therefore be found to render invaluable benefit (though with the positive pole it is possible to arrive at the same point by a way more indirect and tedious), in those cases of fibroids accompanied with *amenorrhœa* and *dysmenorrhœa*, which are only too often the despair both of patients and doctors without such means at command.

Looking therefore at the difficulties and dangers of abdominal surgery, and at the avowed impotency of the greater part of medication in cases of fibromes, I do not hesitate to assert for my method of treating them a precedence on the following grounds:

1st. It is *easy* of application; since it only requires an elementary acquaintance with the principles and practice of electro-therapeutics; it being, however, unconditionally understood that a profound knowledge of gynæcological science must be the indispensable prelude to any attempts.

2ndly. It is *simple;* for it is ordinarily nothing more than a skilful, uterine, therapeutical soundage. This is only what may be expected of every surgeon provided with a good galvanometer of intensity, some sort of battery capable of yielding an adequate current of electricity, an inoffensive cutaneous electrode in wet potter's earth, an inattackable intra-uterine electrode in platinum, and a steel trocar for the galvano-punctures.

3rdly. The current is mathematically *dosable;* so that every operator can carry on the treatment under the same conditions, and adjust the force of his remedy to the nature of the effects he has to obtain.

4thly. The *seat of operation is optional;* for the surgeon has the power of limiting and defining the point of entrance of the

current, making it either the mucous membrane or the tissue of the organ.

5thly. It is of *easy control;* and only utilises an amount of force, which should cause neither shock nor suffering, and ought never to be put to use but in progressive and adjusted doses.

6thly. It is *antiseptic* in itself, by virtue of the high cauterization of the active pole.

7thly. It is for the most part *easily supported;* anæsthetics being only required for certain cases of galvano-puncture.

8thly. It does not *impose upon the patients any forced seclusion;* and mostly admits of their continuing the usual habits of life, and even of doing hard work, in the intervals between the operations.

9thly. But over and above all these considerations, there is one dominant point to be advanced, which alone is of weight enough to turn the scale in favour of the electrical treatment. The simple chemical cauterization, for which you may find the equivalent in the laboratory of the chemist, or in the actual cautery, is not the only matter we have to take account of. This chemical cauterization—so-called polar—is only the first part of the therapeutical scene which gradually unfolds itself.

The electrical current—the power we wield, and the accompaniment of every vital manifestation, in its course through the tissues acts prolongedly and profoundly on every molecule, and thus causes ulterior changes in the tumour structure, which may well astonish both by their extent, safety, and certainty.

I regret that I cannot do more on this occasion than roughly outline these questions of prime interest, and I turn at once to the clinical and purely practical results of my treatment.

With this powerful agent, the constant galvanic current of high intensity, of which I have pointed out the tractableness as well as its many advantages, in our hands, let us ask what can it do, and what ought we to be able to do with it, for the relief of the uterine fibroid?

Symptomatically, the fibroids may be divided into two great

classes, those which are hæmorrhagic and those which are not so.

The positive pole is the express remedy for the cases attended with *hæmorrhage;* the negative pole when they are *not hæmorrhagic.* Each of the two poles, conveying the current, acts in the first instance locally on that part of the mucous membrane with which it is in contact—the negative pole as producing congestion, the positive pole as hæmostatic. Moreover, if they both in their secondary interstitial action induce a regression of the tumour, I believe that in this respect the greater potency belongs to the negative pole. But beyond this the negative pole has a further faculty. If we make it enter by puncture into the substance of the fibroid deposit, it will more rapidly insure the diminution of the tumour, and what is truly remarkable is, that this negative pole, naturally congestioning and little if at all hæmostatic, becomes by a sort of *contre-coup* markedly hæmostatic, and will at the end of a certain time arrest even troublesome hæmorrhages. This staunching effect is due to the cutting off of the supplementary circulation, by the rapid atrophy brought about by the action of the negative current.

As a supplement to the rule which I have just formulated,—pole positive intra-uterine for the restraining of hæmorrhage, pole negative intra-uterine for tumours without hæmorrhage—comes the second indication for *galvano-punctures.* These punctures, as my experience increases, assume daily a more and more preponderating importance in my estimation.

The indications for galvano-puncture are *twofold;* first, as a matter of *necessity* in consequence of uterine atresia, or where there is such displacement of the organ as to prevent any introduction of a sound; second, by *preference* when we see that we can advantageously combine punctures with intra-uterine cauterization, so as to expedite and make sure of the effects that, with the cauterizations only, we should tardily or perhaps imperfectly realize. We must therefore undertake the galvano-punctures *alone* whenever the case will fairly admit of them, or use them in other

cases *as adjuncts* to the intra-uterine cauterizations previously tried.

The manipulations in the operation of galvano-puncture will always be more difficult and even dangerous in incautious hands. I cannot therefore too much insist upon a rigid observance of the directions and precautions I have elsewhere given at length. I can now only offer a very short summary of them :

1st. Absolute and regular *antiseptic* irrigation of the vagina, before and after each operation.

2nd. Use as the puncturing instrument a small steel trocar or needle, and let the punctures be *shallow*, that is, not deeper han from one to two centimètres.

3rd. Make the punctures on the most prominent part of the fibroid ; whenever possible, in the posterior cul-de-sac.

4th. Make the punctures *without speculum*. Slide the trocar through the celluloid sheath which protects the vagina, after having examined and chosen by touch the point where the puncture is to be made.

5th. Take the precaution of *ascertaining the seat of any pulsation*, so as to avoid wounding an important vessel.

6th. In case of any unusual hæmorrhage, immediately *dilate the vagina* with an expanding speculum, and if necessary put on pressure forceps to the bleeding point.

Such is a rapid sketch of the directions for operation ; what now are the anatomical and clinical results to be expected ?

A. As regards the *material* changes we may affirm, that every fibroid tumour submitted to this treatment, sometimes after so short a time as one month, but certainly when the treatment is fully carried out, will undergo a manifest reduction appreciable by the touch, and demonstrable by internal measurement. The further diminution of the tumour which continues for some months, varying in amount from a fifth to one half of the original volume, is generally associated with a coincident and equal accumulation of subcutaneous adipose tissue on the abdominal walls.

The regression of the tumour is not only apparent during

the time of active treatment, but goes on continuously after it has been suspended, and is the persistent proof of the enduring influence of the electrical operations.

The liberation of the tumour from its local attachments takes place simultaneously with its decrease of bulk. The tumour which at the commencement of the treatment was immovable, can progressively be made more and more to change its position, as the absorption of the enveloping tissues, deposited round it, advances.

Another phenomenon is observed in connection with the regression of the tumour. It not only contracts on itself, but it shows a tendency to separate itself from the uterus, to become more distinctly subperitoneal, to detach its mass, as it were, from its setting in the uterine wall, and to remodel itself into a pedunculated form.

B. Clinically.—The results are not less striking. Perhaps they are even more so, as they are not only matter of proof by the examination of the surgeon, but the patient herself is the living exhibition of them. We may generalise the extent and importance of these results by saying, that ninety-five times out of one hundred, they comprise the suppression of all the miseries constituting the fibroidal symptomatology, which may be thus categorically enumerated :—*Hæmorrhages, the troubles of menstruation, dysmenorrhœa, amenorrhœa, nervous disturbances, the direct pains in the growth itself, and from mechanical pressure, and the harassing series of reflex actions.*

In a word, the assertion may be safely advanced that, though our therapeutical resources only carry us so far as the sensible reduction of fibroid tumours, and not to their total absorption, we may, with regard to the symptoms, certainly anticipate their complete removal, and the establishment of a state of health equivalent to a true resurrection. I am justified in saying, that the greater part of women who have persisted in the necessary treatment, not only were cured but remain well.

I use the expression, the *greater part*, because there is no such thing as human infallibility, especially in medicine. I acknowledge having been sometimes unsuccessful, and so

instructive are my failures, that I shall recount them at length in a work now preparing. It will be seen that they were cases in which there was no possibility of satisfactory treatment, owing to an apparently absolute intolerance of high intensities of current. I see now that I was wrong in retreating before this supposed intolerance. Among them, were three cases of fibrome with ascites, and I regret now that, with the aid of anæsthetics, I did not persist in going to the limit of my power. I have also met with the same intolerance in some hysterical subjects, in cases of very irritable uterus, and in others of peri-uterine and intestinal phlegmasia. Now, with my present experience, I should not hesitate to operate to the fullest extent with the patient under chloroform. There remains yet the obscure question as to the class of cystic fibromes, and tumours with a tendency to malignant degeneration, where there is often an accompanying fearful and irrepressible hydrorrhœa. I have recorded three such instances, and in them intra-uterine galvano-cauterization generally proves useless. Something more is demanded, and we must seek in galvano-punctures means of denutritive action more powerful and more efficacious.

Finally, I may lay down the following proposition. No operator should admit the failure of intra-uterine galvano-cauterization, before having had recourse to the galvano punctures, *which he must enforce either with or without anæsthetics.*

We will now turn aside from all theoretical considerations, and look at the facts. I may rely upon them, with confidence, as my great support. I desire, however, in the first instance to prove the comparative safety of intra-uterine medication when my method is adopted.

Both in my *clinique* and in my private consultations as far as regards gynæcological practice, the application of electricity therapeutically assumes two forms. In the one, it is exclusively faradic, in the other galvanic. For the present I pass over faradism, to occupy myself solely with what relates to the patients who have been subject to the treatment by continuous currents.

In the five years, from July 1882 to July 1887, I have made, either privately or at the *clinique*, as many as 5,201 applications of continuous galvanic currents, for most of the maladies included in the gynæcological nosology; and I may enumerate them in the following order:—

1° Fibroids of the uterus—polypi;
2° Entire or partial hypertrophies of the uterus;
3° Subinvolutions;
4° Acute and chronic metritis and endometritis;
5° Ulcerations of the neck of the uterus;
6° Peri-uterine inflammations (perimetritis, parametritis, cellulitis, phlegmons);
7° Ovarialgia;
8° Ovaritis and periovaritis;
9° Salpingitis;
10° Ovarian and tubular cysts at an early stage;
11° Atresia;
12° Hæmatocele.

These 5,201 operations were thus partitioned:—

I. At my clinique, 2,837.

a. 1,524 galvano cauterizations, chemical, positive, intra-uterine.
b. 745 galvano cauterizations, chemical, negative, intra-uterine.
c. 368 galvano punctures, chemical, negative, vaginal.
d. 200 cauterizations, galvano, chemical, of neck of uterus.

II. In my private practice, 2,364.

a. 1,245 galvano cauterizations, chemical, positive, intra-uterine.
b. 1,027 galvano cauterizations, chemical, negative, intra-uterine.
c. 72 galvano punctures, chemical, negative, vaginal.
d. 20 galvano cauterizations, chemical, of neck of uterus.

These 5,201 operations which range over a space of five years, were made upon 403 patients, who went through the treatment more or less systematically. And I must not omit

to mention that I intentionally say nothing about the number, far in excess of the above, who were merely the subjects of faradism, as I have the intention of publishing a separate memoir on that subject.

Now in referring to the history of these 403 patients (276 at the clinique, 127 private), the number of whom, for the time occupied, may really be considered as great, I have only to deplore the loss of two. Of these two deaths I take upon myself the entire responsibility. My method was not in fault. I only was to blame, as may be seen by the full and detailed report.

In one case, I admit candidly that there was a fatal error in my diagnosis. I did not recognise the presence of a suppurating ovarian cyst, which ended in death from peritonitis. Death was due, in the second case, to a puncture made too deeply. The consequence was intra-peritoneal gangrene, for which the abdomen was not opened.

In addition, I have to confess to having either excited or aggravated, in the course of the five years, ten peri-uterine phlegmonous inflammations. These must be attributed to blunders in carrying out the treatment, as will be shown when the account is published at length.

But these errors of practice happened during the early days of my work, and were either:—

a. Negligence of antiseptic measures, which were either omitted altogether or done imperfectly; or,

b. The too violent, or too intense, use of the negative pole, in cases of subacute peri-uterine inflammations.

The fact is, that the negative pole, having a strong power of producing congestion, is a dangerous weapon, which at the beginning of any treatment must be brought to bear with great prudence and reserve, if one would avoid overshooting the mark for which it is intended.

To lay before you the facts of these accidents will serve the double purpose of warning you of what may befall you, and of preventing you from falling into similar errors. My caution is, that whenever the negative pole is put to use, and

there is any trace of peri-uterine inflammation present, you must not only redouble your antiseptic heedfulness, but your operative proceedings must be carried on with deliberate carefulness. You must feel your way, testing the susceptibility you have to work upon by two or three preliminary operations, in which you give doses so feeble that they only serve to enlighten you, and to habituate the patient, so as to lead on safely to the use of higher intensities.

But when I tell you that this operative gynæcology, as I have to practise it, is carried on in such exceptional circumstances that no one else has ventured to encounter them, and upon a class of women who are obliged to walk home shortly after they get up from the couch, who seldom take the necessary rest in bed, who are in no way under my surveillance, and whose poverty forces them in some fashion to get through all the ordinary duties of life, you will be curious to know, and you will ask of me, what is the explanation of this illusive mystery. All that I can say is,—it appears to me that the intra-uterine current, at the high proportions I trust to, seems to have in itself some special antiseptic and atrophic property.

I must close these remarks on the failures, which I have no wish to conceal, but which I now expose to you in all their nakedness, though they so stand as the evidence of only the usual difficulties which accompany the laborious and misty development of any new method of treatment, without speaking of other dangers which lie in the way, such as the possibility of concealed pregnancy, and accidental abortion, and also the risk of opening up a vesico-vaginal fistula. I have already enlarged on this matter elsewhere, and in my next work, on gynæcological electrical therapeutics, I shall devote a chapter to the consideration of the needful precautions.

I am anxious to-day, as the completion of my paper, to put forward a simple statistical statement of what has been my treatment of uterine fibroids.

From July 1882 to July 1887, I have had under my care 278 patients with fibromes or hypertrophy of the uterus in some

manifest degree, upon whom I have used 4,246 applications of the continued current of electricity. The patients and the operations may be thus classified :—

I. Clinique, 186 patients, and 2,347 operations.

a. 1,433 galvano cauterizations, positive, intra-uterine.
b. 593 galvano cauterizations, negative, intra-uterine.
c. 321 galvano punctures, negative, vaginal.

II. Private, 92 patients, and 1,899 operations.

a. 1,085 galvano cauterizations, positive, intra-uterine.
b. 746 galvano cauterizations, negative, intra-uterine.
c. 68 galvano punctures, negative, vaginal.

As I said before, I do not wish to convey the impression that all these patients have been cured. It is not so, for the very good reason that some of them, especially those of the *clinique*, have not persevered to the end, the attendance having been discontinued as soon as the first feelings of amendment have been experienced. But I can affirm that when there has been no negligence, and my advice has been fully acted upon, 95 times out of 100 permanent benefit has been acknowledged. I may also predict that if adopted in its integrity, and worked as it ought to be, the mortality from my treatment will henceforward be nothing. I cannot, however, omit to report a fact which gives occasion for melancholy comparison.

Among the patients who had not the will to let me finish what I had begun, and whose impatience led them voluntarily to seek the removal of their tumours by excision, seven put themselves into the hands of six of our most eminent surgeons, and not one of the seven recovered from the operation. Commentary on this would be superfluous.

One word in parting. Men and their labours can, in general, only find their proper level and value through the esteem of their associates, and the way in which what they have done is publicly accepted. Now, I feel it pressing upon me as a duty, to acknowledge that, if the method about which I have been addressing

you ever meets with the confidence of the profession (to speak only of England), it will be mainly due to your illustrious countryman Sir Spencer Wells, who was one of the first to extend to me the benefit of his experience and authority, and to his learned friend Dr. Woodham Webb, whose name will ever be coupled with its introduction and diffusion. It would be injustice were I not also to refer to the honour such distinguished gynæcologists as Keith, father and son, Playfair, Savage, Elder and others have done me by their visits, and to the encouragement they have given me by their approbation.

This paper having been attacked vigorously in certain quarters, Dr. Apostoli, at the meeting of the British Medical Association in Glasgow, August 1888, offered the following repliqua :—

Every therapeutical innovation which runs counter to prejudices and interests meets with opposition, and has to bear the brunt of hastily formed opinions. This has been the lot of my electrical treatment of uterine fibroids, and I am happy that it should be so, since frank and loyal controversy will bring light upon the subject and strengthen my position.

My first object to-day is to bring forward all the arguments that have been set up against my system, to reply to them, and to show that this can be done with success. In order to avoid personalities and to keep this discussion on a footing of scientific courtesy, I shall group these objections without regard to the source from which they come, and let my reply immediately follow the statement.

In the second part of my paper I propose to introduce to your notice some additions I have made to my therapeutical expedients, which will be regarded as of practical importance.

ANSWERS TO OBJECTIONS.

I. Criticisms on the Book of Dr. Carlet.

Many deprecatory remarks have been made upon the histories of my first hundred cases, as reported in the thesis of my assistant, Dr. Carlet. I must notice them separately.

A.—It is said that I have confusedly mixed up cases of simple *subinvolution*, or the *enlargements of chronic metritis*, with those of fibrous tumours.

How could this possibly happen? Since the greater part of the women had never been pregnant, and among the rest I had to deal with wombs of enormous size, some even rising above the umbilicus; besides, the most careful examination, both external and internal, combined with hysterometry, left no doubt in my mind as to the nature of the cases. But even supposing a mistake had been made in some rare cases, it could be no cause for regret, for it would only prove that two conditions, chronic metritis and fibrous tumours, equally refractory to ordinary management, are amenable to the same treatment.

B.—Judging by the uterine measurements given in my book a large proportion of my cases have but slightly diminished.—It may be true that in many instances the uterine measurement has but little altered. The sound only gives information as to the uterine cavity. The greater part of fibroids, both subperitoneal and interstitial, may coexist with a nearly normal cavity, and consequently may and have undergone reduction without any appreciable modification of the depth marked by the sound.

But independent of this question of anatomical change, variable according to the situation of the tumour, we have to look at that of the symptomatic cure, here the most important. For, how often do we meet with considerable fibroids of which the bearers have no consciousness, while the lives of other women are put in peril by small and even the smallest tumours.

What is it that brings women with fibroids to the consultation room? Generally because they have pain or hæmorrhage. Why are they operated on? Always for the same reason,—to save them from the consequences of pain or hæmorrhage. Cavil as much as you please about the importance of such anatomical reduction as I have obtained; but so far as concerns the symptomatic cure there can be no doubt, for I affirm that the greater number of my patients have been made and remain well. Is there any other known method of treating these affections of which so much can be said?

C.—Many of the reports of my cases are incomplete.—No one knows better than myself that it is so. If I have nevertheless persisted in including these cases in my statistics, it has been with the plain intention of giving a complete view of my practice, so that an opinion might be formed from it of the harmlessness of the electrical treatment which I have introduced.

D.—The treatment is long and troublesome.—This I am so well aware of that since the year 1884 I have made every possible attempt to shorten it by increasing its efficacy. It is with this motive that I have gone on gradually augmenting the intensity of the electrical current, and have made many alterations in my mode of procedure. It will be seen too in the new series of cases, under treatment since 1884, which I have almost ready for publication, how marked is the progress made, in all respects, since the commencement of practice.

II. My method is only an old story, and many others have attempted the cure of fibroids by electricity before me.

There is some truth here. But one may observe about the same difference between former applications of electricity and my method, as would be found between the ancient theriacal quackery and modern therapeutics.

Electricity has been used; but what electricity? in what dose? where? how? for how long and how often? All this is unknown and all was empirical.

Over and above the many indications I have scientifically established as to the *technique* itself, the mode of operating, the electrical localization, the choice of poles, the acquired tolerance of the indifferent or inactive pole, there is one fact which gives me a right to claim priority, and that is, that no one before 1882, or before me, had taken an exact measure of the current he employed, or had employed an intensity of power known to be above 50 milliampères.

III. My method is dangerous, and the danger arises in various ways:

A. From the intra-uterine application.

B. From the making of galvano punctures.

C. From the use of high intensities of current.

I have been reproached on account of several recent deaths said to be directly attributable to my treatment. To this indefinite assertion, I again give the most positive denial, as I did last year in publishing my complete statistics. I prove too, by figures relating to nearly 7000 galvanic applications, the innocuousness of my method provided the operative conditions are appropriate, that it be used rationally, and with antiseptic scrupulousness.

I will say a word on each of the three sources of danger specified.

A.—The intra-uterine cauterization which is nothing more than a therapeutical hysterometry, might have appeared formidable before the common adoption of the practice of intra-uterine raclage. As that which I do is only a sort of galvano chemical raclage, there is every reason to regard it as equally beneficent in its action, and my experience more than fully justifies its *à priori* sanction.

B.—I put entirely out of the question all abdominal or suprapubic punctures.

Any one who is not both gynæcologist and electrician might be expected to set down the *vaginal galvano punctures* as hazardous. In making them we certainly do come within the risk of doing mischief, which must be guarded against, and which my experience enables me to disclose with exactness.

a. It has been urged as a point against my treatment, that after a number of punctures, when there is free suppuration, or a quantity of necrosed matter in the womb, or in the centre of the tumour, there *must be difficulty in keeping off septicæmia.*

This objection would have some force, if there were neglect in following the rules which I have framed:—viz.

1st. To observe a constant and perfect antiseptic practice.

2nd. To make the punctures only every eight or fifteen days, so as to avoid accumulations of fetid matter; with temporary suspension of the sittings as soon as there are any threatenings of fever.

3rd. To make, without exception, only superficial punctures, not more than half, or at most one centimètre deep, so as not to cause any central gangrene, and to admit of an incessant antiseptic treatment.

b. Perforation of the bladder or rectum, followed by fistula, and the wounding of some great blood-vessel, are accidents to be apprehended.

I admit that a misfortune of this nature happened in one of my early operations. I now point out the way in which it may be avoided.

1st. Never make a puncture in the anterior cul-de-sac.

2nd. Confine the punctures to a lateral, or to the posterior, cul-de-sac.

3rd. Make use of a very fine trocar.

4th. Never introduce a speculum through which to make a puncture; and before proceeding to puncture, make a minute and scrupulous examination of the part chosen for puncture.

5th. Puncture as near as possible to the body of the uterus, from without inwards, making the axis of the instrument correspond with the axis of the organ.

6th. Choose for the seat of puncture the most prominent point of the tumour found in the vagina, making it project more, if necessary, by directing an assistant to press it downwards with his hands upon the body above the pubes.

7th. First pass the insulating celluloid sheath through the vagina, and fix it at the spot to be punctured, on the point of the index finger. Then slide the trocar up the sheath and make the puncture.

c. The *high intensities,* which I have been falsely represented as using exclusively and abusively, are denounced as sources of danger; and the less tolerance shown by rabbits, than the human uterus, under a galvanic current, has been made the base of an objection.

As regards the animal, it affords no grounds for comparison. As regards woman, clinical observation has more than sufficiently proved the perfect impunity with which high intensities can be supported; and more than that, it has demonstrated their utility by establishing the fact of the progressive rapidity with which improvement takes place in proportion as the ascending force of the current increases, if it be well applied and well tolerated.

I ought, however, to add that there is a limit to this increase of intensity; and it must be regulated by the therapeutical effect obtained. For the present, I disclaim all participation in recommending what I regard as the abuse of those intensities,—such as the administration, said to have been made, of currents of more than 500 milliampères.

Moreover I feel some difficulty in believing that men who daily put women under the perils of castration or hysterectomy, are speaking seriously when they denounce my procedures by recounting a series of hypothetical dangers.

IV. My method is not efficient.

This objection is presented in a variety of forms:—

A. For some, it is *useless in the greater number of cases.*

B. Others say that the current has *no action on fibrous tissue;* that its effect is only shown on *the uterine tissue.*

C. Others, again, if they admit any action, say that it is only *temporary and ephemeral;* that the tumour, against which we direct it, remains just as it was, and that *relapses* are sure to come.

I answer:—

A.—The faults committed in the application of the treatment when it is done badly or incompletely, the neglect in fact of all the instructions I have given, ought in no way to bring disparagement upon the method itself. Further, I affirm again, as I have already written, that the method properly used has effected, 95 times out of 100, not as I have been erroneously made to say, the absolute removal of the tumour, but:—

1st. An anatomical diminution which does not advance so far as the complete dispersal;

2nd. The quick and lasting cessation of hæmorrhages;

3rd. The disappearance of all the symptoms of compression;

4th. The symptomatic restoration of the patient.

If these four clinical results are not witnessed regularly, and in the same order, in all subjects, the fact may be explained in many ways. I will mention some of the chief.

1st.—The *anatomical regression* generally varies, first, according to the character of the tumour, whether soft or hard, being more rapid in the case of soft tumours than in the hard ones.

Then, again, a difference is made by the situation of the tumour, the localisation of the electric action. The more distinctly this is sub-peritoneal, the weaker will be the influence of the current.

But without doubt the general tendency of all fibroids, when skilfully treated with high doses of electricity, is towards spontaneous enucleation, by their disengagement from amidst the uterine stroma. This curative process, which consists in their liberation either through the mucous membrane or the peritoneum, is seen to take place with some interstitial fibroids.

I ought, also, to note here what I have almost constantly observed as the treatment advanced; namely, the occurrence of an accumulation of adipose tissue under the abdominal tegument. This new condition ought always to be borne in mind when estimating the size, or changes of size, in fibroids, by measurement of the circumference of the abdomen. The external measurement, even with a collapsing fibroid, may remain the same simply on account of the recent, and often abundant, quantity of fat developed in front of the tumour.

I therefore recommend that, at the commencement of every course of electrical treatment, three measurements of the body should be registered, which may serve for future reference:—1st, the circumference of the abdomen at several points; 2nd, the exact thickness of the layers of skin and fat, above, below, to the right and to the left of the umbilicus, taken by means of a graduated compass; 3rd, the weight of the patient.

I cannot deny that I have in some rare cases been disappointed and failed, the same as happens in all human undertakings. The future may enlighten us about these difficulties, for they all relate either to ascitic fibroids, or to fibro-cystic, or to abnormally vascular, fibroid tumours.

I may add that while certain fibroids shrink without any sphacelation, or any appreciable sero-purulent discharge, others only undergo this change as the result of a more or less extensive necrosis.

2nd.—*The arrest of hæmorrhage* has also been disputed.

Many who hold this opinion do so without ever having made, or seen, an experiment on some tissue to convince themselves of the hæmostatic power of the condensed action of the positive pole, when applied to a cut and bleeding surface. Then, I am asked to explain how it is that results are not constant? I can only say that this depends upon different conditions, *clinical*, *anatomical*, and *physical*.

Clinically, hæmorrhages are more difficult to suppress in the cases of interstitial and sub-mucous fibroids.

Anatomically, the arrest of hæmorrhage will be more speedy and certain as the uterine cavity is more narrow and less deep.

Physically, the hæmostasis becomes more decided as we augment the intensity of the electrical current, and insure the perfect coaptation of the electrode with the entire extent of the bleeding surface.

To resume, the arrest of hæmorrhage by electricity is arrived at in three different ways, either associated, or independent of each other.

The action of the current, which is a vehicle of force and of chemical action, may be studied either as it is manifested at the *poles*, or in the *interpolar circuit*.

a. The *polar action* of the positive pole is hæmostatic, either at once, or some time afterwards:—Immediately, if the bleeding surface is totally cauterized by the application of a sufficient intensity:—Subsequently, after some interval from the commencement of the treatment, if the hæmostatic action has not been powerful enough in the first instance, by the appearance of

an atresia, more or less pronounced, of the uterine canal. This atresia, which some gynæcologists will not admit, I have the opportunity of seeing almost every day in some one or more of my former patients, although they have not yet arrived at the menopause. In certain women, with a large uterus and an expanded cavity, in which the ordinary sound had moved with great freedom, I have discovered one, two, or three years afterwards, that it could not then be introduced, and that the canal only permitted the entrance of a sound of the most diminutive size.

Now, this cicatricial atresia (which however marked it may be, and as a new observation, it is interesting to notice this, is not accompanied with dysmenorrhœa) is the physical reason of the postponed electrical hæmostatis, and of the permanence of the results established.

b. The *interpolar action* is equally hæmostatic in a tardy manner, and in an entirely different way, without the polar action being in any degree implicated. Indeed, there is reason to believe that we may stop hæmorrhage, though it must be confessed more slowly, without at all cauterizing the mucous membrane, and by restricting the treatment to galvano punctures made in the tissues of the tumour itself.

The denutrition of the substance of the fibroid will, after a certain time, bring about a progressive stoppage of the hæmorrhage, without the mucous membrane having been touched.

Either pole may be used for this purpose, though I incline to prefer the negative. It is more to be relied upon because it is more denutritive than the positive.

I have, as a matter of experiment, given clinical demonstration of this separate *interpolar* hæmostatic action, by treating several hæmorrhagic fibroids by galvano punctures only, without any intra-uterine cauterization.

I am convinced, however, that the *combined use* of the two methods will be found more certain, in producing the hæmostatic action, in cases where the simple intra-uterine cauterization has shown itself ineffectual.

3rd.—*The cessation of pain and of the effects of compression*

will vary among patients as much as the causes which produce them. Generally, this takes place coincidently with the retrogression of the tumour. In other instances, on the contrary, it is the initial phenomenon which precedes all others. This may be accounted for either by the relief of the uterine congestion, which is early realized, or by the mitigation of the ovarian neuralgia.

There are cases, however, in which this amelioration comes on but very slowly. I have remarked that in these inveterate cases we can generally recognize some ovarian or tubal complication, some inflammatory or suppurative condition of these parts, which is less disposed to yield to electrical treatment.

4th.—*The symptomatic restoration of the patient* is the most striking result of the treatment, the most rapid, and that which most surprises both the subjects of it and their medical attendants.

One of the few adversaries of the method has thus expressed himself: "I have been able to assure myself that all the women under treatment have experienced a stimulating influence, very favourable to general nutrition and the recuperation of their forces. They feel more cheerful, more buoyant, more alert; in a word, seem to have more life. Whether it be that the innervation, sensibility, and mobility of the abdomen and pelvis are more happily excited, the patients keep about without difficulty, and walk freely, in a way which was impossible before anything was done for them. The movements are unembarrassed. The tumour no longer distresses by its weight, or contact with the sensitive viscera. With the trunk and the pelvis disengaged from an overpowering constraint, the limbs do their office with freedom." They acknowledge too that the digestive functions are well performed, that sleep is natural, that the miseries of bladder pressure have ceased, that constipation is less annoying, and that there is a restoration of active life in all its integrity and intensity.

B.—The second reproach of inefficacy is made on the supposition that *the current can act* only on *fibrous tissue* and that it has *no effect* upon the *uterine tissue.*

There is falsity in this limitation of the effect of the current; and the proof is that an action, combined or isolated, may be observed in both one and the other of these tissues.

We see cases, in fact, where the uterus itself undergoes no contraction, as may be ascertained by the sound, while examination above the pubes enables us to decide positively as to a diminution of the subperitoneal part of the fibroid tumour.

On the other hand, in the simple hypertrophies which follow chronic metritis, or in the non-fibroid hypertrophies of the uterine tissues, there is always a lessening of the uterine cavity under treatment.

The action, then, is here only on the uterine tissue, as, in the other case, it was upon the fibrous tissue; and the process of disintegration, set up by the passage of the current, results in promoting a general retrograde metamorphosis of the muscular, connective, and fibrous hyperplasies.

C.—The *third* reproach in reference to *inefficiency*, which consists in a declaration that the effect of the treatment is only *temporary* and *ephemeral*, can be no better sustained.

It is now six years since I began the practice of this method, and I have regularly and carefully kept an account of the condition of my patients.

I can affirm that relapses have been truly exceptional. The very unfrequent cases where I have had to administer secondary treatment were those of women who had unadvisedly discontinued their attendance. There has been no difficulty in bringing this secondary treatment to a satisfactory end.

V. My method is empirical and unscientific.

It is said that it wants precision, and that I have given a theoretical explanation of it which cannot be admitted.

If my method be *empirical*, it stands, in that respect, on the same level as the whole of pharmaceutical practice; *empirical* as the giving of opium which causes sleep, *empirical* as the use of quinine, and digitalis, to check fever or modify the circulation.

The why and the wherefore of things eludes us. What we have to do is to make ourselves familiar with the natural laws ruling the phenomena which come before us.

Every organic or inorganic movement, every molecular change, excites a corresponding development of electricity, and the process of nutrition, like every other vital action, is subject to this law. Now a continued current passed through the human body marks its presence in two different ways. At the points of entry and exit, that is at the two poles, in virtue of an electrolytic action inseparable from the passage of the current, we find an accumulation of acids on one side and of bases on the other.

This is a fact commonly known, and I shall have to refer to the therapeutical importance of these acids and bases.

In the organic substance intermediate between the two poles, the *interpolar region* as it is called, through which the current spreads in rendering itself from the point of entrance to that where it is discharged, there is a twofold action. The one is *cotemporaneous* with the current itself, the other is *posthumous*.

The *cotemporary* action consists in an exaggerated vital and circulatory activity, favourable to the rapidity of nutritive changes. This will explain the absorption of certain effusions, either interstitial or intra-articular, under the influence of a current directed through them.

The posthumous action, enduring after the cessation of the current, occasions that condition known as the *polarization* of the organic tissues. This is an accepted fact. The organic region, thus occupied by the circuit of the current, is in effect charged as a second battery. It is consequently endowed with a supplementary electro-motive force or tension, which in its discharge prolongs the topical and trophic effects that the preliminary current had begun; and it still further advances the retrograde metamorphoses which we see in non-malignant neoplasms.

Yet we encounter some who say that there is no such thing as *interpolar action*, and that the current leaves no visible or tangible trace of its presence.

Who has ever been eye-witness of a current in a nerve trunk? Who has ever seen the something which is transmitted by the telegraph wires?

As it is with many natural phenomena, such for example as nutrition, which we only know by its effects, so it is with the current.

Let any one, who denies the fact of interpolar action, but just apply one pole to the forehead and the other to some part of the body, the hand or foot, and he will at once have sensory evidence of two phenomena which constantly follow: first, the appearance of flashes of light, and secondly, a change in taste of the saliva.

How should we account for these invariable phenomena, unless there be an interpolar action of the electric current?

Place one pole on the neck, over the pneumo-gastric nerve, and let the other be held in the hand. You will thus stop many a threatened vomiting. It must be some interpolar action which produces this effect.

Indeed, nervous pathology as a whole (nervous, medullary, cerebral or peripheral), requires ordinarily nothing more as a means of relief than the interpolar action of the continued current.

If interpolar action were not a reality, electro-therapeutics would soon become an idle word, for it would be reduced almost to the simple chemical or mechanical effects of polar action; and these we might in a great measure afford to neglect.

As we recognize this sceptically treated *interpolar action* by its unavoidable consequences, so we have, as evidence of its presence, the effects of *polar action.*

On this point, again, I am accused of empiricism; and my accusers merely substitute their erroneous interpretations of the respective action of each pole for the formulas that I have laid down.

I have said the *negative pole* is more irritating, more charring, more destructive than the *positive pole.* In opposition, I am told that as acids abound more in the human tissues than the bases, we ought to find a greater proportion of acids at the

positive pole than of bases at the negative pole ; hence the preponderant action, *quantitative*, of the former. But the fact is overlooked that a current has no caprices, and acts only according to the laws of its nature ; that electrolysis or decomposition takes place molecule by molecule, equivalent of acid for equivalent of base, whatever may be the composition of the body under experiment.

The only preponderance which one pole has over another is purely *qualitative*. The dry, positive eschars offer a considerable resistance to the flow of the current, and consequently impede its diffusion. The negative eschars, on the contrary, are softer and more moist, and, only feebly opposing the current, allow of its more easy dispersion. There is no difficulty in convincing oneself of this fact.

Take two electrodes of equal dimensions, of gas-carbon it may be, covered with moistened leather, and place them symmetrically on two parts of the body. Of the two poles it is the negative which will first give indications of its activity by the pain it occasions, the eschars and the extent of the eschars which it burns.

In the same way after punctures with two trocars actually of the same character, the loss of substance resulting from the fall of the eschar, made by the negative pole, will be much more considerable.

In conclusion, if the electrolytic action is found to be concentrated at the two points of entry and outlet of the current, it is impossible to deny the intermediate dynamical action, which is more powerful than either. It matters little for our purpose whether this intermediate action be directly upon the tissue cells, or, which is more probable, upon the nervous influx of which it augments the tension, as auxiliary to the normal currents in them. The clinical results are incontestable. There is the same retrogression of fibromes that is often found to take place after the menopause, or the excision of the ovaries, without our being able to furnish any unimpeachable theory to account for the facts.

VI. My method is of no use, and there are better ways of treatment.

Let us consider the worth of these other modes of getting rid of fibroid tumours :—

A.—Mere *expectation*, or literally *doing nothing*, aided by repose *in bed*, is sometimes trusted to, as sufficient to assure the retrogression of the tumour and the quiet existence of the patient.

This can only be true of a few fibroids, especially after the change of life. But it will not do to lay down an absolute rule, based on these particular cases. Every day's experience shows us that the death of a great many women is the consequence of their tumours, and that others, in large numbers, have their lives embittered by pain and hæmorrhage. I admit that some, under the influence of confinement to bed for several months, find a temporary amendment, but I cannot see that this enforced rest ever produces a spontaneous and regular diminution of the fibroid and the disappearance of the symptoms, such as follow the use of my method. Nor can it be maintained that similar improvements under my treatment are mere *coincidences*, for my patients are not kept in bed, continue their ordinary occupations, mostly come for their sittings to my consulting rooms, and follow the common mode of life.

I believe that much more is to be expected from the influence of the menopause alone, although not as a matter of course ; for I have had under my care not a small group of women from 55 to 65 years of age, who had experienced the disappointment of finding their tumours enlarged considerably, and even doubled in volume, after the menopause.

B.—Then it is said that treatment by *medicines* will give relief and is equal to the cure of fibromes.

This assertion will not bear examination. The very multiplication of the remedies eulogized is a proof of their powerlessness.

What in fact do the recommendations amount to ?

As for *mineral waters*, patients may go on using them,

hopefully and unprofitably, year after year till they arrive at the time of the menopause.

Internal medication is very uncertain and for the most part untrustworthy. *Ergot* stands at the head of the list of things tried. Independently of the local and general mischief of which it may be the cause, it must be allowed that it more often fails than succeeds. Women come to me showing the marks of ergot injections, to which they had patiently submitted for years, without any perceptible benefit.

Before the adoption of my electrical method, one other kind of treatment only had been at all encouraging; it was that of A. Tripier, who places in the uterus pencils of a paste of iodide of potassium.

C.—Next, *surgery* claims the precedence of medicine.

First of all there is the *minor surgery*, which includes *intra-uterine raclage*, *liquid injections*, and *punctures* with the *actual cautery*.

However excellent may be the use of *raclage* in simple endo-metritis, its sphere of action is limited to the mucous membrane. It has no power over lesions of the parenchyma, none over fibroids.

Nothing better can be said of *liquid injections*. They too have special dangers, by no means insignificant.

As for vaginal *cauterizing punctures*, their effect is deceptive and temporary. Their action in no way corresponds with that of the galvano-chemical punctures which I employ. These two modes of puncturing have, in fact, nothing in common but the name.

They are essentially different:—In a cauterizing puncture, even when it is a *galvano-thermic cauterization*, heat is the agent upon which we depend. There is no special electrical action. The platinum wire, brought to incandescence by the current, burns and burns only. It conveys no current into the tissues, which are simply cauterized.

On the contrary, with galvano-chemical punctures we have both a local, chemical action and a general, dynamical action, but no effect of mere burning. The electrical current, going

from pole to pole, inevitably traverses all the tissues upon which we intend to operate.

We now come to *surgery proper*, which assumes to have settled the question magisterially.

The exploits of ovariotomists have given a new character of boldness to abdominal surgery. In urging operations, the risk of the life of the patient has been sometimes too lightly considered. In spite of its difficulties, its dangers, the long convalescence which it involves, and always with the presumption that antisepticism will come to aid in lessening the mortality, abdominal hysterectomy has been by some hands pushed too far. To go no further, for figures, than Paris, our Surgical Society has recently published a statement, showing that according to the operators, the deaths from this operation mount up to from 40 to 50 per cent. If left to themselves, do patients die at this rate from their tumours? And have we not reason to assent to what Thomas Keith has said, that "abdominal hysterectomy has done more harm than good"?

We see, as a consequence, a general disposition to substitute the vaginal operation for that which has been so fatal. True the loss experienced is smaller, but then comes the drawback of its being practicable only at the early stage of growth; for I maintain that it would be impossible in the case of large tumours.

Operative failure in this direction has led many surgeons to discard hysterectomy for the cutting away of the uterine appendages; the intention being to give women the supposed advantages of an induced menopause. But even here there is no guarantee of constant success, for every operator has been obliged to record not only inadequate results, but some cases of death.

It therefore becomes a serious matter for consideration, whether, as a point of professional morality, one is not bound to make trial of a system of treatment which I and others affirm to be not only harmless, but effective, before recommending a patient to take the risks of hysterectomy or the certainty of mutilation.

VII. My method wants exactitude and is uncertain in its effects.

It has been objected that, however easy it may be to graduate the intensity of the current, and consequently to estimate the equivalent of acid and alkali set loose by its passage, there must always remain an undetermined free residue capable of effecting further cauterization, after saturation of the uterine secretions. This uncertain excess of cauterizing material *is a bar to anything like precision* in your procedure.

I meet this objection in two ways, by pointing out, *first*, the mistake made in confining attention only to the polar action; and, *secondly*, that a wrong idea is formed of the nature of electrical cauterization. This is of primary importance.

While ordinary caustics, whatever be their composition, act from without inwards at the point of contact, and, after a time, form in the products of mortification a barrier to any more profound penetration, the galvano-chemical caustic acts in a different manner, by setting up a kind of *auto-cauterization*. The tissues are decomposed by the electrolytic action of the current, and the resulting products are the cauterizing agents. The character of the eschar, thus formed, is in exact relation to the intensity of the current, and the duration of the operation. No acid or basic product is left disengaged, and the tissues cauterize themselves continuously from the beginning to the end of the sitting, without any other limitation, interruption, or suspension of the action, except that which comes from the will of the operator.

This cauterization encroaches more and more on the deep layers of tissues, instead of being restricted to the surface, and ending, as imagined, in the disengagements of acids and alkalis in the uterine cavity.

VIII. My method is difficult, costly, and troublesome.

So far as regards difficulty, there certainly is less than with hysterectomy. I want no assistant, can operate anywhere, at the home of my patient or in my own room, and though the

operator must be both gynæcologist and electrician, the scientific qualifications are easily acquired.

When one has to pay the enormous price demanded for a complete laparotomy equipment, it seems absurd to quibble about 400 or 500 francs, the cost of electrical apparatus.

It will be seen that the trouble of transport and management dwindles to a mere trifle, when I am able to announce that, at my suggestion, the electricians in Paris are now making perfect batteries, which take up very little room, and are quite transportable, the cost being 150 or 200 francs.

IX. My method is imperfect.

Here the objections are both to the apparatus and instruments I employ and to the way in which I use them.

A.—The *apparatus*.

1st. *The galvanometer* of *Gaiffe*. Some call it a *toy;* others say it is *not to be depended upon*.

I have used this instrument for some years and have made my own observations upon it; and I have had it, and others, submitted to the opinion of competent electricians.

We find that the galvanometer of *Gaiffe* is the only one in which the graduation is exact. By testing, I can find an error in the record of only from 2 to 3 per cent., which is of no practical importance. It also has the merit of being cheap.

Edelmann's galvanometer without "shunt" fails to the amount of 7·5 per cent.; with "shunt" the defect increases to 20 per cent. It registered $\frac{160}{1000}$ ampère, instead of $\frac{200}{1000}$ ampère.

An American galvanometer by *Waite* is of the same construction, and has the same faults as the German instrument.

The constants are:—

without shunt		error	6	per cent.	at least
with ,,	10 —	,,	32	,,	,,
with ,,	100 —	,,	25	,,	,,

In face of these plain physical facts all theoretical complaints must give way.

2nd. *The hysterometer in platinum*.

Objection is made to its being straight and rigid; and it is proposed to replace it by a sound made of copper which will bend easily and accommodate itself to the passages.

Any one who is in the habit of passing a sound, as it ought to be done, without the speculum, will give preference to a sound which is rigid:—

a. Because it enters more readily;

b. Because we can more easily change its position in the uterus;

c. Because it can be made to pass more easily over any obstacles, especially about the internal orifice.

Another sound, made of platinum wire coiled round a stem of copper with a point of caoutchouc, has been recommended instead of mine.

The insulating end of caoutchouc is bad, since it stands in the way of complete cauterization. The wire also is wrong in that it does not make a good conductor, is kept clean with difficulty, and with so many interstices can scarcely be made aseptic. This sound is too flexible and does not preserve its polish.

3rd. *Dirty, cold, and troublesome;* such is said to be the pad of clay which I place upon the abdomen; assuredly I should be pleased to find something better.

I have tried several of the substitutes which have been proposed for the clay, but have found none of them to have the same quality of *plastic, adaptive* adhesiveness. Neither do they well guard against the burning of the skin. The women, therefore, have *more pain* and are more scarred, as I observed in London.

The abdominal electrode of *Franklin Martin,* of Chicago, is the best I have met with, and will perhaps be adopted. It gives us the opportunity of applying it to the abdomen at an agreeable temperature.

4th. *The insulating sheath of celluloid.*

In exchange for this, we are offered sheaths made of *gum elastic,* such as used for catheters, which is corroded by many solutions and tears readily. I cannot find that it has any of the

qualities of the celluloid which I introduced. This substance *insulates* perfectly, is *aseptic*, *hard*, easily *cleaned*, *durable*, *not injured* by acids, can be plunged, if necessary, into boiling water, and has only the disadvantage of being inflammable.

B.—Technique.—For some curious reasons which I cannot understand, there has been a sort of jealous rivalry in changing the details of my practice.

1st. In regard to *intensities*.

Some have talked of using currents of 500 and 1,000 milliampères.

Now this would be *dangerous*, and I should say *impossible ;* impossible certainly without chloroform, for in all my experience I have never seen a woman on whom such a dose could be tried :—dangerous for the safety of the skin of the abdomen, which must be burned, and from the general mischief which would follow the operation.

But knowing the little reliance to be placed in the greater part of the galvanometers in use, I look upon all these reports of excessive intensities as exaggerations.

2nd. *Dosage uncertain.*

As I am supposed to have been rather loose in my dosage of electricity, it has been thought proper to call in the aid of mathematics to regulate matters for all sorts of cases, but especially for bleeding cases.

An experiment is made showing that a current of 25 milliampères intensity, traversing a positive electrode of platinum, with a surface of one square centimètre, and applied for five minutes to the mucous membrane of the neck of an enlarged uterus, will so condense the structures that no further bleeding can take place, even when they are punctured to the depth of 1½ centimètres. Hence, it is concluded that success must follow as a constant consequence if we maintain the demonstrated proportions between dose and surface ; and it is laid down as a rule that we are to use a current of 50 milliampères for an electrode of 2 square centimètres surface, and of 100 milliampères for one of 4 square centimètres. This may sometimes turn out to hold good, but not with the precision announced.

For who does not know how many sources there are for these hæmorrhages? lesions of the *mucous membrane, lesions peripheral :—*

a. Lesions of the mucous membrane. These vary in extent and depth, in the condition of the blood vessels, and in the amount of congestion.

b. Peripheral lesions; such as reflex hæmorrhages, hæmorrhages connected with the evolution of intra-parietal neoplasms, passive hæmorrhages due to disturbance of the peri-uterine circulation, hæmorrhages depending upon some affection of the tubes or ovaries.

It is evident that, setting aside simple lesions of the mucous membrane, the dosage of electricity in its application to uterine diseases must vary according to the circumstances of each case. I believe that the general instructions I have given from experience will serve to guide through most difficulties :—Use for a bleeding fibroid the highest intensity of intra-uterine current a patient can bear; if that does not answer, add punctures to the cauterization; should they not be sufficient, put the patient under chloroform and raise the dose.

Such, gentlemen, are the objections made to my method, and such are my answers. I consider my answers perfectly meet the objections.

But there is one fact which overrides all verbal quibbles and theoretical irrelevancies.

As regards my method gynæcologists muster in two ranks; those who have tried it, and those who have talked about it.

The practical men give me their adhesion, and with that I am satisfied.

The talkers have had their say, and one of your English proverbs, "*An ounce of practice is worth a pound of theory,*" is enough for them.

PART II.

THE NOVELTIES IN MY METHOD OF TREATMENT.

HAVING thus, so far as I am concerned, cleared the ground of controversy, I pass on to clinical and practical questions. I am far from supposing that we have reached the last stages of the development of the electrical treatment of fibroids. Some modifications which I proceed to explain will, I think, be found to mark a decided progress.

The two dominating symptoms in these cases are *pain* and *hæmorrhage*. I will give them separate consideration.

I. Pain.

I need not enter into details as to the many sources of this pain; it may be either concentrated in the uterus itself, or diffused.

We have, 1st. *Localised uterine pain*, arising from an augmenting interstitial compression, such as is often complained of during the early period of growth, without there being any appreciable bearing upon the neighbouring nerves or organs.

2nd. *Extra-uterine pain*, which may depend upon a not uncommon, but often oversighted, partial *perimetritis* or *parametritis*. We meet with *inflammatory conditions of the appendages;* and sometimes with uncomplicated *ovarian neuralgia*.

To relieve this symptom, pain, the almost uniform gynæcological solicitude, we have, as I was the first to point out, a powerful resource in *faradization*. The currents of *tension*, applied as much as possible in the cavity of the uterus, and under the conditions which I have for some time indicated as to electrodes, and especially the duration of the sitting, are *sedative* in a high degree.

They will be found of almost *certain arresting power in simple ovarian neuralgia; calming* only in cases of *pain from other sources*, and but of very little service in the *acute* and *suppurating* forms of *peri-uterine inflammation*.

We have then, in my opinion, a most energetic agent with which to encounter this element of *pain*, in cases of fibroid tumour, in the judicious association of *induced* and *continued* currents, under the form of an intra-uterine galvano-chemical caustic.

But we are not restricted to the use of these means only. For we have in such cases a supplementary expedient in galvano puncture, or the direct transmission of a current through the substance of a tumour, using for this purpose the negative galvano puncture. We may perhaps account for the good effects observed, by the rapid retrogression of the tumour, or in the setting up of a more powerful derivative action. Explicable or inexplicable, the clinical fact remains undeniable, that many of my cases of painful fibroids have been put at ease by the *negative galvano punctures.*

Such was my ordinary practice till lately, when a few instances of successlessness led me to try the effect of the *positive* puncture on some patients, in whom the reaction from the negative punctures had caused too great inconvenience or alarm, and on others whose hysterical temperament made the negative punctures insupportable.

First I tried with steel needles, but I was thwarted in two ways. *First*, they oxidised and became immediately useless; and then the oxidation, together with the dry eschar formed around the electrode, created an obstacle, which no one as yet had noted, to the passage of the current, and consequently caused a diminution of the electrical supply. Thus, other things being equal, while a negative galvano puncture furnished an intensity of 150 milliampères, that of the positive puncture did not exceed 50 milliampères.

To free myself from this difficulty, I put aside the steel trocars and replaced them by a fine *gold* needle, which is not acted upon in the same way and will last for some time. The only precaution to be used with this needle is, that it must not be allowed to remain in contact with any *mercurial* solution, which disintegrates metals, and renders the gold brittle. The vaginal irrigations must therefore be made with

the carbolic, or other antiseptic mixtures, to the total exclusion of all mercurial preparations. I may say that I have great confidence in these positive punctures for fibroids, especially when we encounter persistent pains; and I even have recourse to them when the pain seems to be connected with a state of peri-uterine inflammation.

II. Hæmorrhage.

I believe that we may improve our way of treating hæmorrhage and render it *shorter* and more *decisive*.

We occasionally fail for two reasons: first, that all the bleeding membrane inside the uterus is not *equally* and *uniformly* cauterized; and secondly, that we have not used a current *strong enough* to cauterize sufficiently.

1st. *Irregular cauterization.*

I employ a straight platinum sound, which answers perfectly well in a small uterus with a small cavity. But its action lessens in proportion as the extent of the mucous membrane enlarges. This may be owing either to the instrument moving too freely and coming in contact with only *one surface of a large cavity*, or to some *inequalities* of surface such as are found in the hour-glass form of uterus, when the small straight sound touches only isolated points, cauterizing some to the utmost, while others escape altogether.

I overcome these difficulties in two ways:—

a. After a multiplicity of experiments I have devised a new electrode, which is soft, and not only a good conductor, but *harmless* and quite *aseptic*. It is composed of *gelosine*,* and can be made to mould itself upon the whole of the uterine interior.

It must be previously sterilized either by open boiling and then cooling, or by exposing it in the containing vessel to a temperature of from 100 to 120 degrees centigrade. This matter is then introduced into the cavity of the uterus, so as

* *Gelosine.* Gelosine is the mucilaginous principle recently extracted by M. R. Guerin, chemist, of Paris, from the gelose of the *Gelidium corneum*, a sea-weed of Japan, found in abundance at Singapore.

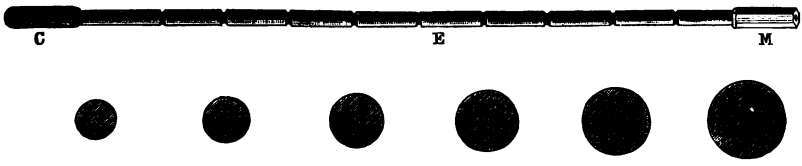
to fill it, by means of a long piston-like sound of some insulating material, such as hardened caoutchouc or celluloid. The metallic stem of this piston sound may then be used as electrode, and the current passing through it, to the centre of the gelosine paste, thence radiates over the whole mucous membrane.

There is another way of making use of this gelosine packing. Withdraw the piston sound when the cavity is completely filled, and plunge a metallic sound, insulated nearly up to the point, into the middle of the gelosine, and make connection with the battery.

b. I succeed in cauterizing the whole of an irregular cavity by progressively increasing the size of the electrodes, so that in the end the entire surface is brought into contact with the conducting body.

To do this with sounds of gold or platinum, the only available metals, was a costly affair, and I instructed Gaiffe to make for me a series of seven sounds of gas carbon,* which *conducts readily*, is *little subject* to the action of the *positive pole*, and may be had *cheap*. I possess therefore a case of seven sounds of different sizes, rising from 5 millimètres to 12 millimètres in diameter. Beginning with the smallest sound, sufficient dilatation may be made for the others to follow in

* Electrode for galvano-chemical cauterization, one-third of actual size.



C. Gas carbon 2½ centimètres long, rounded at the extremity. It is fastened by a screw to the end of the metallic stem. It may be replaced by others of the same length, but of different sizes. The diameters, gradually increasing from 5 to 12 millimètres, are represented by the shaded circles.

E. Circular grooves, at regular distances of 2½ centimètres, on the caoutchouc covering of the metallic stem of the electrode.

M. Handle of the electrode to which the rheophore is attached.

succession, till it is found that one of them gives the coaptation required.

This is the solution of the first part of the problem:—the equal spread of a current over the whole of a large or irregular uterine cavity.

2nd. *The uterine mucous membrane insufficiently cauterized.*

The coagulating or hæmostatic action—*local* and *polar*—which we seek at the positive pole, under ordinary circumstances, will be strong and efficacious according to the quantity of acid disengaged. that is, in other words, it will vary in proportion to the electrical intensity. Now, there are two means by which we can regulate the intensity, at the points of entry and discharge of the current.

a. The *first* is to engage a large number of elements. We may thus apply in certain cases an intensity of current varying from 100 to 300 milliampères. But with regard to these degrees of intensity, we must not lose sight of two considerations, the safety of the uterus and the tolerance of the patient.

If a few women are able to bear unflinchingly, without chloroform, as much as 200 or 250 milliampères, there are many more in whom it is impossible to make the dose exceed 100 or 150 milliampères. Now in a uterus of *large size*, where it would be necessary to introduce an electrode of proportionate length, perhaps 15 or 20 centimètres long, this latter strength of current would not answer our purpose. For it is with electricity as it is with other natural forces, that power diminishes as the *surface is extended.* We see this in a watercourse, where the mechanical effects of a confined portion of the stream are reduced to insignificance if the bed be much widened.

b. This leads to the adoption of the *second* and more practical means of attaining the same end. We vary and augment the intensity at the points of contact of the poles without altering in any measure the total interpolar intensity. The surface of the active electrode must be diminished or its *density* increased.

It is understood that, with a greater intensity in an electric circuit, the action of the two poles will be different according to their respective size. Here, then, in varying the extent of the

electric surface we have the means, at will, of rendering the poles *active* or *indifferent*.

It is easy to make this accommodation in regard to the uterus. We wish to produce a vigorous cauterization, without increasing the general interpolar intensity beyond the point easily supported:—Lessen the intra-uterine electrode by one-third, or fourth, or a fifth of its original length, and forthwith the cauterization or topical action at the seat of contact will be made thus four or five times more powerful.

I therefore lay it down as a rule in severe hæmorrhagic cases, where it is expedient that a patient should bear a high dose of electricity without much suffering, that the intra-uterine electrode be reduced to a very trifling length; though, under such circumstances, it is essential that it be passed from one extremity of the cavity to the other, so that every part of the mucous surface is successively and completely cauterized.

I began my operations in 1882 with a metallic sound, bare only at the extremity. In my first essays in cauterizing the mucous membrane of the uterus I had no other. Now I have improved the instrument, and my electrodes of *carbon*, though of different sizes, are all of the same length,—2½ centimètres.

The metallic stem of this instrument is covered with caoutchouc, and on it, at distances of 2½ centimètres, lengths which correspond with that of the carbon electrode, I have slight circular grooves marked.

The electrodes are applied as follows:—

1st. After disinfection in some strong antiseptic solution, in order to secure full cauterization, the instrument is driven as far as it will go, if possible to the end of the uterine cavity.

2nd. When the electrode is in this position, the highest bearable intensity of current is turned on, and we judge of the necessity of augmenting by the effect of previous operations. The intensity must be increased when the electrodes of larger volume, and consequently of more surface, are taken into use.

3rd. The first stage of cauterization being finished, the instrument is withdrawn just as much as the length of the carbon, and in that situation the second cauterization is effected

the same as the first, and so on, changing the position of the carbon till all the interior of the uterus is cauterized section by section.

To do this methodically the index finger is passed into the vagina, and the pulp and nail pressed on to one of the circular grooves of the stem. While, in shifting the seat of action, the other hand retires the sound, the index finger in the vagina remains immovable, and gives information as to the extent of change of position of the electrode by the touch of the following mark.

4th. It is better if possible to cauterize the entire cavity at one sitting, letting each sectional cauterization last from 3 *to* 5 *minutes*, as the gravity of the case and the size of the cavity may show to be proper.

5th. In continuing the treatment, the duration and force of the current must be made to depend upon the effect produced by the cauterizations at previous sittings.

6th. It is well to be aware, that when the cauterization of the neck of the uterus is once made, the electrode, in passing through the internal orifice for further action, will occasion much more pain. I believe I was the first to mention the fact that the neck of the uterus, which is so little painfully affected by ordinary caustics, the hot iron, or the knife, is, on the contrary, very sensitive, and much more so than the body, to the electrical currents, either induced or continued.

I think, *in conclusion*, I may say that it will henceforth be admitted we have in electricity a most powerful means of safely treating fibroid tumours, and that it will in future be felt as a duty by the surgeon to make use of it before adopting other measures. Carrying out my method as I have directed, I am convinced it will yield to others the same new and interesting results that it has been my good fortune to witness.

At the meeting of the British Gynæcological Society, June 27th, 1888, Dr. Rutherford closed his paper on a case of fibroid tumour treated successfully by this method, as follows:—

Next I would note the entire disappearance of a large soft fibroid tumour and the entire cessation of the menorrhagia and metrorrhagia which, from time to time in years past, brought the patient to the brink of her grave.

Three applications of the continuous current were made, the negative electrode being intra-uterine, and the greatest intensity of current being 120 milliampères. What was the process by which this diminution and final disappearance of the tumour was brought about? The explanation I would offer is that the galvanic current caused a sloughing of the tumour within its capsule; that when the broken down material was absorbed into the general circulation, septic symptoms set in and continued until the entire tumour had disappeared. This is only supposition, but I believe it to be supported by the septicæmia which was undoubtedly present; by the adenitis and phlebitis which subsequently occurred, and by the temperature, which indicated suppuration, especially until the end of December. For a few days, then, the process, whatever it may have been, remained quiescent, as indicated by the return of the temperature to normal and by the improvement in the patient's condition. It was, however, soon lighted up again, and on January 2nd, 1888, the temperature was decidedly febrile.

With regard to the temperature, it may be of interest to note that from January 9th to 22nd, the temperature was at its highest in the evening; from January 23rd to February 10th the elevation of temperature was highest almost invariably about midday, and declined again towards evening.

I must not omit to mention that after each application of electricity the tumour became markedly harder than before, remained firm and contracted for some hours, and then slowly relaxed. This hardening has frequently been noticed, and is due to the contraction of the non-striped muscular fibres of the uterus and tumour. The process by which these tumours diminish in size is at present undecided.

By some it is argued that the passage of the electric current through the tumour causes a coagulation of the albuminous material contained in its tissues, and a splitting up of compound

bodies into simpler ones, and that their chemical absorption takes place. I am not in a position to deny that by such changes the tumour does diminish in size; but against this theory I would argue that if chemical absorption of the tumour does take place, owing to the passage of the electric current, then this process should continue so long as the electricity is applied, and the tumour should in time entirely disappear. Such, however, is not what happens. In all the reported cases, there has merely been a diminution in the size of the tumour, and not a complete disappearance, except in the case I have brought before you, and in one reported in the *British Medical Journal*, in which the tumour was enucleated, and was expelled per vaginam. Indeed, I believe it is admitted on every side that as a general rule the tumour diminishes in size, but does not completely disappear. Another theory is that the electric current causes an interstitial inflammation, which proceeds along the strands of connective tissue present in every fibroid. These connective tissue bands in time cicatrise and cause a fatty degeneration of the muscular fibres surrounded by them. I have examined tumours which have been treated in the first instance by electricity, and have failed to find any such changes. Where galvano puncture has been practised changes will be found immediately around the puncture, but similar changes would, I imagine, be found if the thermo-cautery or a red-hot iron had been inserted into the tumour. In any case the changes are extremely local, and do not extend into the substance of the tumour.

Whatever the process may be by which these tumours diminish in size or disappear I am unable to say, and I have no desire to theorize. In this new field of electro-therapeutics there are many earnest workers who will in time further elaborate and perfect a method of treatment, which is at present in need of careful experiment and accurate observation. I cannot conclude without thanking Mr. Peck, our resident Medical Officer, for the copious and accurate notes.

At the meeting of the Chicago Gynæcological Society, March

1888, Dr. Franklin H. Martin read a most valuable paper, reporting his results in fifteen cases of fibroid tumours of the uterus, treated by Apostoli's method, to which I shall allude more fully in the next chapter. In discussing the paper, Dr. P. S. Hayes said:—

The point has been well discussed, and there can be little further said. It occurs to me, however, that there may be a reason why the positive electrode used in the uterus is more hæmostatic than the negative, and that is on account of the cicatrix which follows the use of the positive electrode being more prone to contract; the cicatrix following the negative being like the cicatrix of a burn with caustic alkali. From my own experience in the use of electrolysis, I find frequently that, at the time of operating, there is a slight hæmorrhage, or, at least, an oozing of bloody serum more likely to follow the use of the positive than the negative pole, especially if any other than a platinum electrode is used. The destruction of tissue around the positive pole is not nearly as great as that around the negative; the oxygen is separated about the positive pole and the acids are liberated, and I find the eschar which follows essentially the one produced by the action of the strong mineral acids on albuminous tissue. On the other hand, if the negative pole is used, we find that the destruction of tissue extends probably twice as far from the electrode. The appearance is entirely different, that from the negative pole looking very much as though it had been frozen, and the scar tissue which results from the use of the negative pole does not contract as firmly as does that which follows the positive, and it seems to me that this can be explained to a large extent by the chemical action which takes place along the electrode. There are two, and, possibly, three factors present in this method of using electricity; there is the physical effect, due, of course, to the liberation of the gases around the electrodes; there is the chemical effect, due to the electrolysis or separation of the salts of the body into the acids at one pole and the alkalies at the other; and then there is the physiological effect, which we do not understand as well as we do the chemical and physical effects. Whatever

be the amount of chemical action which takes place around the pole,—that is, in the uterus,—an equivalent amount of chemical action takes place under the electrode that is placed on the abdomen; and almost invariably you will find an irritation of the skin, and you may possibly get a blister within the circumference of the electrode, so that on the second or third day you will find it difficult to apply the electrode where it was first applied. That the electricity, as it passes through the tumour, affects the cell life is a question that has yet to be proven, and I think the determination of the matter can be considered almost entirely due to the peculiar chemical action which takes place around the electrode.

In his discussion of Dr. Rutherford's paper at the British Medical Association, Dr. Bantock objected that he would defy any one to diminish the size of the tumour he held in his hand, by means of the electric current. For a man of such fine abilities, this seems to be an argument bordering upon the puerile. To expect the galvanic current to act, electrolytically or catalyctically, upon dead tissue as it does upon living tissue, is to make confession of an ignorance in regard to the *modus operandi* of electric currents that is to be deplored. Dr. Bantock has not given the subject the study it merits, and hence cannot give any opinion founded upon investigation. But apart from any theoretical reasoning, the published results of cases, now marching on to the thousand, reported by men whose ability, erudition, and honesty not even their peers will gainsay, have placed the method of Apostoli upon an enduring basis, far out of the reach of cavil. Dr. Bantock believes the results to be grossly exaggerated. That is because he is not *au courant* with the literature of the subject; because he could not accuse men of like ability with himself of being unable to make an intelligent diagnosis, or of making an honest detail of results. If Apostoli has rung the death-knell of indiscriminate laparotomy, the surgeons themselves furnished the rope. Dr. Apostoli has never claimed that he can entirely eradicate a tumour. The time, however, is near at hand when cases of this

kind, *fully* authenticated, will be reported. Instances are on record, and are now under competent observation. What we do claim for the method is: 1st, that it will improve nutrition; 2nd, that it will diminish size; 3rd, that it will relieve pain; 4th, that it will arrest hæmorrhage; 5th, that, governed by intelligence, it is an entirely safe procedure. In face of facts such as these, so amply substantiated as to be beyond the peradventure of a doubt, there must be purely personal factors at work to deny the method a hearing, or to refuse it the highest *rôle* in conservative gynæcology. Nothing else known either to surgery or medicine offers as much. It is a relief, almost certainly absolute, of the salient symptomatology of uterine tumours without endangering life. I have been struggling in this direction for years. I have turned over in my mind many methods that would reduce to a minimum the dangerous operative necessity in diseases of women that has characterized the history of surgery for the last fifteen years. Nearly ten years since I confessed my faith in massage, electricity, and well-regulated hygiene. I have agitated it in every way known to me. It was left, however, to one of larger originality, of deeper study and better training, to formulate the laws that govern our procedure to-day. Dr. A. Laphorn Smith says of it:—

"In presence of the powerlessness of purely medical therapeutics and of the mortality of abdominal hysterectomy, which is always considerable (40 to 50 per cent.), as well as the dangers and difficulties connected with surgical interference of every kind, Dr. Apostoli proposes a method which is simple, inoffensive, and most often sovereign: 1st, The treatment is, in fact, easy, and is summed up in a good therapeutical hysterometry which is within the reach of all physicians who are supplied with an apparatus for measuring the current (a good galvanometer of intensity), any kind of a battery, provided it gives out a large quantity of current, an inattackable platinum electrode, and a sufficiently moist cake of clay. 2nd, This operation performed with every antiseptic precaution, and followed by proper rest, is harmless, for in more than three thousand intra-uterine

galvano-cauterizations, divided among two hundred patients who underwent a more or less complete treatment, he has had only a very few accidents, which should be laid to the blame of the inexperience inseparable from starting, and to operative mistakes which were corrected by practice. 3rd, Well applied and continued sufficiently long (from three to nine months on an average), this method is most often sovereign, and leads ninety-five times out of a hundred to the following results: Anatomical retrogression of the fibroid, varying from one-fifth to one-third and sometimes even one-half, but never to the total disappearance of it; rapid and permanent arrest of the hæmorrhage; disappearance of the phenomena of compression, and the restoration of the patient symptomatically.

"The rare cases of non-success, 3 to 5 per cent., observed, are nearly all found to be ones of ascitic fibroid. The treatment loses also a part of its influence in fibro-cystic tumours, and when the complications of peripheral inflammation or severe hysterical diathesis render difficult and prevent the employment of high intensities. Intra-uterine galvano-chemical cauterization is compatible with a subsequent pregnancy."

Dr. Engelmann, of St. Louis, has written elaborately and well upon the subject. His success is unquestioned, and I commend his paper (*Trans. American Gynæcological Society*, 1886) to the thoughtful consideration of everyone. Dr. Sutton, of Pittsburgh, says that the method of Apostoli can have no possible influence upon sub-peritoneal tumours, and I imagine him to be sceptic of the good effect of the galvanic current upon any kind of neoplasmata. Experience shows Dr. Sutton to be in error. Sub-peritoneal tumours may begin as interstitial, taking origin from some pathological condition of the cellular tissue of the uterine wall. Theoretically we would suppose the uterine endometrium lining the cavity of an organ engendering pathological change of its walls, to be itself the seat of cell metamorphosis, or degeneration. Post-mortem examinations show that this is true. The interpolar action, the changed condition of cell life, set up by the continuous current, goes on just the same, but with a weaker action, in the sub-peritoneal

tumour as in the interstitial variety. There is the same molecular circulation, the same transference from cell to cell, of the electric stimulus. It is not the immediate action around the poles alone, but it is the shock given to the intercommunion of the cells, their circulation, and their transference to each other of the beneficent electric *order*, that leads to arrest of growth and diminution. If Dr. Sutton will read Dr. Carlet's essay he will find mention of sub-peritoneal tumours diminished in size, and all painful symptoms alleviated. If he will read the list of Dr. Keith's cases, he will find similar facts recorded. Or if he will refer to any one of the hundred or more physicians who have attended Dr. Apostoli's clinic in Paris, since I myself have been at work here, he can have histories of interest given him, where sub-peritoneal tumours of great size have been very considerably diminished, and where, from a relief of the painful symptomatology, the patients have been able to resume their accustomed duties. The amount of argument opposed to originality is a sure indication of its inherent merit. Somebody's doxy must go to the wall, and that somebody will of course wail. All scientific revolutions have *fought* their way to fame, and healthy scepticism is not baneful. It is only the dreary agnostic who will not investigate, who denies because too lazy to find out, or who is too incompetent to formulate an opinion for himself, that encumbers advance. It has been urged that many cases had reached the climacteric period, "when, as is well known, fibroids will frequently by themselves undergo a retrograde change, and gradually disappear." Then why operate upon women at the climacteric? How many cases are recorded of the *entire* disappearance of the tumour after the menopause? But this objection is of course a weakling. Tumours do not seem to have any inherent predisposition to suicide. If protoplasmic matter have inherent potentiality to originate pathological changes, it may be inferred that it has equal power to restore the morbid to the normal, and upon this theory we might have spontaneous cure. I do not believe in the potential molecule. To my mind it is clear that all molecular action, creative or otherwise, is due to some stimulus

external to itself; and hence that pathological change has as causative some stimulus external or internal, and that spontaneous cure is always due to a stimulus. But many tumours *grow* after the climacteric, and the vast majority remain *unchanged.* It is like saying to the physician, "That case of typhoid fever might have gotten well without your interference, because such things have occurred." Why keep the woman waiting with such an unsightly object always with her, to see if the years that go and come will eradicate it, before testing a method which is unaccompanied with danger or much pain, and which has everything in its favour? In closing an article in the *Gazzetta Medica di Torino*, Dr. Berruti says: "Io voglio sperare che le applicazioni del nuovo metodo iniziate nell' Ospedale Maria Vittoria, circondate da tutte le precauzioni, confortate da tutti i mezzi perfezionati e raccomandati dall' autore, riesciranno a darci il concetto esatto del ralore e dell' importanza del metodo che ci auguriamo, pel bene dell' umanità, sia quale il Promotore assicura e quale merita la tenacita de'suvi propositi, la sua fede inconcussa ed il suo lungo studio." La Torre, who studied with Apostoli, read a paper before the Fourth Congress of Obstetrics and Gynæcology at Naples, September 1888, speaking of his success in the treatment of uterine fibroids by this method.

Berruti further says—and it is a graceful tribute to a man whose politeness is always the same, and who never seems to weary in explaining his method to strangers: "Tutti poi, e specialmente quelli che hanno studiato la nuova pratica alla clinica dell' Apostoli, sono d'accordo sulla buona fede del promotore, del profondo studio e della compiacenza che il medesimo dimostra a quanti vogliono verificare la diagnosi delle malattie e tutti i particolari della cura." Dr. Basile Massin, Interne of the Obstetric and Gynæcological Clinic at St. Petersburg, came to Paris especially to work up the method for the service of Professor Slavanjsky. Dr. Wright, now of the Glasgow Infirmary, formerly assistant to Professor Simpson, took away with him notes of several cases that he watched, in which the results were most gratifying, and which notes, I

believe, he intends publishing. Every case reported from Apostoli's clinic in the Rue du Jour has many competent witnesses behind it; all medical men, ambitious and industrious. No statistics more reliable, or more fully authenticated, have ever been published. The power of the positive pole of the continuous current to arrest hæmorrhage is simply marvellous. I began my studies with Dr. Apostoli in October 1888, and up to this time of going to press I have seen over fifty women treated for hæmorrhagic myoma. Some of the women were in an extremely bad way. Madam Richard had to be carried upstairs, and was bleeding profusely. The first application made her much more comfortable. After the third application, there was never any return of the hæmorrhage, and under negative electro-punctures the tumour is diminishing rapidly in size. Dr. Hall, of Baltimore, has been a most faithful attendant upon the clinic for many months, and has taken full notes, which she intends publishing very soon. Dr. Apostoli, himself, intends giving to the world, before spring, the results of his work during the last two years; so that if my own list of cases is small, it is simply because I feel that I have no right to anticipate any of my friends, by publishing material in advance, to the detriment of their own endeavours.

CHAPTER V.

REPORTS OF CASES OF UTERINE TUMOURS.

THE *résumé* of the cases of Dr. Apostoli, treated by him at his clinic, as published in the thesis of Dr. Carlet in 1884, is as follows: "Out of 94 cases of tumour:

1st. 59 were treated with galvano-caustic positive.

2nd. 21 were treated with galvano-caustic negative.

3rd. 5 were treated with galvano puncture, preceded or followed by positive or negative galvano-caustic.

4th. 9 were treated successively with galvano-caustic positive or negative.

In all there were:

a. 649 applications of galvano-caustic positive.

b. 228 galvano-negative.

c. 36 galvano-punctures negative."

Dr. Apostoli was treating or had treated up to this time, privately, 24 cases, making a total of 118 cases, with more than one thousand galvano-caustic applications.

Carlet says: "The galvano-caustic intra-uterine causes a rapid diminution in the size of the tumour, but not their total disappearance. It restores the patient's health, suppresses hæmorrhage, and offers the woman a future of comparative well-being."

One of the most interesting of these cases is that of Mdlle. R. B., sent to Dr. Apostoli by Mons. Terrillon, the eminent surgeon, who for fourteen years had suffered, very gravely at times, from a hæmorrhagic myoma. The cure seemed to be complete. Just here, I wish to cite two cases, one from the

clinic of Dr. Péan, and the other sent by Dr. Labbé. They presented themselves for treatment in December 1888, the one being almost *in extremis* from excessive hæmorrhage. Malignant disease was suspected, and demonstrated to be such, subsequently, by the microscope. Galvano-caustic intra-uterine arrested the hæmorrhage at once. It returns with less severity, at longer intervals, but is always checked by positive application. The other case was one of an enormous fibroid, extending upward to a point midway from the umbilicus to the ensiform appendix, and well down into both flanks. It was hard and immovable. Through the vagina it was found compressing both bladder and rectum. Operation had been refused by Dr. Péan. Up to February 8th, 1889, the woman had received twelve galvanic treatments (five punctures and seven galvano-caustic, all negative). The tumour has fallen to a point about one and a half centimètres below the umbilicus, is softer, and freely movable. The woman has charge of one of the largest free schools in Paris, and before coming to the clinic had been unable to attend to her duties for three months. She says now that she feels perfectly well, and is quite strong enough to resume her post of duty. All the dimensions have been reduced from one and a half to four centimètres. Another case of great interest is that of Mademoiselle G., thirty-eight years old, who was sent to the clinic from the suburbs of Paris, and who presented herself for treatment in November 1888. She has a large fibroid; lobulated, hard, resisting, and immovable. Its long diameter is from the umbilicus to the last lumbar vertebra. The three lobes can be distinctly defined. From the symphysis pubis to the upper border of the tumour measured forty-seven centimètres. She was unable to walk, both from a phlebitis occasioned by pressure, as well as from the pain incident to motion. No hæmorrhage. Within the vagina, at a distance of two and a half inches from the introitus, the tumour, pressing upon the rectum, has the feel of a child's head. The first three treatments—galvano-caustic negative intra-uterine, 150 milliampères, 10 minutes—produced negative results. After the second galvano puncture (negative, 130 milliampères,

10 minutes) she felt herself much better, and was able to walk to the clinic. She has received now five negative punctures. The tumour is falling toward the pelvis, in such wise that the distance from symphysis pubis to ensiform appendix has been reduced four centimètres. The measurement from one flank to the other has diminished one centimètre. The diminution is still going on, and the patient is in every way decidedly better. Another woman came for treatment just before my arrival in Paris. A large interstitial fibroid reached to a midway point between symphysis pubis and the ensiform cartilage. The os uteri was crowded up against the symphysis, and was reached with difficulty. Woman, forty years old. She has received fifteen galvano-punctures negative, 150-275 milliampères, 10 minutes. The upper border of the tumour is now midway between the symphysis pubis and the umbilicus. It is freely movable, and gives no discomfort whatever. Treatment still in progress. Another woman, a cook, aged forty-one, came to the clinic last November. Diagnosis: fibroid, sub-peritoneal, bilobed, filling the abdomen. Abdominal circumference at umbilicus 125 centimètres. Hysterometry impossible. 4 galvano punctures, 150 milliampères, 10 minutes, negative. Punctures made through the most prominent part of the vaginal tumour. This canal was then utilized for the application of eight galvano-caustic, negative applications, 120 milliampères, 10 minutes. In three months the abdominal circumference has fallen to 109 centimètres.

These cases might be multiplied without difficulty, but as Dr. Apostoli may allude to his more recent work in the introduction which he has been kind enough to write for this book, I will pass on to a consideration of the cases of others which have fallen under my notice. Dr. Franklin H. Martin, before the Chicago Gynæcological Society, March 1888, read "A Report of Fifteen Cases of Fibroid Tumours of the Uterus treated by Galvanism." He says: "From January 1st, 1887, to January 1st, 1888, I applied galvanism, in strong, accurately measured and definitely concentrated doses, in gynæcological cases 1,400 times. During this time I employed

galvanism for uterine fibroids 623 times in fifteen cases." The result was as follows:

Not suitable for treatment, and recommended for operation	1
Benefited	4
Symptomatically cured	5
Absolutely cured	5

This paper is so full of interest and is so instructive that it is worth the reading, but it is over long to give *in extenso* here. *It will be noticed that five cases are reported as absolutely cured.*

In the February number, 1888, of the *Edinburgh Medical Journal*, Dr. Skene Keith reports six cases of uterine fibroids treated by electricity. In all of these cases there was marked diminution in the size of the tumour. Dr. Rutherford's case of cure I have already called attention to. Dr. E. W. Cushing of Boston writes me that he is having good success with Apostoli's treatment. In a very excellent monograph upon the electrical treatment of the diseases of women, Dr. Massey draws attention to the case of Dr. Holland, and then speaks of his own good results. In Dr. Holland's case the result was brought about by exciting active contraction of the muscular fibres of the uterus, thus causing an enucleation of the tumour. This action of the current would be especially valuable in polypi and sub-mucoid tumours. Dr. Massey, who is having an exceptional experience with Apostoli's method, commends it most highly. In the *New York Medical Journal*, February 4th, 1888, and in the *New York Medical Record*, July 7th, 1888, Dr. MacGinnis and Dr. Carpenter are especially struck with the benefits resultant upon this plan of treatment. On November 27th, 1888, Dr. Delètang of Nantes read a report, before the Academy of Medicine, Paris, of ninety-seven cases treated with great success after the plan of Apostoli. The history of each case is fully recorded, together with the name of family physician, etc. Dr. Skene Keith reports, in the practices of himself and father, three thousand applications and ninety-two cases of uterine tumours, and expresses himself so thoroughly pleased with the method as to adopt it exclusively. Dr. Keith, senior is known to be one of the most successful, honest, and pains-

taking abdominal surgeons of the day; his results in surgery have never been surpassed. Therefore, when one so competent, so universally honoured as he says that he should consider it criminal in any one to undertake a laparotomy until galvanism had been given a fair trial, it rings out a note of warning as clear as the clarion. Sir Spencer Wells, Keith, and Playfair have all visited Apostoli's clinic, and I believe that they have all expressed themselves favourably, when the cases are suitable. Elder, before the Medical Society of Nottingham, who has twice visited the clinic in Paris, reported the beneficial results in forty cases of tumours, endometritis, sub-involution, and peri-uterine inflammations. Dr. Woodham Webb, who is a frequent visitor at Apostoli's clinic, and who has seen and followed a great many of his cases, who knows that all of the statistics emanating from the Rue du Jour under the authority of its director are honest, frank, and genuine, has written in terms of the highest commendation of the work going on in Paris. Savage and Taylor of Birmingham, Barton of Liverpool, Livy of Clifton, Murray of Edinburgh, Aveling, Holland, Steavenson, Duncan, Parson, and Shaw of London, all report good results.

Dr. Moritz Benedikt of Vienna published in June 1888 the results of his investigations. He says, that if the method of Apostoli had only been known and practised years ago castration would never have found a foothold. Before the Philadelphia Obstetrical Society, December 6th, 1888, Dr. T. Hewson, Bradford, read a paper: "Notes on Gynæcological Cases treated with Electricity." In discussing this paper, Dr. B. C. Hirst thought it was gratifying that we were advancing in this branch of therapeutics. It seemed that for a time we did lag behind other gynæcological centres. He tried electricity some time ago, but with very little result, because he had, he thought, used too weak a current, and because he did not thoroughly understand the application of electricity in gynæcology. He thought that much of the criticism of this kind of treatment had been ill-considered. See Appendix for full report and discussion. Dr. La Torre of Rome, in his paper referred to (see Appendix), says: "These eight observations

seem to me to prove conclusively that the elimination or enucleation of certain fibroids of the uterus may occur spontaneously under the action of electricity. Here are eight cases of greater or less severity. . . . I heartily approve the opinion of Apostoli, who has sent me the following note :—"*In the treatment of uterine fibroma electrolysis cures them symptomatically—often clears up a diagnosis, and is frequently of the greatest possible assistance to the surgeon.*" Vuillet of Geneva seeks "to direct the tumour toward the uterine cavity, by means of electricity, thus making it sub-mucous and aiding in its spontaneous enucleation." Dr. Doleris theoretically holds the same views, and the cases of La Torre prove that cases of spontaneous enucleation after the use of electricity are not rare. Apostoli's experience is, that interstitial tumours often, under the influence of electricity, tend either to the external peritoneal surface, or the internal mucous surface.

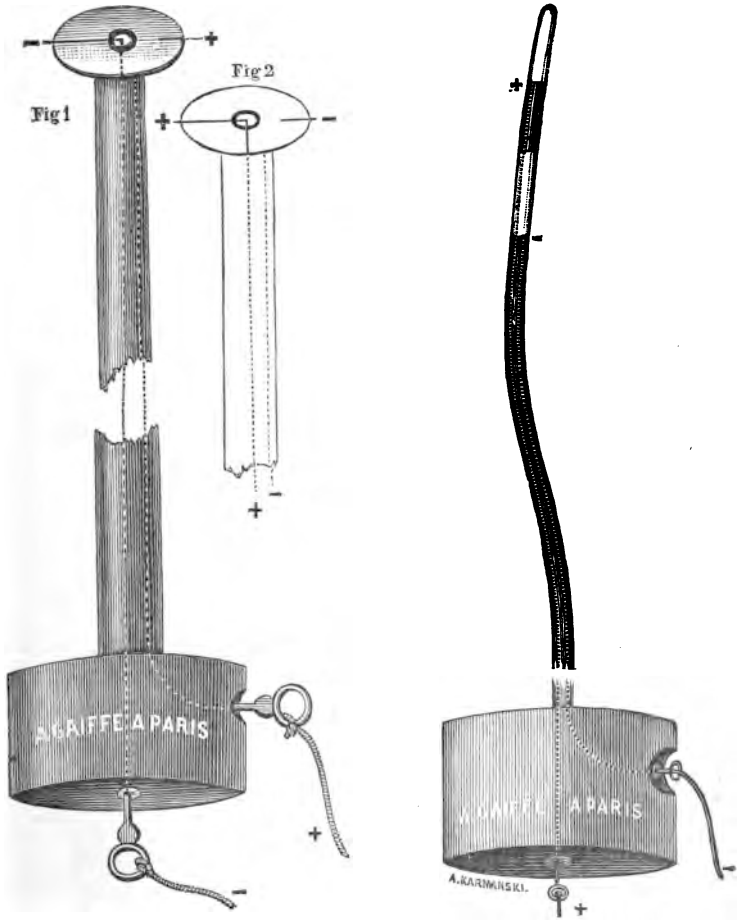
Professor Wilson of Baltimore, the President of the American Gynæcological Association, very recently wrote to Dr. Apostoli, that he was well satisfied with his method, and since providing himself with a Gaiffe battery and galvanometer he was having excellent results.

CHAPTER VI.

DISEASES OF THE OVARIES AND TUBES.

Ovarian Pain.—In nervous women and hysterical patients generally this localized pain, always present but intensified by deep pressure over one or both ovaries, is a prominent symptom. Associated with it are other evidences of an absence of nerve tone. Deep pressure at the epigastrium occasions a similar pain. Perhaps there will be a tender spot on top of the head. Then there is that endless train of subjective symptoms known to every physician. In whatever light we may regard this ovarian super-sensitiveness, it is, to the patient, a pain so real and intolerable as to make her life miserable. The fault may be in the higher nervous centres. There can be no question that the general trouble is here, and that a faulty co-ordination and differentiation misinterpret conditions and exaggerate symptoms. The peripheral irritation of some kind is in the ovary, may be itself a starting-point, or there may be just enough of it present to start a false impression of importance along a diseased nerve track. This primary stimulus, adding to itself particles of diseased representation by traversing an unhealthy route, will be received by the brain—itself functioning badly—and interpreted by it in an exaggerated way. The pain *is* real, no doubt of it, but its severity, in an otherwise healthy subject, would be slight; but in hysterical women this symptom is unbearable, because the whole nervous track is working badly. These cases are treated with the faradic current, using the long

thin wire, and carrying both currents through a delicate electrode, about the size of an ordinary sound, up to the fundus uteri. (See Figs. 27 and 28.)



Figs. 27 and 28.—Apostoli's Bi-polar Electrode, also in charcoal point.

Apostoli says: "On the 20th February, 1883, I presented to the Academy of Medicine of Paris a double or bipolar intra-uterine exciter (see Fig. 29) with an explanatory note. To legitimize the use of this new uterine exciter, I made to the

Medical Society of Paris, the 28th April, 1883, and 23rd February, 1884, two communications on double and bipolar uterine faradization. A. Tripier, by creating this method of

Fig. 29.—Apostoli's Bipolar Electrode.

uterine faradization, has formulated an almost uniform and constant treatment of simple metritis. . . . I have proposed

Fig. 30.—Section of Female Pelvis.

to replace his inconvenient and more or less painful method by one which concentrates the two poles in the uterus and combines the following advantages:

"1. Doing away with the cutaneous pole.

"2. Concentrating in the uterus the whole of the electrical action.

"3. The operation is easier, and does not require the assistance of the patient nor of any one else to hold the tampan.

"4. The operation is less painful, on account of the current not passing through the skin.

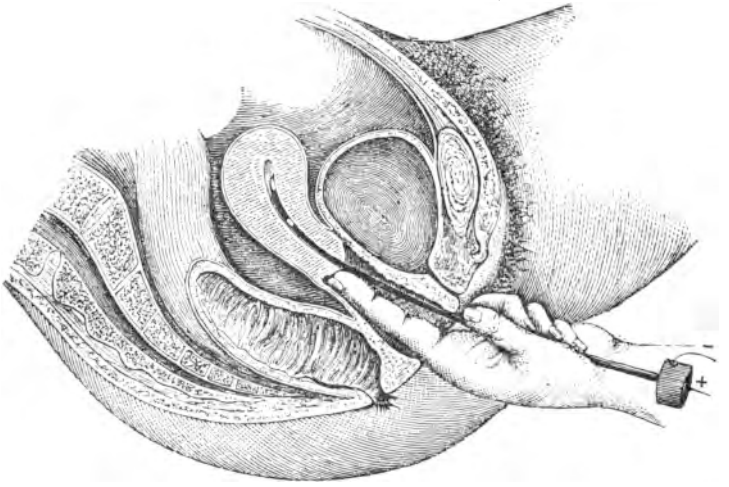


Fig. 31.—Showing the Electrode in Position.

"5. The operation is stronger and more effective, on account of the possible increase of the uterine contractility, the facility being given by employing, although with less pain, a much stronger current, with the result that it is more curative."

A sitting of ten minutes dissipates the ovarian tenderness *entirely*, so that even deep pressure will not provoke it. I have seen as many as twenty-five of such instances at Apostoli's clinic. Of course the general condition remains the same. Only the ovarian pain succumbs.

Ovaritis.—Acute ovaritis, or oöphoritis, is a disease of such exceedingly rare occurrence that Cornil says that in all of his autopsies during many years he has never met with more than two or three instances of it. Neither can I see how a

positive diagnosis of uncomplicated acute oöphoritis can ever be made. A primary oöphoritis, beginning within the stroma of the gland, is not self-creative, and the factor that developed such an inflammation would be felt in adjacent tissues equally. Menstrual suppression causes hyperæmia, so does normal menstruation. But the pathological hyperæmia is not limited to the ovary, but is felt along the tube-ovarian tract, and even in the peritoneum. Acute oöphoritis, as we meet it usually, at least as I understand it, is merely one of the conditions entering into salpingitis, peri-oöphoritis, zymotic disease, etc., which themselves are forms of expression of infection.

Chronic Oöphoritis—meaning by this a state of enlargement due to continued hyperæmia, from any cause whatever—is rare, except in relation to pelvic inflammations and tubal disease. Chronic ovaritis connected with tubal disease will be treated farther on. If the case can be diagnosed as unconnected with pelvic peritonitis, or tubal disease, the positive galvano-caustic action, with 25-50 milliampères, 10 minutes, will give satisfactory results. Pathologists seem to be sceptical in regard to the sequence of the acute and chronic forms,—the following of the latter upon the former. Chronic ovaritis is not uncommon, when viewed as a symptom of something else. Excessive venery will cause it; but it will also engender changes of vascular supply, changes in the nervous centres, and changes in the uterine endometrium. Frequent pregnancies may set up a hyperplastic condition of the ovary, followed by fibrous metamorphosis. Malpositions of the uterus, by interfering with the integrity of the pelvic circulation, most often occasions ovarian disease. In *The American System of Gynæcology*, an exceedingly well-written article by Dr. Coe, upon diseases of the ovaries, has received merited attention.

Ovarian Cysts.—We are not sufficiently advanced as yet, and we have not enough cases to report, to justify an opinion. Large cysts demand the attention of the surgeon. Small unilocular cysts at the very beginning have been treated by galvano-puncture, with apparently good results. The time, however, that has elapsed since the operation—I mean in such

instances as have been under my personal observation—is too short to form a just idea of its merits. Mundé's paper, published nine years ago, dealing with the methods that then obtained, and analyzing the statistics, was, up to that time, and for some time afterward, the most valuable contribution of record upon this branch of electro-therapeutics. It is even now a classic. It should be remembered, however, that our methods have changed with times, and that we should never puncture a cyst as Semeleder did. The masters of surgery have reduced the mortality of ovariotomy to such a low rate, that the electrician cannot compete with him here. Time may be in the future, when Science shall so refine the whole matter of electric currents that even in the case of large cysts the electrician may hope for favourable results. But it is not now; and it is better to send such women to the abdominal surgeon.

Salpingitis and Peri-Uterine Inflammations.—In the *Archives de Tocologie*, reviewed in Part XV. of *The British Gynæcological Journal*, Cornil and Terrillon have a readable article on the pathology of salpingitis. Owing to the frequency with which the tubes and ovaries are removed at present, the numerous opportunities of examining them microscopically have been the means of studying the pathological changes taking place in them. In salpingitis there is an increase in the number and size of the normal villosities. The wall of the tube is thickened owing to inflammatory change. The varieties of salpingitis may be classed as:

(1) *Salpingite Catarrhale Végétante;* the tube is hypertrophied and swollen, and united by adhesion to the ovary. The fimbriæ are sometimes congested and enlarged, and are then visible; at other times they become fused with the inflammatory material surrounding the ovary, and binding that organ to the tube. In the ovary are found hæmorrhagic cysts, and Graafian follicles more or less diseased. Microscopically there is a proliferation of the villi of the tube. The muscular coat is not much hypertrophied.

(2) *Salpingite Purulente.* In this variety the tube is distended with pus, and is often accompanied by purulent cysts in

the ovary. Microscopically no microbes are to be found in the pus. The tubal villi are greatly hypertrophied, and are infiltrated with round cells. The columnar ciliated epithelium becomes shorter, though the cilia are often present. The muscular coat becomes greatly thickened.

(3) *Salpingite hémorrhagique.* The villi in this class are slightly atrophied, and the epithelium covering them assumes a more flattened form. The tubal wall is stretched and thinned.

(4) *Salpingite Blennorrhagique.* The tubes become distended with muco-purulent fluid, consisting chiefly of detached epithelium undergoing mucous degeneration. The villi are small and vascular, covered with cylindrical cells with cilia. In places these cells have become detached and accumulated in the folds of the villi.

(5) *Salpingite Tuberculeuse.* The tube is irregularly thickened. Its peritoneal covering contains tubercles. The walls are thickened, and contain patches of caseous infiltration and degeneration. The interior of the tube contains caseous material, while the villi are greatly hypertrophied and covered with cylindrical ciliated epithelium. Giant cells were found in places in the villi. With regard to the lesions of the ovaries, the most common was the fibroid induration, generally affecting the surface of the organ. The Graafian follicles were replaced by cysts.

Dr. R. H. Fitz, the Professor of Pathology at the Harvard Medical School (quoted by Grandin, "Electricity in Gynæcology and Obstetrics," *Cyclopædia of Obstetrics and Gynæcology*), gives the following description of the *post mortem* findings :—

Chronic pelvic cellulitis is indicated by thickening, induration, and deformity (shrinkage) of the pelvic wall, or floor, or broad ligaments.

Chronic pelvic peritonitis is indicated by a superficial thickening, induration, perhaps also shrinkage, of the pelvic peritoneum, with adhesions, cheesy and cutaceous material, or fluid (bloody or serous).

In *chronic pelvic peritonitis, the tubes* may show little or no

change, or they may be shortened, thickened, and dense, adherent, dilated or not, with or without contents. The *ovaries* may show no change, or may be indurated, deformed, buried in adhesions, with or without cysts.

In *chronic salpingitis* the tubes are elongated, dilated, varicose, the free end adherent or closed. The walls are thickened, the lining thickened, gray, translucent, the surface smooth or granular. The contents are a watery, yellow, puriform material, with flocculi and cheesy masses. This condition may become a hydrosalpinx.

In *chronic oöphoritis* there is thickening, shrivelling, induration of the ovaries, with or without cheesy or calcareous masses. Adhesions are usually associated; the tubes need not be simultaneously affected, but may be. Grandin goes on to say: "These views, which emanate from a most careful observer, teach us a number of things. In the first place, in any given case we are not in a position to state that the tubes or ovaries are altered; these organs may be imbedded in adhesions, and yet be in themselves in a normal condition. Such being the case,—and the laparotomist has himself often proved this by showing us specimens which he has removed, and yet they were normal,—the aim of treatment should be to cause the absorption of these masses of exudation and the loosening of the adhesions, and it should not be directed toward the removal of organs which may be impaired in function but still not diseased. In the second place, we learn from the above considerations, that the woman's life is not imperilled by the conditions in her pelvis, although her life is often made practically unendurable. It follows, hence, that the treatment should be one which, while palliating her symptoms, will not subject her to any more risk than she is at the time under. Obviously laparotomy does subject her to risk, and we must therefore seek some method which does not. Of the routine methods applicable to the treatment of these chronic inflammatory affections of the uterine adnexa, the persistent tamponade, the hot douche, etc., are scarcely effective, or at best but temporarily so, except where the condition is chiefly a chronic cellulitis. Some absorption of

the masses of exudation may thus be induced, but where the changes are chiefly around the tubes and ovaries, where the condition is mainly a chronic pelvic peritonitis, these methods, it is within the experience of all gynæcologists, are not of much benefit, aside from the fact that but few patients are willing to submit to the very protracted treatment necessitated, seeing that we are not able to promise marked and lasting amelioration. *A priori* we should expect speedier and more marked results from electricity, and this is amply proved by a study of the few recorded cases in which this agent has been resorted to. By means of this agent we can unquestionably cause absorption of the inflammatory remnants, and in many instances this is all that is necessary to restore the woman to a state of relative well-being." Mundé reports the following case: "Mrs. C. O. S., twenty-seven years, married twice, the second time four years ago, no children, but two miscarriages two years before, both during the same year. After first miscarriage was confined to her bed with fever, and pelvic and abdominal pain for several weeks; this occurred again after the second miscarriage, when she was more seriously ill. Since then she has been confined to her bed, during each menstrual period, by profuse hæmorrhage and severe pelvic pain, has become thin and pale, and is scarcely ever free from distress in the hypogastric region, chiefly on the right side. She had heard a great deal of the present operative tendency, and was in dread of having some disease which would require the removal of her ovaries and womb, more or less, according to the popular idea of these organs. She was extremely anxious for a child, and was willing to do anything but deprive herself of that hope. I found the uterus immovably ante-latero-verted, and adherent there; in the right broad ligament a well-marked, very tender swelling, which was evidently the inflamed and swollen ovary and tube; in the left broad ligament, a much smaller and less tender mass. The diagnosis was perfectly plain, and the prognosis equally so. It was a case for removal of the uterine appendages, if the patient was to be relieved from her suffering, which certainly prevented her from enjoying life, and was gradually making her a chronic invalid

I told her so. She asked in reply whether nothing could be done to give her relief, so that she could at least be free from intermenstrual pain, and suffer a little less at the periods, and whether it might not be possible for her to conceive at some future time. She said she had come to me because she had heard that I would give her a chance of being relieved before insisting on a capital operation, and she wanted to take that chance if it existed. I told her that I could give her no hope as to a cure (except by operation), little of relief, and still less of conception, but that I was willing to try what palliative treatment would do if she would give me at least three months. To this she assented, and I began a regular course of galvanism every other day, iodoform and glycerine tampons after each sitting, two blisters a month, over each ovarian region, hot vaginal douches. Tonics (chiefly iron, which she greatly needed), malt; and at the periods, at first one or two suppositories of extract of opium, according to the pain, and hot applications to the abdomen. These latter remedies were used only during two periods. The patient began to improve within a month; the intermenstrual pain diminished; she said she could feel the relief each galvanic sitting gave her. It was certainly not the iodoform which did it, although that may have helped a little. Her appetite improved, she gained flesh, and could walk quite long distances without feeling tired or experiencing pain. There was apparently little change in the local condition, except that the swelling was less tender and softer, perhaps a trifle smaller. The uterus remained immovable; but the general health of the patient improved so much, partly in consequence of the freedom from pain, that after five months of treatment she returned to her home in the western part of the State, with directions to continue the galvanism if she felt the need of it." Grandin further says: "In these chronic inflammatory affections of the uterine adnexa the constant and characteristic symptom is pain, often so intense as to render life unendurable. This pain is largely due to the fact that the essential organs, the tubes and the ovaries, are included in the remnants of exudation, their function being, furthermore, thus

impaired, and again, the pelvic nervous supply is pressed upon by the same remnants. A further factor uniformly present is pelvic congestion, which, as we have seen, is a frequent source of discomfort, if not actual pain, to the woman. Notwithstanding these local conditions the women menstruate—that is to say, in accordance with the prevalent view, they ovulate—and, therefore, although diseased, these women are not, as is so often stated, incapable of conception; an argument which we frequently hear advanced in justification of a laparotomy which *per se* has sterilized them. The question, indeed, is narrowed down to this, the finding of a method of treatment which will loosen adhesions, cause the absorption of inflammatory remnants, quiet the pain, relieve the local congestion, and at the same time not risk the life of the woman, or render her absolutely incapable of procreation. Evidently laparotomy for the removal of the appendages will not satisfy the above aim. Will electricity do so? Be it understood that we are not arguing that there is any method by means of which a *restitutio ad integrum* may be affected; we seek simply for some substitute for the radical operation of extirpation; a substitute, that is to say, which will palliate the local conditions and the symptoms while not unsexing the woman."

At the meeting of the British Medical Association at Dublin, August 1887, Dr. Apostoli presented the following paper, "On a New Treatment by Electricity of Peri-uterine Inflammation," which I give *in extenso*:—

The important subject of peri-uterine inflammation, in which the prognosis is so difficult, the consequences are so serious, and the treatment is so uncertain, brings before us some of the most perplexing problems in gynæcology. Only too often does it happen that the futile efforts of the surgeon to give relief to his patient, by the application of all his medical resources, exhaust his own ingenuity and try to the utmost her endurance.

It may truly be said that perimetritis is the *point noir* of gynæcology. It is in the conviction that I may be able to throw some new light upon these difficulties that I venture, in a

summary manner, to report to you the observations I have made, and what I have done in reference to them. Ever since the year 1882, when I began my study and treatment of fibroid growths, I have carried on concurrently similar researches on uterine inflammation. I believe that my attempt to unravel the pathology and improve the treatment of this malady has not been fruitless of new ideas. On this ground I ask some share of your attention.

Besides what has been made known in my oral teaching at the clinique, and by my lectures at the practical school of the Faculty of Medicine, which have been delivered without interruption for the last five years, the thesis of my pupil, Dr. Carlet,* on the electrical treatment of fibromes of the uterus, contains reports of many cases of peri-uterine inflammations, treated electrically and with success. One case is especially noticeable,† as it was that of a fibrome complicated with a long-standing chronic form of phlegmonous inflammation, in which I employed the vaginal negative puncture.

I also made a communication at the International Congress of Copenhagen,‡ in which I dwelt upon the use of faradisation, either alone or in conjunction with intra-uterine cauterizations, in these affections.

A year later, 1885,§ in a paper on peri-uterine hæmatocele treated by galvano-puncture, vaginal, I enlarged upon the important part which galvano-puncture, applied in my way, is called upon, in the future, to play in the treatment either of

* "Sur un nouveau traitement électrique des tumeurs fibreuses de l'utérus (d'après la méthode du Dr. Apostoli), par le Dr. Lucien Carlet, Paris, Octave Doin éditeur, 1884—et note sur le traitement électrique des fibromes utérins par la galvano-caustique chimique, réponse à M. P. Zweifel (d'Erlangen), par le Dr. G. Apostoli."—Voir *Archives de Tocologie*, Août 1885.

† Thèse Carlet (p. 169).

‡ "Sur un nouveau traitement électrique des perimétrites." Lecture faite au Congrès médical international de Copenhague, Août 1884.—Section d'obstétrique et de gynécologie (Comptes rendus, p. 141).

§ "Sur un nouveau traitement électrique de l'hématocèle péri-utérine." Communication faite, en collaboration avec Doléris, à l'Association francaise pour l'avancement des sciences.—Congrès de Grenoble, Août 1885.—Voir *Archives de Tocologie* Novembre 1885.

solid exudations (chronic cellulitis, phlegmon and peri-uterine phlegmasia), or of neoplasms (interstitial myoma, local hypertrophies), or of uterine and peri-uterine cysts (hæmatomes, extra-uterine fœtation, etc.).

In 1886, in my memoir giving an account of my new treatment of chronic metritis, especially endometritis,* I introduced, incidentally, the subject of peri-uterine phlegmasia. Notice of the same kind is also to be found in a note appended to my pamphlet on the use of galvano-puncture in gynæcology.†

The subject is therefore nearly a novelty, and in this place I only wish to explain my views upon the modern question of treatment by electricity.

Notwithstanding the variety of names which have been given to peri-uterine inflammations, sometimes fashioned only according to the inventive ingenuity of authors, and sometimes only indicating the localisation, they all mean pretty much the same thing, except as regards the point of intensity.

Whether it be called a perimetritis, a parametritis, a phlegmon or a cellulitis, we have always to deal with a peri-uterine inflammation, either limited to the cellular tissue only, or involving all that is included in the pelvic folds of the peritoneum. Throughout, the therapeutical indications are much the same, and it is of them only that I wish to speak.

I do not fail to see how complex the problem is, and I am not presumptuous enough to suppose that I have resolved it. I only wish to establish the fact that my operative proceedings are justified by the general results.

Wishing not to go beyond therapeutical considerations, I make use of the ordinary symptomatic classification, and I accept the division into the three forms of acute, subacute, and chronic cases.

I. *Acute perimetritis.* The common feeling of the profession,

* "Sur un nouveau traitement de la métrite chronique et en particulier de l'endométrite, par la galvano caustique chimique intra-utérine." Paris, Octave Doin, éditeur, 1887.

† "De la galvano-puncture chimique, vaginale, négative, en gynécologie." Mémoire lu à la Société de Médecine de Paris, le 9 Octobre, 1886.—Voir *Union Médicale* des 16 et 19 Octobre, 1886.

shared also by the public, certainly is, that a palliative treatment is all that can be adopted in this disease. When called to a woman suffering from perimetritis, or phlegmonous inflammation, it is mostly with reluctance and hesitation that anything more is done than to order soothing applications to the abdomen, and to await the result. I protest against this sterile inactivity, which prevents no mischief, does nothing in the way of cure, and leaves the disease to run its own course unopposed.

Although the operative proceedings which I think necessary require great precaution, I undertake them for two definite objects; first, to calm down the pain the patient is enduring, and secondly, to arrest, if possible, the inflammatory action, and to prevent its running on to suppuration.

I have already, in 1883,* and before the congress at Copenhagen, in 1884, made known the general lines of my treatment, which may be thus summed up. I faradize every woman, even when under an acute attack of inflammation, observing, however, the following practical conditions:

a. I proscribe every faradization that would cause the least pain, and expressly that of quantity, engendered by the bobbin with short and thick wire.

b. I use for such cases the bobbin with long and thin wire, from which I obtain a current of tension, on account of its specially anodyne effects.

c. I begin with a simple vaginal application, by means of a large bipolar electrode, the point of which is placed against the inflamed part.

d. I only employ a current easily bearable, so as to cause no suffering nor any excitement of the patient, as this would ensure an entire failure of the treatment.

e. All the success of this medication depends upon making the first sittings sedative, so that they may serve as a prelude to more active measures; and the faradization will only become

* "Sur un nouveau traitement électrique de la douleur ovarienne chez les hystériques." Communication faite au Congrès de Rouen, à l'Association française pour l'avancement des sciences, Août 1883.—Voir *Bulletin Général de Thérapeutique*, 15 Juin 1885, et *Archives de Tocologie*, Juin 1885.

hyposthenic on the double condition of its low intensity and its long duration.

f. Each sitting should last 5, 10, 15, 20, or 25 minutes, as may be required, and should not terminate before the patient spontaneously declares that she is better and suffers less.

g. It is necessary to reinforce what has been said, by dogmatically averring that no success will come out of this treatment unless it be managed, not only without violence, but with extreme gentleness.

h. There may be one or two sittings each day, as may be wanted for lowering the febrile action, allaying pain and bringing about what is called the subacute state of the inflammation.

j. Every faradization should be preceded and followed by a vaginal irrigation, with the sublimate solution, and all the sounds should be scrupulously disinfected.

II. *The subacute stage.* As soon as the sound can be introduced into the uterus without much pain and without danger, I consider this stage to have set in, and it requires some alteration in the treatment.

Intra-uterine medication is now necessary, its force being increased gradually. It is here that we can advantageously combine faradizations with the continuous current.

a. I recommend, first, faradization bi-uterine,* because we desire to prolong in the uterus the same anodyne effect that we sought for in the vagina. We must therefore faradize the uterine cavity.

The current must always be that of tension. The intensity is increased by advancing the bobbin, and this must be done as softly as possible, without any jerking, till we reach the limits of personal tolerance. Every day the current may be repeated, until an evident amendment is taking place and the inflammation is giving way. This will be the indication for still more

* "Sur la faradisation double ou bi-polaire." Communication faite à la société de médecine de Paris le 28 Avril, 1883, et le 23 Février, 1884. Voir, l'*Union Médicale* du 28 Octobre et du 1er 1884, ainsi que l'*American Journal of Obstetrics*, Septembre 1884.

decided action, when we must call to our aid the constant galvanic current.

b. The use of the intra-uterine galvanic current, in small but gradually increasing doses, is the second part of the treatment which we have to offer to the patient, with a view to more rapid progress in the cure. Here the action is purely chemical, dynamic, and stimulant, and is intended to stop any tendency to suppuration, and to accelerate the absorption of the morbid deposits.

We must begin with short sittings, of only three or four minutes, with an intensity of not more than from twenty to forty milliampères. After a while, both dose and time may be augmented, and we have no better guide to trust to than the ease with which the patient can support this intra-uterine cauterization. The most exact care must be taken not to transgress any of the rules I have laid down for the safe performance of the operation, never omitting the diligent observance of every antiseptic precaution.

One or two sittings a week may be made, regulating the intervals by the strength and condition of the patient. Rest in bed after each operation must be enforced.

The early cauterizations should be with the positive pole, as it occasions less congestion than the negative. The negative cauterizations, having a greater derivative power, must, however, be brought to bear as soon as we can make out, by the way in which the action of the positive pole is tolerated, that they can be aptly and beneficially employed.

The surgeon must never lose sight of the fact that with his patient on the confines of an acute stage of disease, he is handling a curative agent which, while capable of rendering great service, may also, by indiscreet and inexperienced usage, do her grievous mischief.

To sum up this part of the subject:—These two stages of acute and subacute perimetritis are difficult to overcome, and our great effort must be to get rid of them, and to place the patient in that chronic state in which our action will be more clear and definite.

III. *The chronic stage.* However excusable a certain amount of timidity and indecision may be in treating the acute and subacute conditions of this disease, there is nothing to hold back the surgeon from following my recommendation to act boldly, and even heroically, when he comes to encounter the chronic stage. Here he must, judiciously but unhesitatingly, push the intra-uterine galvano cauterization to its highest pitch, and then superpose the vaginal, chemical galvano punctures, negative and monopolar. And in order that the inflamed peri-uterine zone may be directly brought under the influence of the current, that its full effect may be secured, and that none of its derivative and resolutionary force may be vaguely expended, the only sure expedient must be utilized. I mean, that puncture must be made into the diseased part itself. The whole electric irrigation will then bathe its substance, and the disintegrating action will more easily make havoc of the inflammatory exudation, and ensure its absorption. The negative galvano puncture is a therapeutical resource so full of promise, above all that I can express, that no exhortation of mine to familiarise yourselves with it can be too hardily driven home.

In another memoir, on galvano-puncture in general, I have stated the leading reasons which induce me to use the negative pole only, as the therapeutical agent for the purpose we have in view. I have also laid down the rules for well doing the operation, have pointed out the dangers, have given every precautionary counsel, and have left nothing unsaid as to the preparatory and post operative care that ought to be taken.

To make the subject more intelligible, I will tell you what you may expect to see in a patient upon whom you have done the operation of negative galvano-puncture. Towards the latter part of the day, you will find that she complains of some little pain in the body, and she will most likely have uterine and intestinal colic.

This will cease perhaps before morning, and keeping her in bed for two or three days, there will be within that time a marked subsidence of the feeling of distension, and with that the pelvis will be found to be less blocked up, the sensibility

will not be so acute, and pressure will be better supported. Of course it is wiser, especially in bad cases, to maintain the recumbent position, so as to give a greater chance of the absorption of the exudative matter; but with the defective accommodation at my clinique, I have involuntarily had forced upon me a solution of the question of bed-keeping. If I were asked whether it were useful, I should answer, Yes. But as to its being obligatory and indispensable, the many recoveries which have taken place without it enable me to say that it may be dispensed with. And this is one of the recommendations of my system of treatment. We can in case of necessity do without a long confinement, and allow many of the women—I do not say all—to go through the operations, and yet not much interrupt their ordinary occupations. I have had, among the frequenters of my clinique, several cases of chronic perimetritis, varying in severity from the simple state of parametritis to that of a complication with lateral phlegmon and general cellulitis, which have been restored to health under such conditions.

General Precepts.—One of the first questions we have to consider is that of the propriety of using chloroform. To that I can only say that, as the punctures are more painful than the cauterizations, an anæsthetic will often be advisable; but as fortunately more than half the patients have either an indifference to pain, or fortitude enough to bear it, they do very well without being narcotised. A subcutaneous injection of morphia some few minutes before the operation will, however, help them to submit to it more quietly.

1st. *Intensity of the operation.*—If the patient be not chloroformed, her feelings must guide us as to the force of current we employ, resting at the point of her tolerance; but with chloroform a dose of high intensity must be the rule. It may be raised, according to the urgency of the case, from 50 to 250 milliampères.

2nd. *Duration.*—The mead time for the current to be kept running must be five minutes, but if needs be, it may be maintained as long as ten minutes.

3rd. *Time.*—This is a matter of indifference. Still, when a

choice can be made, it is better to take the time midway between the monthly periods.

4th. *Number.*—The number of operations will be ruled by the gravity of the case. One puncture will often put an end to a slight parametritis. A state of general cellulitis may make it necessary to operate eight or ten times. The operations must follow each other regularly; and if it be found that the early punctures have not produced an appreciable effect, we must conclude that there has been some operative omission, probably some antiseptic negligence, and the proceedings must be modified accordingly.

5th. *Seat of Puncture.*—Within the limits of what is possible, two considerations must influence the practitioner in making his galvano punctures, and he must reconcile them in the best way he can. It is essential that he should attack the most prominent part of the exudated mass, and at the same time he must endeavour to restrict his punctures to the neighbourhood of the uterus, and to make them as much as possible on the posterior parts. The exudation is almost always lateral or posterior, and this is the practice I have adopted. I recommend others not to deviate much from it. I make out, with the pulp of the index finger, the central or projecting part of the deposit. I search attentively for every arterial pulsation, and avoid every spot where I find it. I then, without a speculum, pass the celluloid sheath up the vagina, guiding it with the point of the finger to the place chosen for puncture, hold it there steadily, and press the trocar through it, to a depth of not more than one centimètre, into the swelling. The trocar is made to enter in a horizontal direction, and then by turning the point it is forced on towards the axis of the uterus. I thus escape all danger of touching the peritoneum or of wounding any adjacent organ.

6th. *On the trocar and the length of the punctures.*—Platinum is not indispensable for the negative pole. Metals are not attacked by it. We have therefore the option, and it is better to take steel, as with it there is no difficulty in making the punctures. The trocar should be long and *filiform*, but not too slender.

The punctures must be made as short as possible. There are two reasons for this advice; long punctures are both dangerous and useless. I say *useless*, because the trocar only serves the purpose of introducing the current at a given spot. The penetration of the current will be in no way influenced by the depth of the punctures. But long punctures are *dangerous*, as the point of the trocar may pierce the peritoneum, and give rise to internal hæmorrhage from some wounded vessel which had remained untouched in examination by the vagina. They are also dangerous from the injury they may do to the peritoneum, ending in suppuration or gangrene, for which it would be difficult to secure an outlet.

7th. *Perfect antisepticism.*—The importance of rigorous antiseptic precautions requires no explanation. Besides the washing out of the vagina with the sublimate solution before and at the completion of every operation, the patient should not be dismissed without the introduction of a plug of iodoform gauze. This should be renewed every day, or at least every second day. Beyond the protection it gives as an antiseptic, it serves the purpose of opposing an obstacle to any sexual relations.

8th. *Local effects of the operation.*—There is no obscurity about this point. The eschar resulting from the negative galvano-puncture will separate, on an average, between the fourth and eighth day, and there will be a loss of substance corresponding with the size of the eschar. A sinus is left penetrating into the substance of the exudation, and setting up a drainage, which will last in proportion to the size and depth. The small sinuses will of course close up the soonest. But the mean duration of the permeability of these openings may be taken as from fifteen to thirty days, during all which time the iodoform gauze must be constantly renewed.

To comprise in a few words the essential parts of my researches, and the clinical results which have been worked out from them, I may say:—

1st. Electricity, in the form of faradaic currents of tension, can, and ought to, be made to calm the pain at the outset

of an acute attack of perimetritis, and is a sedative of first importance in abridging the first stage of inflammation.

2nd. The continued current is a power which we use in two ways; first in the form of intra-uterine chemical, galvano-cauterization, to cut short the acute stage; second, as vaginal, negative, galvano-punctures, to get rid of the chronic condition in all its forms and stages.

Is the restoration *ad integrum*, complete and definitive, the prevailing result of my treatment? I do not pretend that such is the case; I do not even expect it, and I content myself with offering for trial a method of relief and cure which I believe to be more speedy than any others.

Again, we may force electricity into our service in another way. Given a case of actual suppuration, or of menacing suppuration, we have only to use our negative galvano puncture, form an eschar, open up a sinus, and direct the exit of the pus to the nearest point of the vagina. And this we can do at will, when it is most fit to do it, and in the most convenient way.

We have then, in the galvano-puncture, an effective means of arresting an inflammation, and of dispersing an inflammatory deposit. Or, we may use it as a sure and direct way of opening a profound and ready-formed collection of pus. No plan of setting up a vaginal drainage, controllable as to amount and duration, can be more simple; and this we may associate with any local and antiseptic treatment that may be desirable, as I have shown elsewhere in relation with the subject of hæmatocele.

The subject, of which I have just dotted down the salient points for your consideration, is new and undeniably full of interest. You must not suppose that I think I have done much for it, as I may fairly claim to have done for fibromes and endometritis, but what I have seen and watched, with painstaking anxiety, is so rich in clinical results, so fertile in unexpected therapeutical consequences, that I feel I cannot too earnestly urge you to study the subject for yourselves, and to fathom it to the utmost, if possible.

In any given case, it is a matter of exceeding difficulty to determine whether the tube and ovary are entangled in a mass of exudation, or whether there be salpingitis and oöphiritis without any exudation. The finger in the vagina makes out the swollen and enlarged tube easily. There is great sensitiveness to the touch, and while the real trouble may be on the left side, the patient often appreciates it more keenly in the opposite groin. Sometimes the rectal touch permits free orientation, so that the differential diagnosis may be reached. But this is not always so, and out of many hundreds of women I have not found it usually so. The well-known symptomalogy is the same in both instances. Extension of the morbific principle from the uterine cavity to the tube

Fig. 32.—Apostoli's Platinum Inter-uterine Electrode.

A. Ordinary hysterometer capable of being inserted at once into a hollow handle.
F. Notch, marking the normal depth of the uterus.
C. Celluloid sheath for isolating the vagina.
E. Attachment of the reophore.
D. Screw for tightening and fixing the sound at the desired length.

would necessarily influence the ovary, setting up an inflammation. Any discharge dropping from the free tubal extremity would originate a perimetritis, and set up lymph exudation; so that even when the tubes and ovaries are diseased, there is very apt to be this covering of exudate. For true pus tubes, electricity offers but little of consolation. They should be extirpated, unless one wishes to test the theories of a very eminent French surgeon, who in January 1889 advocated uterine drainage, before the Academy of Medicine. But in the simpler forms galvanic puncture offers every hope of a cure. If the tube itself is to be punctured, the positive current is probably preferable, especially to begin with, because it excites less inflammation, and does not make such a large

hole. In catarrhal salpingitis and peri-uterine inflammation it acts like a charm. A case is recorded in the Rue du Jour, which I have twice seen, or oftener, of a woman who upwards of two years ago was treated for a salpingitis, post-puerperal, with much lymph deposit, with such success that she conceived and bore a healthy child. She then had the same conditions of affairs on the other side, but is now quite well, after five galvano punctures. Many, very many, women come for treatment, with all the symptoms of salpingitis, and in whom the exploring finger can easily determine the mass. Some of them have histories of peri- or para-metritis, some of specific poisoning, some of post-puerperal contamination, and some without any well-defined history whatever. If it be once determined that there is no pus tube, the habit is to puncture. If there be a pus tube bound up in inflammatory deposit, we direct the current to the deposit. Even women belonging to this category always express themselves as feeling greatly relieved. It is not good logic to maintain that salpingitis causes sterility, because we must confess to much faulty diagnosis—many cases having been diagnosed as such and operated upon, as Grandin rightly says, when an examination showed no disease of the tube or ovary; and even a salpingitis once originated does not necessarily entail permanent loss of tubal function or ovulation, because a catarrhal salpingitis is an entirely curable disease.

CHAPTER VII.

METRITIS AND ENDOMETRITIS.

(From Dr. A. Laphorn Smith's translation of Dr. Apostoli's memoir on this subject.)

When my master and friend, A. Tripier, addressed, in August 1859, his memoir to the Academy of Science at Paris, entitled: "Conjunctive Hyperplasias of the Contractile Organs; of Faradization in the Treatment of Engorgements and Displacements of the Uterus and of Prostatic Hypertrophy," he opened the door to a great revolution in therapeutics, which was doomed unfortunately to undergo the fate of a great many things which are new—to be honoured with indifference by his contemporaries, or to be forgotten by them. Many other writings since then, and especially his "Clinical Lessons on Diseases of Women," which appeared in 1883, go to confirm his first views, which have a double object: First, to clear up the question of pathogenesis and to show the predominating influence which circulatory troubles produce in the nutrition of contractile organs; and to indicate the different processes in the pathological history of local circulation, and to bring to bear a new exciter of smooth muscular fibre, which nature herself creates without ceasing in an uncontrolled form, but which science, and especially medical science, utilizes in a form which is dosable, localizable, and controllable: I speak of electricity.

Tripier, guided by a perfectly justifiable induction, has thus traced in a masterly manner the path to a new intra-uterine theraphy, which enjoys at once the best qualities of a preventive and a cure.

We no longer ignore to-day that the great majority of uterine inflammations, probably of septic origin, are due most often to an arrest of the retrograde metamorphosis of the uterus after confinement or abortion, that they are created entirely by uterine subinvolution, and that the circulatory troubles, characterized by congestion and stasis, preside over their initial evolution. If the physician interferes then by removing obstruction and sepsis at the same time, producing a passing hyperæmia, a sort of circulatory drainage, if he combats the primary inertia of this organ, the slowness of the circulation of which gives rise to all the subsequent inflammation, he puts in force an excellent treatment which prevents and cures at the same time. Such is the *rôle* of faradization, which, applied in the uterus in the proper manner, preceded and followed by an antiseptic injection, produces a sort of interstitial massage, provokes the contraction of all the smooth muscular fibres, excites and hurries the circulation, accelerates absorption of exudations, and so corrects a languid or perverted nutrition.

Tripier and I (1) were able to say that, being given a woman who had just been confined or aborted, who, for various reasons, found herself in the presence of threatened subinvolution, with all its inflammatory *cortège*, we could, if we wished, be masters of the situation, and be able to remove the disease in preventing and putting away the greater number of the local causes which might provoke it; such is the true preventive treatment really useful and efficacious, thanks to faradization. But supposing, as is usually the case in the ordinary practice of gynæcology, that the disease was constituted by a process which had already lasted a greater or less time, and which has been quietly left to itself, three principal cases may present themselves:—

1. The process starts most often by the mucous membrane, which may be simply hypertrophied or dotted over either with granulations or fungoid growths or vegetations, the embryonic elements of new formation appear equally in the parenchyma, and acquire considerable importance, to the detriment of the muscular stroma, whose functions are not slow to be more or less destroyed. Sometimes the embryonic elements degenerate,

and are eliminated *en masse* as on the surface of an exposed wound which produces a more or less abundant muco-purulent discharge. Sometimes, on the contrary, frequent hæmorrhages bear witness to the presence of fungoid growths, composed almost entirely of vessels of new formation. Sometimes, also, the hypertrophy of the dilated glands produces a characteristic mucous discharge.

We find ourselves, in these three forms which all start from the same source, in the presence of internal metritis, also called endometritis, or acute or chronic metritis of the mucous membrane, characterized, as we have just seen, by various lesions of the mucous membrane, which may co-exist in the same uterus, and by a consecutive parenchymatous hypertrophy due to the formation of a veritable embryonic stroma, made by the heaping up of little round cells scattered about the muscular bundles.

2. In the second case the uterine inflammation is still young, and more or less in the neighbourhood of where it began; it is characterized by a more or less slight inflammation of the mucous membrane, and by a preponderating process of congestion and infiltration of the parenchyma, with a more or less considerable circumvascular hyperplasia of the conjunctive tissue which either retards or stops, in some places, the return circulation. We have then to do with what is called parenchymatous metritis in its first stage.

3. Finally, in the third place, the inflammation is of a later date and the pathological process is more advanced; it is characterized by hardness and resistance of the uterine parenchyma, which reminds one of cicatricial tissue, and the circulation of which, here and there, is either null or very weak. The conjunctive tissue, young and succulent, then becomes hard and fibrous, and the uterus, on section, is pale, indurated, and devoid of blood; that is chronic metritis which has reached the second period, or period of duration.

What can we do against these three different pathological conditions, which in most cases cannot be distinguished as separate morbid entities, but appear as a hierarchy of negative morbid processes, running more or less the one into the other,

the first stage of which is simple and recent subinvolution, and the last, either chronic indurated metritis, or fungoid or hæmorrhagic metritis? Tripier, who in gynæcology only sees one inflammatory process—engorgement—only believes in one uniform medication—the one which, as we have just seen, is a regular triumph of preventive medicine, namely, faradization. But this is where he makes a mistake: the induced current, which is a sovereign remedy after a confinement or an abortion, in the very young and congestive forms of engorgement or metritis, begins to lose its claim in the other stages, either hyperplasic, retrogressive, or supplementary, of uterine inflammation; and here clinical experience is in perfect accord with pathological anatomy.

In showing us that when the uterus begins to be invaded by vessels and tissues almost entirely formed of embryonic elements, as in metritis of the mucous membrane, or endometritis, or when the muscular stroma begins to atrophy, and disappears as in parenchymatous metritis in its second stage; then I say the direct exciters of the smooth muscular fibres, separated from all chemical action, no longer find a sufficient substratum for their activity.

Tripier made the mistake of not seeing that where ergot, which is nothing else than a general but uncertain faradizer, failed, there the interrupted or induced current ought to fail in doing that which, under other circumstances, was so judiciously assigned to it. Here, then, is the moment we differ from the therapeutics of Tripier, and if we cast an eye around us we would only see more or less hardy attempts destined to perfect the doctrinal ideas of Tripier, and to render more efficacious and more complete the intra-uterine therapeutics which he had so happily inaugurated. He wished to leave the mucous membrane alone, but we have just seen that it is it which is most often found diseased, and which contains even, especially at the beginning, a greater or less fraction of the pathological condition; moreover a tendency of the modern school of gynæcology is to destroy it, in order to renew it. From all sides new methods of medication are proposed, which may be divided into two

great classes. On one side the endless list of caustics, either liquid or solid, destined to destroy chemically the mucous membrane and to make intra-uterine counter-irritation. On the other side we address ourselves to the cutting instruments, in order to perform the excision of the diseased mucous membrane, or the scraping of this same mucous membrane, which we wish to suppress in order to permit the uterus to constitute for itself a new one, with all its normal attributes; we have addressed ourselves equally to the red-hot iron and the thermic galvano cautery, in order to act with greater speed and energy.

I ought to declare here that this intra-uterine tendency of contemporary gynæcological therapeutics constitutes a real and important progress, which will only bear all its fruits when it shall have been sufficiently systematized to be safe from all danger, and to be submitted to the rigorous control of an exact posology; but the general reproach which may be made against all intra-uterine therapeutics adopted so far might be summarily formulated as follows:

1st. It is brutal, blind, and may be dangerous by inexperienced hands.

2nd. Its dosage is wanting.

3rd. It is difficult to localize.

4th. It has a more or less instantaneous action, which ceases generally after its application.

5th. It is sometimes sterile, inefficacious, or fanciful.

6th. It treats the mucous membrane, but is wanting in direct action upon the parenchyma.

Four years ago I was struck with all these objections, when (using the new galvano-chemical intra-uterine medication for the cure of fibroids), I commenced attempts at similar applications for the cure of chronic metritis.

The thesis of Dr. Lucien Carlet, which contains my memoir on the new treatment of uterine fibroids, with more than a hundred observations in support of it, mentions also, in the form of conclusion, that parallel researches made by me in chronic metritis will receive a therapeutic consecration shortly

Since then I have had many opportunities of justifying my first treatment of four years ago, and my present memoir has for its object to-day to make a complete exposition of my new method of treatment. It may be resumed in the following formula :—

To apply to the uterus the constant current of the battery of a sufficient strength to destroy the mucous membrane, and to produce a healthy derivation.

Operative Procedure.

After this physical, instrumental, but absolutely necessary introduction, which constitutes, so to speak, although very briefly, the materia medica of this new treatment, it is necessary now to describe very minutely the operative process. The operation will only bear all its fruit on the condition of being rigorously executed, as I shall recommend, without deviating for a single instant from the rules which I shall lay down. The whole success depends upon it.

We shall follow the operation in the chronological order of the manœuvres of which it is composed.

A. Preparatory Precautions.—Firstly, you must above all things—and this is of the very greatest importance—carry out a good and thorough antisepsis. That is, the operator should carefully wash his hands with an antiseptical solution, either carbolized or sublimated, and he should only operate in a favourable and perfectly aseptical locality.

Secondly, he must then rapidly examine all the couples of the battery, in order to see that they work well, and thus to avoid any interruption during the course of the sitting. It suffices for that to close the circuit on itself, and to make each of the couples enter successively into it, one by one ; the deviation of the compass which serves as a galvanoscope will reveal immediately the passage of the current, and consequently the total integrity of the battery which is being used. On the contrary, if there is no deviation you must search for the one at fault, in proceeding from the periphery to the centre, and we shall soon recognize the seat of the interruption, which may depend either

upon the breaking of one of the reophores, or some remediable defect of the collector (such as a loosened screw, or the handle not pressing sufficiently on the brass points, which collect the current, or these latter may be too much oxidized to allow the current to pass freely), or perhaps it is one of the wires which join the batteries together that is broken or disconnected, or it may depend upon some infirmity of the battery itself—such as its being used up, wanting water, or the zinc being in a bad condition.

This being done, we must cure on the spot, if possible, the cause of the interruption (11), and we shall then place the two handles of the collector at zero, to be ready to start—I say handles, in the plural, because I suppose, as is usually the case, that you have a battery provided with a double collector, which permits of your taking the elements one by one at the beginning, at the middle or at the end of the battery. To explain myself. You must be able to take the elements one by one in order to render the operation as bearable as possible, for if you have a battery mounted two by two or four by four you can understand how sharp and sudden the transition from one number to another would be, and what consequences might result. There is a first principle which you should always have before your mind, and which ought to be engraved in the thoughts of all gynæcologists, and that is that the uterus will bear anything on two conditions, first, that you obtain a good antisepsis, and second, that you do nothing roughly to it.

Thus it will support a current which is fearfully intense, provided that you inflict upon it only a progressively increasing dose without shock or jerk.

The only way not to violate this rule is to possess a collector which will permit of your giving it the current cell by cell.

You may, at all events, even with a collector of two by two or four by four, avoid the difficulty, and arrive at the same insensibility of the operation by employing a medical reostat which you introduce into the circuit. This additional resistance has for its object the offering of a first barrier, varying in amount to the passage of the current, and, consequently, to render more

tolerable and less sudden the transitions which would be too great without it.

Thus, with the collector divided one by one, the patient easily supports the difference between one cell and the next; there is always a slight shock, it is true, but it is reduced to a minimum; if, on the contrary, the collector is divided two by two, three by three, or even four by four, the shock becomes greater with this transition, and the patient finds herself in the position of one who ascends or descends easily a flight of stairs, step by step, but who, when she goes up two or three steps at a time, finds it much more difficult.

The introduction of the reostat smoothes these transitions, and takes the place, so to speak, of an inclined plane which renders the fall less sudden and easier; instead of having a vertical and violent shock, we get down by a longer descent which diminishes the sudden force of the fall.

The only inconvenience of the reostat is that it requires a greater number of cells, for if, before the introduction of this additional resistance, twenty elements, for instance, were sufficient without it, you would require an additional number, varying in proportion to the number of unities of resistance (called ohms) interposed—as a rule, 200 to 500 ohms of resistance are quite enough to deaden the shock. Two railway waggons can only touch after overcoming the resistance of the buffers which soften the force of the collision; in the same way, the current which has to go through 500 ohms before arriving at the skin will have its energy diminished, and to make up for this deficiency you must add a greater number of cells.

The double collector has the further advantage of permitting us to employ any fraction of the battery to the exclusion of the rest.

If the first cells were used up, for instance, or if there were some interruption to the current which we could not correct at the moment, we might then utilize the middle or the end, and to do this, instead of placing the two handles at zero, we would place them at the figure higher up than the last couple which we do not wish to or cannot use.

3. The galvanometer will also be an object of special attention. You must make sure that the needle oscillates in every direction without striking, and that it is perfectly suspended. There are two ways of fixing the galvanometer—either on the cabinet which contains the battery, or it is independent, and introduced into any point on the circuit at the will of the operator.

4. The battery, collector, and galvanometer having been tested, we place them near the operating bed or sofa, so that, without moving, you can on one side stretch out the hand and easily move the handles of the collector, and on the other hand be able to see and follow easily during the whole operation the oscillations of the galvanometer. You adjust the needle, or rather you turn the multiplying scale until the zero on the compass corresponds exactly with the needle.

5. You pass the hysterometer through the flame, and then you plunge it, handle and all, into a strong carbolic solution, in order to make sure of its being perfectly aseptic.

You arrange the length of the intra-uterine sound, in drawing it out from the handle, according to the previously determined or the probable length of the uterus. You then cover the sound with an insulating sheath of celluloid.

6. You attach the reophores, or, better still, one reophore first, to the metallic plate which lies upon the clay.

7. See if the clay is in the proper condition for humidity, and especially if it thoroughly moistens the tarlatan.

B. PRELIMINARIES.—1. *The woman.* Before beginning, you must in a brief and paternal manner explain to her what is necessary for the success of the treatment; you will prevent all emotion, especially if the woman is nervous, by assuring her that the operation is harmless and perfectly bearable. It is necessary never to begin, especially the first time, before obtaining her complete acquiescence, in order that she may relax all her muscles, and avoid all movements that might be hurtful or dangerous. You will make her take off her corsets and untie her petticoats, in order that her breathing may be free and easy, and that the belly may be completely exposed.

If you operate in your office she should get upon the table. If you attend her at her own home she should lie across her bed, the feet resting on two chairs, taking good care, however, in both cases, that the buttocks project completely beyond the edge, in order to give perfect freedom to the hand which introduces and holds the intra-uterine sound.

Once placed in position, the woman must remain absolutely immovable, and you must remind her that, no matter what happens, she must not move, but that, on the slightest sign, if she desires, you will stop the operation; she will thus be more satisfied, she will breathe easier, and will aid any manœuvre required for the introduction of the sound.

It would be well, and even useful, to make, before examining her and operating, an antiseptic vaginal injection of sublimate, 1 in 1000 or 2 in 1000; it will exercise a preventive and curative action in cases where we might have reason to fear the carrying of septic products from the vagina into the uterus.

2. *The clay.* You quickly place the clay on the belly, above the pubis, and away from the hairs, after having warned the patient that it is always cold, but that this disagreeable feeling will soon disappear. You must cover it with a dry cloth, such as a folded towel, for instance, on which the woman is to place her two open hands (12) side by side, so that she may exercise a slight pressure on the clay, in order to render it more uniformly and completely applied to the skin.

We never apply the clay to the skin without having first determined that the epidermis is healthy, and there are no pimples or abrasions, nor any wounds of any kind, no matter how small. It is at such points as these, in fact, if you do not take care, that the current, finding the door more open, will enter more easily, and then, in virtue of the law I have laid down, when speaking of the contact of the metallic electrodes, it will be dense at all points where the epidermis is removed, and it will, therefore, accumulate there its peculiar action (of heat and even burning). If you find an erosion, no matter how small, you must close it, either by means of collodion or with paper,—in a word, with some non-conducting body,—in order to

prevent the current from passing through this abrasion to the epidermis.

3. *The sound.* Its introduction into the uterus is the most important stage, and exacts the greatest care and practice.

A great part of the operative success depends on its good execution.

I cannot now enter into all the details which should regulate the use of the hysterometer, referring the reader to special works, and especially to the one which I am preparing for this purpose. I must content myself at present with summing up the manœuvres, by saying, and by repeating, that extreme gentleness should always preside over its execution. Never should the introduction of the sound—for this is merely an introduction of the sound for therapeutical purposes—be made with the slightest possible force. On the slightest resistance, however small, you must stop, go back if necessary, and begin again; the uterine cavity should show its road, so to speak, to the operator, who should allow himself to be led into it.

I reject the employment of the speculum in making a proper hysterometry, and for making sure that it is complete. I will only give one reason which seems to me to be beyond question. If in writing we always hold the pen-handle as near as possible to the point, it is in order to give the writing as much assurance and firmness as possible; it is in order that the hand which holds the pen may be nearer to the paper, or to the resistance over which the pen has to travel. Now compare two specimens of writing, the one which was written while the pen was held near the end of the handle and the other near the point, and the comparison will be altogether in favour of the latter.

The same thing applies to the introduction and the fixing of the sound; the search which you must make, the resistances which are to be conquered, the road you must follow, all these things will be better executed when the conducting hand is as near as possible to the point of the instrument.

With a speculum the hand is obliged to hold the instrument by the handle end. Without the speculum the conducting hand

doubles itself, so to speak, or better still, we can invoke the aid of the two hands. The left hand, for instance, holds and fixes the handle, at the same time giving it a slight movement forward. The other hand with its index finger in the vagina and adjacent to the posterior lip, following it, and guiding it when necessary, in all its movements laterally and forward, straightening and correcting its course when it goes wrong.

Now, this vaginal finger, as near as possible to the point of the sound, is really the most useful one in the practice of hysterometry; it is it which makes us for the most part perceive, what it is difficult to do without it, that the sound has arrived at the end of its course, and that it is striking exactly against the bottom of the uterus. Well, I ask, the same as in writing, can we discuss the merits of the two methods? The reply leaves no doubt, and hysterometry performed without a speculum is much more sure, more complete, and more harmless.

It will sometimes be necessary to precede the hysterometry by preliminary intra-uterine antiseptic injection, the same as the vaginal injection, which, apart from the topical action, will have the double advantage of clearing the uterine cavity of the products of secretion, or the mortification coming from previous operations, and thus to permit the current to act more uniformly and more energetically upon the underlying mucous membrane.

4th. Once the sound is well introduced into the whole extent of the uterus, you must take care that the vagina is well protected by the isolating covering of celluloid, and for that it ought to touch at one end the neck of the uterus, and at the other project from the vulva. During the operation we should not cease to be careful of this, for if it should become all at once and suddenly painful, you will generally find that it is for want of watching the handle, which has slid forward, and which no longer protects the vagina in its entirety.

5th. You will then attach the reophore to the intra-uterine exciter, taking care to do so sufficiently firmly that it may not become detached during the seance, and thus cause a shock which would result from the interruption of the current. The fixing of the wire should be accomplished by means of a slight

twist of the peg (which is at the end of the conducting wire) into the hole which is prepared for it in the handle of the sound. You must not bring too much force to bear upon it, as you might displace the instrument in the uterus and wound it by pressing on it.

C. THE OPERATION, PROPERLY SPEAKING.—Everything being ready to commence, the operation may be divided into three stages. These are: the initial stage, the middle, and the end.

1st. *The initial stage.*—(*a*) You must not begin to turn on the current until all pain or sensibility resulting from the passage of the sound shall have totally disappeared. A few seconds of waiting are sometimes necessary for this purpose.

(*b*) This done, the hand which holds the sound steady will move no more; in order to give it more security it is better to leave the conducting finger in the vagina, where, if we are sufficiently sure of ourselves, we hold the sound by the handle; the dorsal surface of the handle will rest against the internal surface of the corresponding thigh of the patient.

(*c*) You will now turn your eye towards the compass to see how it answers to the passage of the current, and at the same time you must not lose from your sight the countenance of the patient, which will warn you of all the sensations she feels.

(*d*) The hand which remains free should be placed on that handle of the collector which corresponds to the positive pole, as the operator desires it; for the characteristic of the positive pole is that it always belongs to the handle which is in motion, or which is at the highest figure, while the handle which remains stationary, or is at zero, or at a figure lower than that of the handle which moves, belongs to the negative pole, according to the method of construction of Gaiffe.

(*e*) You will then commence slowly, very slowly, to turn on the cells, especially if it is the first operation you have undertaken, or if you are not acquainted with the patient; at first you will go to twenty or thirty milliampères. Then proceed to fifty; by this time you will have gained, what it is very important to do, the confidence of the patient, who will soon find out of her own accord that electricity does not cause much pain;

you will then reach 70, 80, or 100 milliampères, and it is better for the first time not to go beyond this figure.

(*f*) IT IS THEREFORE IMPORTANT NEVER TO MAKE THE PATIENT SUFFER TOO MUCH, AND NEVER TO INFLICT MORE PAIN THAN IS BEARABLE. THIS IS THE TRUE CRITERION WHICH SHOULD FIX THE LIMIT OF THE DOSE. It will, of course, vary with each patient and each disease, but for me it is impossible to doubt that the success of the operation depends on the execution of this formula. A uterus which has been made to suffer too great pain, is in danger, indeed, of having its pre-existing inflammation increased, especially if there is any inflammation of its periphery; that is why I strongly recommend only to apply the current at the beginning slowly and progressively in fractional doses, so to speak, and then to wisely interpret the replies of the patients in order to be enlightened as to the intensity which they are capable of supporting.

2nd. *The middle-stage.*—(*a*) Generally a few seconds suffice to apply to the uterus in an ordinary operation the maximum dose desired, but with very nervous or very hysterical women, and especially when we operate for the first time, we must take care to wait one or if necessary two minutes, to arrive at the maximum dose which they can bear.

(*b*) The point that we can reach will generally be 100 milliampères at the first sitting; during the others we may try to raise it to 150 and even 200. We can, if necessary, when a serious case requires it, reach 250. The maximum figure, once obtained,—which differs, I repeat, according to the patient,—we will keep it at the same level during a period of between five and ten minutes, but on an average of five minutes.

(*c*) The variations which should take place in the dose and the duration of the operation are justified by this fact, namely, that in the first place all women do not support electricity equally well, and besides they each require a different intensity according to the gravity and previous duration of the disease; thus it is advisable, in a difficult case of severe hæmorrhage with marked fungous endometritis, to prolong

the application to the maximum possible point of toleration, which might be as much as ten minutes; with other persons, on the contrary, very hysterical and nervous, and easily enervated by the slightest pain, a sitting of three or four minutes will be as much as they can bear.

(*d*) There is an important precaution which you must take during the sitting, and which concerns the method of holding the sound; it is necessary to hold all the intra-uterine portion always applied against the uterine wall, and as far as possible to put it successively in contact with each of them, anterior, posterior, and lateral, in order to disseminate and equalize, in this manner, its caustic action, and to render it as efficacious as possible.

(*e*) One thing it is important to know, and that is to understand the oscillations which take place in the needle during this period, while the number of cells in use remains the same.

In certain patients who have a very resisting skin, we must not be surprised to see the deviation of the needle become greater; which bears witness to the increasing electric intensity or outflow, which increases because the current passes better through the epidermis, which has taken a certain time to become softened and to allow itself to be penetrated. Once having reached the summit of its course, the needle generally becomes stationary, or moves at least but slightly, and thus proves, by its greater or less fixation, that the current once having been well established circulates in an almost continuous and identical manner.

3rd. *The end.*—(*a*) The same precautions which I have just advised for the application of the current should be always rigorously applied in order to suspend it. *You must stop gradually couple by couple, and never suddenly, in order to avoid a shock and painful contraction of the uterus or abdominal wall which would follow.*

(*b*) When must you finish the sitting? I have just said that two factors should enter into serious consideration,—*the object to be obtained and the sensibility of the subject.*

What then shall be the criterion which shall guide the physician? If the woman tolerates it well, and bears the current without complaining, the duration, according to the therapeutical object in view, should be from five to eight minutes, and even ten minutes. If she does not tolerate it, but complains loudly, threatens to move, and becomes agitated, you must know that you should stop. The whole tact of the doctor consists in not listening to childish complaints, and on the other hand not turning a deaf ear to them when they are real. To continue an operation when it is too painful would be to expose oneself to serious mistakes, and I therefore beg of you to diminish the dose enough to render it tolerable, and if even after being considerably reduced she still complains, you must suspend it. There is every reason to believe that the next sitting will be better borne, either because the emotion of the first beginning will be less, or because the uterus itself will not be so irritable.

(*c*) If the same intolerance were manifested at the following sitting, you would have reason to suspect a *peri-uterine cellulitis* which had been overlooked, and in the presence of which you must stop, or it may be an extraordinary uterine susceptibility, as I have seen in certain cases of hysteria, rare it is true, which have compelled me to stop my interference at a dose of 30 or 50 milliampères.

(*d*) Once the handle of the collector has been brought back to zero, we mark the parallel return of the needle, which also having reached zero will now pass a little in the contrary sense, a thing which might surprise at first sight the doctor who is not acquainted with the physical effects of electricity.

This is the reason: every application of the continuous current creates at the point of contact of the electrodes with the surface attacked or electrified, an electric polarity or what is called a secondary battery, the current of which is in inverse sense to the primary current which has just stopped. It follows, then, that when we terminate an operation, when the two handles have returned to zero, the figure which precedes the button marked *repose*, and while there is not, consequently,

any couple in the circuit, which, however, still remains closed, the secondary battery, created by the passage of the current at the level of the point of contact of the electrodes with the body, enters in turn into action, and gives rise to a new deviation of the needle in the opposite direction to what it was at first; a deviation which is slight, it is true, and of little intensity, but sufficient, however, to provoke a new and peculiar sensation in the woman, different from that of the beginning or middle of the operation, but sufficient to make her say sometimes to the doctor who has just told her he has finished: "Are you beginning again?"

(*e*) You will remove very delicately the intra-uterine sound, steadily and very slowly (13), then you take off the clay and clean the belly of the patient, which has been soiled.

(*f*) You then wash out the vagina again with the same antiseptic solution, and you leave in there a tampon of iodoform gauze, the use of which has a double object: first, to continue the antiseptic during the interval between the sittings, and secondly, to put a certain amount of impediment in the way of coition, which is very important.

D. AFTER THE OPERATION.—The instructions which you should give to the patient who has just been treated are of the very greatest importance, for on their being well executed the whole success of the operation depends.

(*a*) If we desire that the treatment should bear its full fruits, it is absolutely necessary that the patient should lie down at full length during a time varying from one to several hours.

If the operation has been performed in the doctor's office, the patient should only go home as late as possible after the colics which follow the cauterization shall have partly disappeared. She should avoid all fatigue and rapid movements, and you must repeat to her that the forgetting of these instructions may expose her to a serious inflammation (such as perimetritis) with all its accompanying miseries.

(*b*) You should always warn the patient of the uterine colics, which are generally in proportion to the intensity of the operation which she has undergone. Frequently the post-operative period

is even more painful than the operation itself. The woman should not be subjected to any surprises, and therefore it is better to tell her beforehand what she may expect.

(*c*) You will tell her that a sanguineous discharge may appear in the course of the evening as a result of what she has just gone through—a discharge which is not severe, and which is generally stopped of its own accord by rest, without any treatment.

(*d*) The following days she may also have a sero-purulent discharge, which depends upon the same cause, and which only requires antiseptic vaginal injections every night and morning.

(*e*) You must formally forbid all sexual intercourse that night and the following one; it would be even good to suspend all conjugal relations during the whole course of the treatment, in order to avoid pregnancy, which, if it came on prior to the operation, might result in an almost fatal abortion.

(*f*) All the discomforts, whatsoever, which may be felt, are generally tolerable, and rest is, without exception, the best way of diminishing them; they disappear of themselves the same evening or perhaps the following day. In cases, however, where the pain is too great you may order the application of a large emollient poultice on the belly, which will diminish to a certain extent the pain following the application.

GENERAL CONSIDERATIONS.

The operation having been thus placed within the scope of the gynæcologist, it is necessary to follow with a few general considerations, which have also their importance.

A. JUSTIFICATION OF MY METHOD AND OF ITS INTRA-UTERINE FIELD.—It might be asked *à priori*, as it has before been done *apropos* of fibroids, if it is really useful to penetrate into the uterine cavity in order to obtain the maximum therapeutic effect, and whether the intervention would not be quite as efficacious without attacking directly the uterine mucous membrane; the method would gain thereby in popularity and security, for it would be much easier, and totally devoid of danger. Yes, certainly, that would be the ideal; to introduce one pole into the

vagina, to fix it against the neck, for instance, close the circuit upon the belly or elsewhere, and make a very weak current, almost homœopathic in quantity, so to speak, pass through it, the curative effect of which to be quite as favourable. Some doctors have tried this medication in fibroids, guided either by a too prudent caution or insufficient experience. I have myself examined the results thus obtained, and I soon perceived that, the same as in fibroids, intra-uterine electric intervention is obligatory for the following reasons, which may be resumed in these formulæ :—

1st. To treat the intra-uterine mucous membrane, which is always diseased.

2nd. Obtain a good intra-uterine antisepsis.

3rd. Establish an intra-uterine derivation issue, which would aid rapidly in the absorption of exudations.

4th. To permit the utilization of the inherent properties of each pole by applying the positive pole in the hæmorrhagic or ulcerated forms, and the negative pole in the others.

5th. Take advantage of the local (galvano-chemical) and general action (trophic) of the current.

6th. Permit the current to pass with certainty through the whole uterus.

I must now justify these propositions. The most judicious classification that has so far been made of metritis or inflammation of the uterus is the one which is based on the varying preponderance of the lesions of the parenchyma or the mucous membrane, whence the names on the one hand of internal, mucous, or catarrhal metritis, or of endometritis, and on the other hand of parenchymatous or interstitial metritis.

(*a*) In the first case the lesions of the mucous membrane are crying ones ; they justly absorb the attention of the clinician and fix the eye of the pathological anatomist. Nothing more natural, in this first category, than to act directly upon this mucous membrane affected with different inflammatory processes. Nothing more absolutely necessary than to establish in the intra-uterine cavity a perfect antisepsis which will be curative and preventive at the same time. Nothing more legitimate than to

destroy it more or less rapidly, creating at the same time in the midst of the uterine cavity an issue, so to speak, and a focus of salutary derivation. Indeed, on all sides, and with good reason, gynæcological intra-uterine therapeutics is becoming more and more established, being substituted almost entirely for the old external application on the uterine neck, which was handed down to us by the school of 1840; and the numerous successes obtained by it are a sufficient plea which requires no commentary.

It is to systematize it, and to submit it to rules, that I proposed the intra-uterine galvano-chemical cauterization, which has always given, in my hands, rapid and constant results, and which, in opposition to the surgical treatment at present in vogue, such as the curette or liquid injections, offers the following advantages, which I recommend to the attention of all observers:

1. An easy method which any gynæcologist can execute alone and without help.

2. A method which is mathematically dosable, which cauterizes much or little, according to the wish of the operator, and which is marvellously subject to a simple and precise graduation.

3. Progressive cauterization, which is never instantaneous, and which may be administered in fractional doses which accumulate at the will of the physician.

4. An active cauterization which may, if we desire it, go beyond the limits of the mucous membrane, and of which we can easily graduate the extent and the depth.

5. It unites to the galvano-chemical action contemporary with the passage of the current, and similar, according to the active pole, to that of acids or of bases, an after trophic (15) action followed by a process of retrogression and certain disintegration, a proof of which is its similar action on fibroids.

6. A rapid method which offers every facility, according to the intensity of the cauterization, which is whatever we desire it to be, to act with variable quickness according to the case.

7. Absolute harmlessness of the medication, and made without any brutality and according to the antiseptic fashion, and with an absence of instantaneousness which is, on the contrary, characteristic of the surgical method now in vogue.

8. Possibility of localization in a case where we do not wish to affect more than a limited extent of the uterine mucous membrane.

9. A weapon with a double edge, which, according to the pole in action, is able to give different effects, which may be resumed in a local action which is either hæmostatic or congestioning.

10. Cauterization which is antiseptic above all things on account of the energy of the chemical current employed.

11. The operation is little or not at all painful, and it, as a rule, does not require chloroform.

All these conditions are sufficient, it seems to me, to give an ample weight to my treatment in rendering legitimate its greater efficacy.

We have, moreover, every interest in localizing it entirely in the uterus, in order to insure to the current its maximum effect, to have the physical certainty that the whole organ is treated, since it is wholly affected, a thing which certainly would not be the case if we limited ourselves to a simple application to the outside of the uterine neck.

In this manner nothing is lost, none of the electricity strays away in tempestuous deviations which might close the circuit (if the active pole were placed otherwise, and far from the uterine cavity), by side roads distant from the body of the uterus.

It is for this same intra-uterine object that we create in the uterus, in the very centre of the diseased organ, a focus of derivation (analogous to what is done by a blister or a cautery) which is not extinguished by the cessation of the current, but which survives it, on the contrary, during a more or less long time, transforming into a slow and continuous action the temporary shocks which the passage of the current has transmitted to the uterus.

(*b*) There remains the question of interstitial or chronic parenchymatous metritis, which is also suitable, in my opinion, for the same treatment.

Here, in fact, is what pathological anatomy teaches us. "We admit two periods in the development of chronic parenchymatous metritis: the first period a period of infiltration, and the second phase a phase of infiltration. The first is characterized by the congestion and hypertrophy of the whole organ. The uterine tissue is soft, gorged with juices, red, and allows a considerable quantity of blood to flow when cut. The mucous membrane is thickened, and sometimes wears the same appearance as in internal metritis; in fact, we have never seen the two forms, parenchymatous and mucous, absolutely isolated the one from the other."

The therapeutical indications of this first period, or period of congestion, will therefore remain identical with those of mucous metritis, properly speaking, with the exception of the modifications of the pole, or the intensity, on which we shall insist later on.

We now come to the second period in which the tissues of new formation are retracted and transformed into cicatricial tissue; the vessels are destroyed, and the young and succulent conjunctive tissue becomes hard and fibrous; the uterus thus becomes smaller, and when we make a section of the organ we find that the tissue is hard, almost cartilaginous, crackling under the knife, pale, indurated and anæmic. It is in this condition that we can say with Carl Schrœder that chronic metritis always becomes a disease of long duration, which absolutely tries to the very last the patience of the patient and the physician; if it is not mortal by itself, it hastens at least a fatal issue by the disorders of nutrition, to which it gives rise. It may happen even that it becomes dangerous, and even fatal, by the hæmorrhages which it causes, or by the extension of the inflammation to the peritoneum. Although it is rarely mortal, this disease none the less poisons one's existence. It never goes away of itself, at least not before a very advanced age. It resists all methods of treatment. Scanzoni says that he has

never cured it. And, in fact, the complete return of the organ to its primitive state is never seen.

If, by the side of this testimony of such competent authorities, which is reflected in every classical work, we examine now the tide of methods of treatment which have been advised, one by one, praised and then abandoned, we see that they add a new weight to the gravity of the prognosis. All, or nearly all, the methods which have been tried have been external ones; sometimes they have been local bleeding, sometimes irrigation with hot or cold water; sometimes massage has been advised, hydrotherapy; on the one hand general treatment reigns supreme, and on the other local derivation, from cauterization of the neck performed in a thousand different ways, to its amputation, and in spite of all that the prognosis remains grave, the treatment uncertain, very often *nil*, as both the patients and their medical adviser can bear witness.

Well, here again I can give a remedy which has rarely deceived my hopes. I always advise the same medication destined to hasten the nutritious changes, to precipitate the absorption of old exudations, in appealing to the supplementary circulation; the same treatment which just now triumphed over vascular congestion during the early periods of the disease, is destined now (thanks to a change of the pole, of which I shall speak later on) to set up vascular hyperæmia, to combat anæmia, and to favour the formation of new vessels destined to perform a new irrigation of the blood.

All this proves, once for all, that we may in vain invoke in gynæcology the influence of the general condition or diathesis; it is possible that it requires another and additional treatment, but the *gist* of the cure will always be a local treatment, intra-uterine or interstitial, of a truly local lesion, which will not be cured or relieved except on this condition, and then all the more quickly and in a more perfect manner, when the treatment is energetic and thorough.

The intra-uterine therapeutics, once justified, I must now consider, in order to complete my plea, how to legitimize the whole extent of its application. In gynæcology, you may tell

me, there have been more or less exact classifications, which separate metritis into metritis of the neck and metritis of the body of the uterus, which are characterized, both the one and the other, by special symptoms.

Why, you may add, should we cauterize in this case the whole mucous membrane without having regard to the possible localization of the inflammation which may remain for a long time encamped at the entrance to the uterus, or which may penetrate deeper and deeper? Theoretically, that may sometimes be true, and we may, in recent cases especially, conceive an invading march of the affection, whose first halting-place is the neck. How greatly clinical experience differs generally from these cases, which the weakness of our minds conceives and applies everywhere! How greatly the disease, as we see it, differs from the books,—showing us that irregular forms are most often the rule! "When the uterus is affected with metritis, De Sinety says with good reason (20), the most often the whole organ is diseased, the mucous membrane as well as the tissues which it covers, the body as well as the neck, often even the peritoneal covering. Nevertheless, there is no doubt that these lesions may in certain cases, without being limited, in the precise sense of the word, to the mucous membrane or to the parenchyma, to the cavity of the body or the neck, predominate at one of these points, and according to these predominancies, the clinical symptoms differ."

We can, therefore, in some rare cases, but very rare, limit ourselves to treating the neck alone, when it alone is supposed to be diseased, without touching the body, and with this object in view we only introduce the sound as far as the level of the internal os. But how deceptive is this criterion, which should thus limit our intervention, which all the classical works establish according to the nature and consistency of the discharge between metritis of the neck and metritis of the body. Who can say that the internal os sets up an impassable barrier between these two cavities? Who can say that they have an autonomy of their own and distinct, and that their

circulation and innervation, common to both, do not create bonds of physiological and pathological union? When in doubt, is it not better, as in a fire, to go beyond the limits of the evil, act upon the whole mucous membrane which is supposed (very often erroneously) to be healthy, in order to be more sure of the therapeutic result, and to exercise a preventive action against the invasion of the inflammation, which, sooner or later, will not hesitate to gain the cavity of the body, if it does not do so at once, as many good authorities think, and with whom I quite agree?

Thus my whole intra-uterine therapeutics is justified, for it is very often, if not always, demanded by the diffusion of the inflammation at the very beginning; it is destined also to exercise a very favourable preventive action in cases where its curative action would not be always anatomically justified.

To resume. Owing to the perfect harmlessness of my operation, I leave to the timid and dogmatic the cauterization of the neck alone, in order to claim the double title of curative and preventive, only for that treatment which addresses itself to the whole uterus, and to the whole of its mucous membrane. In exceptional cases, when we are unable to introduce the sound completely without great difficulty, I recommend the cauterization of the neck alone, with this absolute reserve, that if it is not followed by a rapid success, the double intervention which is alone curative in most cases, will be absolutely necessary very soon, or as soon as possible.

B. NATURE OF THE OPERATION.—My operation is destined to put in action the chemical and trophic effects of electricity raised to its greatest medical expression.

I make a chemical galvano cauterization or a chemical cautery, as Tripier very properly calls it, and which is commonly but erroneously called electrolysis. I pass a current of a sufficient dose to produce an energetic cauterization at the points of entrance and exit of the current from the system. I utilize the intra-uterine scar alone, and I bring to bear all my care, as I said when speaking of the clay, to avoid the other eschar, by spreading the current over a large

extent, by diminishing its density, and consequently by reducing to a minimum its local effects upon the skin.

We have thus in our hands a weapon, cutting differently with each of its edges, whose general action has a certain resemblance, but whose local action differs according to the pole which is employed.

On one hand, it is the positive pole, directly coagulating or hæmostatic, on which the acids accumulate.

On the other hand, it is the negative pole, diffluent on the contrary where the bases precipitate, and which enjoys all the chemical properties of caustic potash for example :—

1st. The positive pole will be the remedy indicated in all forms of ulceration and hæmorrhage, and will derive its effects from a twofold action : the first, contemporary with the passage of the current, having a manifest hæmostatic power in proportion to the intensity of the current. The second, more distinct and coming after the passage of the current, which, thanks to the retractibility of the positive cicatrices, and to the greater or less atresia which follows it, assures a lasting future to the treatment, because it saves the woman from a return of the hæmorrhages later on.

The positive pole has, therefore, an immediate action at the spot itself against an existing hæmorrhage, which it may and should arrest with but slight delay ; and here, for instance, is an experimental proof, which will render living and undeniable the influence which we can have, on the other hand, on the uterine mucous membrane.

Take a large fungous, ulcerated, and easily bleeding cervix ; expose it at the end of the speculum, perform a local bleeding by means of a pin or knife. You can stop this hæmorrhage in a very short time ; you have only to use my bipolar chemical galvano cautery (which I have employed for several years for the cauterization of the ulcers of the cervix), which is composed of a conical ball made of carbon or platinum, mounted on a handle, in which the two poles terminate, and which are separated the one from the other by an isolating layer of gutta-percha ; the two poles with the same surface

separated thus by a distance of only a few millimètres, may accumulate their action within a limited radius, and we can then study the value and the nature of their respective scars.

A cauterization practised under these conditions on a very hæmorrhagic surface, with an intensity of 200 milliampères, and lasting, on an average, from two to three minutes, produces the following results :—

The two scars differ the one from the other.

(*a*) The *positive* will be *white*, more or less like *mother-of-pearl*, and all the more bloodless if the application has been made for a longer time or at a higher dose.

(*b*) The negative scars will, on the contrary, be *violet*, soft and diffused, with rather a deep colouration, and the bleeding will be little or not at all arrested at this place.

But apart from this powerful action, which is certain because it is physical, there is a more distant action, which is preventive and curative at the same time, which is the result of a loss of substance and subsequent cicatrix, which, anatomically speaking, resembles the cicatrices produced by a powerful acid, and thus exercises a final action on the calibre of the vessels, which will be opposed to further hæmorrhages.

The positive pole is, therefore, in my hands, the immediate and indirect treatment of congestive and hæmorrhagic forms of metritis or endometritis, which it will arrest, as we have just seen to be the case with artificial hæmorrhages of the cervix.

In saying *immediate* I should always mention some restrictions; it may happen in fact that this action may not always be so marked and rapid as in the experimental example which I have just cited; this may depend on several reasons; either on the current being too feeble, or not lasting long enough, or on account of the return of the hæmorrhage as the result of walking, of fatigue, and especially of connection.

I operate in fact on patients who do not remain in bed, and who walk about shortly after having been operated upon.

I am moreover obliged to make a certain reserve in the treatment, having regard to the social position of outdoor

patients at the clinic,—for instance, who are obliged to work; I act in this case more slowly and with more circumspection; I take three to five sittings on an average to obtain an effect, which one single operation at a high dose, and long continued, would have given me, if I did not have my hands tied by such considerations; my duty, in fact, is already laid down.

On the one hand, I must not make my patients suffer too much, and on the other, I must limit myself, while I am treating them, to not condemn them to bed, and to permit to the great majority of them to continue their daily life of working women, which they could not do if the reaction were too painful owing to the influence of too strong a dose.

I should add, moreover, in order to put you on your guard against certain clinical and premature answers, which might lead you into error, that the definite arrest of the hæmorrhages by the positive pole may not only sometimes be somewhat delayed, but in some cases, which are however rare, it resembles the negative pole, by seeming, at the commencement, to increase the hæmorrhages; and these are the mechanical reasons.

(*a*) The passing of the sound, performed more or less well, may provoke the return of a former hæmorrhage, by causing an intra-uterine traumatism at the moment of entering or removing the sound.

(*b*) The coming away of the first sloughs, while the cicatricial tissue has not become sufficiently resistant, also favours the return of the hæmorrhage. You must take care not to be discouraged, and especially not to form a too hasty judgment as to the final effect; you should persevere all the same, and before long you will obtain the success which I have always observed.

If the cure is sometimes still further delayed, it depends on the intolerance of certain patients who, without meaning it, defeat our intervention: diathesic intolerance, if I might dare to so express myself, such as occurs with certain cases of hysteria, who only tolerate medium doses, which are insufficient to produce and obtain a rapid effect. Inflammatory intolerance, united with the fact that the uterine periphery is diseased,

owing to perimetritis or any phlegmonous inflammation, preventing in a more decided manner still, especially in acute forms, all energetic intervention.

I can assert that outside of all these particular cases, which are rare enough, and excluding all those women who have of their own accord stopped all treatment because they felt, for the time, better, of the other patients, where the number and the intensities of the operations were sufficient, the hæmorrhages have always been arrested.

Supported by the same clinical indications, I employ the positive pole for the treatment of another disagreeable symptom, namely, rebellious leucorrhœa. But here I should say the disease answers less readily to the treatment than hæmorrhage does; often at the beginning and sometimes during the course of the treatment, a sero-purulent discharge, resulting from the intra-uterine scarification, increases the pre-existing leucorrhœa and transforms it, during a few days, into a regular hydrorrhœa. But this effect is altogether temporary, and produced by the treatment itself, especially at the beginning; once it is suspended, everything returns to the normal condition, the cicatrix modifying advantageously the uterine mucous membrane, so much as to diminish, or sometimes even suppress, the serous or catarrhal exudations of some patients.

2nd. The negative pole will be more used in the non-hæmorrhagic forms, and I therefore give to it, on account of its scar, the name of fluidifying pole; it is especially adapted for the treatment of chronic metritis in its second stage, and of certain forms of endometritis. It will constitute a true intra-uterine blister, which will resemble this remedy by its stimulating and derivative action at the same time. It will bring on very often at the beginning of its application, in dysmenorrhœa and in certain forms of amenorrhœa, either a more or less abundant return of menstruation, easier and less painful, or the appearance of slight supplementary hæmorrhages, not generally very intense, which will prove one of the most salutary forms of derivation; for if one woman suffers because she loses too much, another suffers just as much because she loses too little.

To sum up, if I had to qualify each pole by its tangible and principal action, I would say: if the two poles hasten the retrogression and the denutrition of uterine hypertrophies, united to endometritis, and congestive parenchymatous metritis, side by side with this general action may be placed indications special to each of them.

The positive pole, acid, decongestioning, hæmostatic in the highest degree, is especially useful in the hæmorrhagic, congestive, or ulcerative forms; it combats and prevents the tendency to excessive vascularization, and by the same process becomes an indirect treatment for rebellious leucorrhœa.

The negative pole, basic, diffluent, little or not at all hæmostatic, is, on the contrary, destined to excite the languid or perverted circulation, and old, atrophic, or indurated forms of chronic metritis, by a strong appeal to the intra-uterine circulation. This is the remedy *par excellence* for indurated chronic metritis, whether complicated with amenorrhœa or dysmenorrhœa, and it may be used, with equal success, in other inflammatory processes in which hæmorrhage does not predominate.

C. INTENSITY OF THE OPERATION.—Persuaded that the action which the continuous current exercises on a given part is, in general, in proportion to the intensity given out and the rapidity with which it is given; having, on the other hand, the avowed object of producing an intra-uterine scar, and varying in energy according to the gravity of the disease to be combated and the receptivity of the subject; I determined to raise the electric outflow to the maximum which it was possible to reach, medically speaking, and all my concentrated efforts in this direction have been devoted to rendering it tolerable. I am, moreover, convinced (and I intend before long to give you the proof) that the antiseptic action of the current of the battery increases with the intensity, and that this same current, the vehicle of the chemical and trophic action, should exercise, at a high dose, a curative or preventive antisepsis, according to the cases.

In the same manner for fibromas, my theoretical views concerning the influence of the electrical intensity utilized, have

been fully verified by clinical experience. I began at first with small doses, which were, however, the maximum of the current medical practice then in vogue; I employed at first, five years ago, a current of 40 or 50 milliampères, and I was not long in being convinced that generally the therapeutical effect increased with the height of the electric outflow. I have thus successively and progressively been able to reach 100, 150, 200, and even 250 milliampères.

This high intensity, which at first sight seems colossal, and which the skin would certainly not have tolerated with the forms of metallic electrodes, covered with chamois skin soaked in water, I have shown a new means of making tolerable to the epidermis with full success. There only remains now the uterus (if my technical method is scrupulously observed) of which we have to take account, but generally and very fortunately its tolerance surpasses our anticipations, and if the intervention remains aseptic and without traumatism, we can, without danger, boldly apply to it very high intensities; this is the clinical response nearly always constant which I have observed (in 90 or 95 cases out of a hundred). There remain, however, some exceptions, which are these: To resume whenever the uterine periphery is inflamed (whether it is perimetritis, parametritis, pelvi-peritonitis, or salpingitis) a relative intolerance is manifested, which will increase on the one hand with the height of the current, and on the other with the acuteness of the circum-uterine inflammation. Moreover, in the subacute stages we are forced to satisfy ourselves with small doses; we must be circumspect and even parsimonious, on penalty of missing the object in view, and of seeing the pre-existing inflammation becoming greater. But once the acute stage is ameliorated, the tolerance of the patient will augment and increase in proportion.

Side by side with this counter-indication against high doses, there is another category of patients who must be treated with the same reserve; these are certain cases of hysteria, where tolerance, or rather intolerance, varies greatly, without our knowing, as yet, exactly why. Certain women, in fact, most

often manifestly hysterical, bear an intense current badly, from the very start. In some this intolerance is transitory, and disappears with subsequent sittings; in others it is constant, and is not even diminished by a long course of treatment, as I have sometimes observed.

Any practitioner who forgets the recommendation which I here make, to respect this *modus vivendi* and not to offend it, would run the risk of compromising the operation, which might become dangerous on account of the unconscious sudden movements made by the patient. He might even bring on an hysterical crisis, the consequences of which, in the case in point, it is needless to emphasize, when we know that there is a sound in the uterus. I expressly recommend, therefore, that care, gentleness, and slowness be redoubled, especially at the first application of electricity.

But what rule should the practitioner follow, in view of the variations coming from these few exceptions which I have just mentioned?

The evidence of the patient will be our safest and most reliable guide; every operation must be tolerable for the uterus, and no severe pain must be felt in the womb; if it is otherwise you must lower and lower still more the intensity, until tolerance is attained, and then you can raise it again; you must have sufficient clinical perception to distinguish between genuine uterine pain and the mere fears of a too timid woman. I purposely employ the word uterine pain, in order to differentiate it well—as indeed most of the patients generally do—from that which may be felt at the other pole on the skin, oftenest at the epigastrium, which should remain indifferent as far as possible—or from intestinal colic.

To make all things agree, and not to embarrass the physician in the labyrinth of diverse indications, which may seem contradictory, this is the manner in which I proceed. If I am operating on a woman for the first time, I test her susceptibility at first slowly and carefully, especially if I have to do with an avowed hysterical case, or a patient affected with peri-uterine phlegmasia; I warn her beforehand, that no matter what

happens, she must communicate all her impressions, that she should on no account endure a too painful current, and that I will stop instantly if she wishes it; that done, I go on to the first halting-place, somewhere about fifty milliampères—either it is well borne or it provokes pain; if it provokes pain, I wait a moment to see if it is calmed spontaneously, and to make myself quite certain that it is not the cutaneous pole which is the cause. If in spite of this waiting a keen sensibility persists, if the woman complains of suffering from the sound, a sensation which she often locates at the root of the greater lips, we should diminish lower and lower, until absolute tolerance is reached. If, on the contrary, tolerance is manifested from the very beginning, the dose will have no other limit, as I have already said, than the attainment of the object in view, which varies according to the case and the disease.

The physician thus warned that he must keep a scrupulous account of all too severe, nervous, or painful reaction, will not be long in regulating with judgment his operative procedure; his boldness will increase with the number of sittings, feeling certain on the one hand of the harmlessness of the proceeding, and having the assurance on the other that the soil is suitable for high intensities.

Besides this question as to the proper quantity to administer, there is another, that of necessity; for although it is important not to act roughly, it is quite as necessary sometimes to cure quickly; and as the therapeutic effect is in proportion to the intensity given out, you must proportion, as I have said, this latter to the object to be obtained, to the gravity of the disease, and to its long duration. Hæmorrhage is the most frequent symptom which generally calls for the most active and rapid intervention, and we must not forget that we must cauterize, for everything depends on this most important effect.

If it is easy to obtain this cauterization on a shallow uterus, where the active pole is necessarily limited, and consequently where the electrical intensity, flowing out on to a small surface, has a pretty strong intensity, on the other hand in a large uterus, with a very deep cavity, we are obliged to multiply the

intensity in proportion, in order to obtain the same effect; for here the electrical density diminishes with the length of the sound engaged. If, indeed, the total quantity of electric fluid which flows from the surface of a pole is independent of the size of the pole, we must not forget, however, that the more this pole is limited, the greater will be the activity, the more dense will be the current crowded or concentrated on a small surface; the larger it is, on the contrary, the less will be the cauterization, on account of the lessened density of the current, rarefied, so to speak, or spread out over a larger surface. To make up for this deficiency, we should give an intensity of current, other things being equal, proportionate to the length of the uterus.

CHAPTER VIII.

DISEASES OF MENSTRUATION AND MALPOSITIONS.

Amenorrhœa.—Badly-nourished girls, or women that simply need toning up, do well under Franklinic electricity, which is an excellent tonic. It quiets the anæmic head pains and shoulder aches. If the patient be the victim of a wasting disease, the amenorrhœa is conservative, and the woman needs the care of the general physician. She has amenorrhœa because she has no blood to lose. In chlorotic-anæmia the Franklinic current is excellent, being generally sufficient to restore the menstrual function to normal, coincidently with a better state of health. In the intermitting form, where, for instance, a woman menstruates irregularly, sometimes indifferently or not at all, and sometimes properly, if the woman be married, we can use the continuous current, with the positive pole within the uterus. This especially in large, well-nourished subjects. In virgins, the faradic current, one pole at the lumbar region and the other over the uterus, does remarkably well. In a badly-nourished married woman, the faradic current is also used, one pole within the uterus and the other over the uterus. I also am very fond of a general faradization in these cases of amenorrhœa—one pole at the back of the neck, and the other in a basin of warm, slightly-salted water, in which the feet are immersed. It is especially valuable in the insomnia of irritable, nervous, chlorotic girls. Central galvanization should supplement local treatment in hysterical women. If this does not alleviate the hysteria, try Franklinic electricity, passing the sparks from the large ball electrode through the tender spot in the head. If a

crisis is about to appear, place one pole of the galvanic battery on the head and the other in the patient's hand, and interrupt the current sharply, with a tension of five to ten milliampères. As a general rule, to which there are exceptions, the faradic current is to be preferred to the continuous. It is impossible to outline any absolute routine. Begin a few days before the expected period, and get in as many treatments as possible, one daily, before the day of its appearance.

Dysmenorrhœa, Membranous Form.—Dr. Wylie, in *The American System of Gynæcology*, says: "If we could accept the desquamative theory of Dr. John Williams, it would be easy to explain membranous dysmenorrhœa; and if the view advocated by Kundrat and Engelmann of the growth of the utricular glands and proliferation of round cells before menstruation, and the exfoliation of this proliferated mucous membrane during the flow, is correct, then we should say that the membranous dysmenorrhœa is merely an exaggeration of a normal process, and the membrane comes away *en masse*, instead of in minute particles. I am inclined to believe that the process which takes place in the uterus and leads up to menstruation is one of growth—a preparation for pregnancy, and unless impregnation takes place and stimulates and directs further growth, that disintegration will take place and the accumulated blood escape, and the tissues again start another cycle of growth. If this disintegration takes place by fatty degeneration, and the lower or underlying part degenerates before the superficial part disintegrates, the latter may be thrown off in shreds or cast off in one piece. This abnormal process may be the result of the preparatory growth going too far in developing a decidual membrane, or it may be the result of some irritating disease abnormally increasing the supply of blood, thus inducing excessive growth of the lining membrane, or the irritation may so greatly increase the normal vascular tension that the superficial layer is dissected off by hæmorrhage in the deeper layer." In cases of membranous dysmenorrhœa we have a right to expect the best results from the steady continuous current, with the positive pole in the uterus, and a current of as high tension as the patient can

comfortably bear. Should there be a co-existing fungoid endometritis, then use the negative pole in the uterus. These cases almost always respond readily to this treatment.

Other Forms of Dysmenorrhœa.—Dr. Wylie says: "My experience has led me to some very definite conclusions about the cause of dysmenorrhœa. In the majority of instances I think it is caused by a hyperæsthetic condition of the endometrium, especially at or near the os internum, often combined with more or less stenosis or induration at this point—stenosis due to degeneration, contraction, and atrophy, the result of imperfect development followed by disease—a disease followed by induration, atrophy, and contraction. These same conditions, in all probability, render abnormal the processes that take place in the endometrium previous to and during the flow—may cause it to disintegrate and exfoliate in pieces, and add to the pressure of the blood or cause spasmodic muscular contractions, etc. The hyperæsthesia may induce spasmodic uterine contraction, which may cause the pain without the presence of any special induration or stenosis at or about the os internum. It only causes confusion to classify dysmenorrhœa as neuralgic, ovarian, obstructive, etc. Clinically, it cannot be done. It is true that ovarian and other diseased tissues about the pelvis become more painful on account of the vascular tension in the pelvis before and until menstruation is well established; but, unless there are abnormal changes in the lining membrane or decided obstructions to the flow, menstruation will relieve the pain caused by congestion in the peri-uterine tissues. In acute inflammation or disease of the uterus itself, unless the flow is retarded by pressure of the swelling, menstruation lessens the pain, and the pain varies inversely with the amount of the flow."

The whole article of Dr. Wylie on this subject is well written, original, and exceedingly interesting, and will repay the reading of it. In so-called "*neuralgic*" dysmenorrhœa, or that due to spasm of the os uteri, galvanism, with the positive pole active and in the cervix or uterus, is the treatment *par excellence.*

Subinvolution of the Uterus and Vagina.—Not having treated

any of these cases myself, or seen them treated, I quote from Grandin: "Under the term subinvolution we understand that relaxed, congested state of the uterus and the vagina which is so often met with after labour, at term, and abortion. The condition is a subacute one, as we speak of it here, and has not become chronic, when, as will be noted, electricity should be differently used. We are dealing with a passive hyperæmia. The uterus is enlarged, soft, and succulent. It is heavy, and tends to sink down in the pelvis proportionately as its ligaments and the pelvic floor are similarly relaxed and lacking in tone. There exists not only uterine congestion, but also pelvic congestion. The symptoms are intensified when the patient is in the erect or the sitting position, and these symptoms are the result of the congestion, which is in turn intensified by the sagging of the uterus. Leucorrhœa, menorrhagia, even metrorrhagia, are the outward manifestations of the general pelvic congestion. There is present an endometritis, but it is purely the result of hyper-secretion; it is a catarrhal endometritis, in other words, and not an endometritis characterized by degeneration of the elements of the uterine mucous membrane. We are thus specific in describing the nature of the local conditions, because it is essential to differentiate subinvolution from hyperplasia (chronic metritis), the method of using electricity in the one case differing essentially from that of use in the other. In subinvolution of the uterus we aim at emptying the organ of its excess of contained blood, at causing it to contract, at rendering it lighter, so that its tendency to sag downwards will be lessened and the peri-uterine circulation is so far improved. It is at once suggestive how amply electrization will fulfil the purpose of adjuvant to our routine measures. Of these routine measures we are able to dispense with one, and this is resort to intra-uterine applications. In the endometritis accompanying simple subinvolution they are unnecessary where electricity is used. As to the variety of the current, since we aim at stimulation, at causing contraction, it is obviously the faradic which should be chosen. Further, we wish to stimulate the entire uterus, and not to irritate it locally, and therefore faradization should be

instituted with one electrode over the cervix and the other over the abdomen, instead of inserting one electrode into the uterus. This, at least, should be the rule at the outset, while the uterus is large, heavy, and succulent; later, when the organ is smaller, mild galvanization, vagino-abdominal, may be resorted to for improvement of nutrition. As for the strength of the current, it should be mild, applied for a few minutes every other day. The result will be noted in gradual diminution in size of the organ and lessened tendency to sagging. In the absence of that factor which so commonly keeps the uterus in a state of congestion—we mean a laceration of the cervix—the result from electrization of the uterus will be marked in a few weeks. At the end of each electrization the vagina should be carefully filled with glycerin tampons, in order that in the intervals of treatment the uterus may be held at a slightly higher level in the pelvis, and thereby the uterine and the peri-uterine circulation may be utilized. It is apparent, and we desire to emphasize this, that electricity is advocated in case of subinvolution on account of its powerful contractile effects, as a valuable adjuvant to other means for reducing the local congestion. It enables us to dispense with intra-uterine applications, which have always seemed to us of questionable utility in subinvolution pure and simple; and through its relatively speedy action in diminishing local congestion, and its general tonic effect on the pelvic organs, resort to pessaries, which aim at sustaining the uterus at a higher level in the pelvis, and at taking strain off the suspensory ligaments, will less frequently be necessary. In case of subinvolution of the vagina, faradization, which is here indicated as well in preference to galvanization, may be suitably applied by means of the vaginal electrode, and since relaxation of the vaginal walls is a fairly constant accompaniment of subinvolution of the uterus, both conditions may be treated at one and the same time. Faradization of the vaginal walls improves their tone, stimulates the muscular fibres, and relieves the congestion here as elsewhere. While, in the treatment of subinvolution, as defined by us, we have laid special stress on the faradic current, and given our reasons therefor,

it is necessary to state that observers are not strictly in agreement, some preferring galvanism, and others a combination of galvanism and faradism. Rockwell, for instance, in his recent contribution (*Am. System of Gyn.*), says that in most, if not in all, cases of subinvolution, we must depend mainly upon the galvanic current, although the faradic is by no means useless. He would apply the negative pole internally, and he considers a strength of from twenty to forty milliampères amply sufficient.

It is possible that he has in mind cases of longer duration,—more chronic, in other words, than those which we are considering. *A priori* it would seem to us advisable to use the faradic current in recent subinvolution, where hæmorrhage and leucorrhœa were predominant symptoms, and to resort to galvanization, or to galvano-faradization, when the discharges have been lessened, and the organ has become denser and less congested. These are questions which as yet the individual observer must settle for himself. In the specific case he will have very little difficulty in making his choice of current, if he only bear in mind the essential differences between the two—the faradic being contractile and stimulating, the galvanic, while also contractile, being chiefly absorbent and sedative."

Superinvolution.—Grandin also writes: "This condition is the opposite of subinvolution. In the one there is incomplete retrograde metamorphosis, in the other there is excessive. The uterus is smaller than normal, instead of larger; amenorrhœa, instead of metrorrhagia, is an accompaniment. The amenorrhœa need not be absolute, however; there may be a slight periodic discharge of a few hours' duration, although the uterus is lessened in size; and this is a point which materially modifies the prognosis in regard to the result from the instituted treatment. As long as there is evidence of ovarian activity, we may hope for success from persistent treatment. In the absence, therefore, of external manifestation of ovulation, the presence of molimina is a favourable prognostic factor. Obviously the treatment called for is stimulation. This may be secured in a variety of ways, such as by applications to the endometrium, the insertion of stem pessaries, the use of sponge tents; but

unquestionably the most direct and powerful stimulant is the faradic current, applied by preference to the interior of the uterus by means of a double internal electrode, or else one electrode externally over the uterus and the other within the cavity. The applications of faradism are called for in particular just before and during the presence of molimina. In the intervals, frequent utero-abdominal galvanization should be resorted to, the negative pole being placed within the cavity to secure the local hæmorrhagic effects. Constant treatment of this nature may result in enlargement of the uterus and in restoration of the menstrual periods, for we thus not only stimulate the uterus to growth, but the ovaries as well to function. Where the superinvolution has existed for some time, and there is complete absence of molimina, it is questionable if even persistent electrization will be of benefit, although it should always be given a faithful trial."

Displacements of the Uterus.—*Fixed Uteri.*—At the meeting of the Philadelphia Obstetrical Society, December 6th, 1888, Dr. Wm. L. Taylor presented a paper on this subject, which is worth reproducing. I take the report of it from the *Journal of the American Medical Association* for January 26th, 1889:—

"In looking over his case book he found the remark, 'uterus fixed,' so often noted, so often underscored, as much as to say 'here again,' that he fain would ask how many of these cases were, in their inception, recognized as cases of peritoneal inflammation. In a number the note is made, 'patient had attack of inflammation of bladder.' 'Inflammation of bowels' has been of alarming frequency, whilst 'congestion of the liver' makes him wonder at the special degree of sensibility of that organ in women. In a series of cases where the lymph deposit seemed to be the most diffused, a positive history of an active and acute inflammatory trouble could not be obtained. There was only the history of a continued abdominal pain and tenderness, dating from an abortion, from heavy lifting, seldom from normal labours, and presumably never from gonorrhœal infection; seldom—I might say never—have I had perfect success in my efforts to trace the cause to this infection. The history

of the husbands, as to the existence of a gonorrhœa or gleet, at the time of commencement of pelvic trouble, is, in the vast majority of cases, worse than uncertain. In several of the sub-acute cases the only ascribable cause appeared to be indirectly, if not directly, the effort to prevent conception. Freedom from the possibility of, at least, paternal cares, leads to an amiable weakness, and coition follows coition in quicker succession than the law of conservatism would recognize, and, plus the menstrual congestions, which now even anticipate, without the restful periods of pregnancy and lactation, congestion and inflammation of the peri-uterine tissues follow. That this is as immediately the cause of the fixed uteri, the thickened and enlarged ligaments and tubes, and tender ovaries, as is gonorrhœal infection, even in prostitutes, I am inclined to believe. Where the deposits of lymph were more localized or larger in quantity, seeming as if it had been poured out quickly, and had by gravity centred itself around the uterus, there were histories of acute, well-marked attacks of cellulitis or peritonitis. The causes were difficult labours with badly lacerated cervices, these lacerations extending through into the cellular tissue; and also criminal abortions. In these cases, how often traumatism and how often septic poisoning was the exciting cause it is impossible to say. Catching cold while menstruating, falls, and various other accidental causes were among the number. The average physician, as soon as the patient is up out of bed, shakes himself by the hand and says, 'I have cured my patient.' But he hasn't! There is still the important sequel to deal with, the lymph deposits. In fully three-fourths of all the cases the body of the uterus has become fixed in retroflexion, even in multipara. Just as soon as the uterus feels the stimulus of congestion or inflammation of surrounding tissue, it becomes turgid and heavy, and sinks decidedly lower in the pelvis until the cervix is near the vulvar orifice, and following the curve of Carus, the fundus is retro-displaced. Here it is, as it were, frozen in, fixed immovably. All around it is a mass of inflammatory lymph, becoming more dense and resisting as organization advances. In the centre of this the sound probably

indicates the uterine body with a measurement of three-and-a-half inches. The cavity is tender and the cervix softened, congested with venous blood. Now this deposit varies greatly in quantity as the inflammation has been, by judicious treatment or by nature alone, limited or allowed to involve a great extent of peritoneal surface. The possibility of determining the amount of lymph deposit and the degree of fixation by bi-manual examination seems to me to be one of the few certainties in gynæcological practice. A uterus which is low in the pelvis and which cannot be raised to the normal line, and a fundus which is retroflexed and cannot be reposited, with the other evidences, bi-manually, of thickening and deposit, cannot but point to the certainty of previous inflammation. A sterile uterus and a fixed uterus seem to be almost synonymous.

"The need of shortening attacks of pelvic peritonitis, aborting them if possible, can only be appreciated by those called upon frequently to treat the sequelæ.

"If these are thoroughly treated the amount of lymph thrown out is small, and probably will be absorbed almost as rapidly as it was thrown out. But we meet a case which was treated by 'the other doctor around the corner,' and the uterus and its appendages are imbedded and immovable. Now what are we to do? The great object is to get rid of as much of this effused matter as we possibly can. The older and more thoroughly organized this becomes the less chance there is of rapid and complete absorption. So the moral is, commence early. It is going to do one of three things: undergo absorption, break down and form pelvic abscess, or become organized, acquiring an adventitious circulation. In a case of recent or comparatively recent deposit he commences treatment by correcting the digestive tract, getting the stomach, liver, and bowels in better condition, and surface circulation is stimulated by warm baths and frictions. He then gives mercuric chloride, with the iodide, commencing with small doses frequently repeated, and gradually increasing the dose and lengthening the time. Locally he relies upon the abdomino-vaginal galvanic current and gentle or more decided uterine massage, as there is great or little

tenderness. This uterine massage he prefers in cases of long standing, where the tenderness has disappeared, but still used carefully where there is tenderness, he finds it beneficial. Every other day, or twice a week, make steady pressure upon the fundus of the uterus with the index finger of the left hand, in the rectum and upon the cervix and body of the uterus with the right index finger in the vagina. This pressure is kept up for two or three minutes, gradually trying to force the body upwards and forwards. Then efforts at lateral movement for the same length of time. This massage is followed with the continued galvanic current, using the abdomino-vaginal method. For the breaking down of pelvic lymph he has not used electro-puncture, preferring the slower and as certain absorption by the stimulation of pelvic circulation. Where there is tenderness he uses the positive pole in the vagina and the negative over the abdomen for the first three or four applications, and it is marvellous how rapidly this tenderness disappears. He then reverses the poles, using the negative with a ball or small crescent-shaped electrode in the vagina. These *séances*, including the massage, last for about fifteen or twenty minutes. The strength of current averages about twenty-five to thirty milliampères. After this is over he frequently packs the fornix with wool, introducing a small ring pessary to keep the wool as much as possible in position. After he gains a certain amount of mobility he introduces a Smith-Hodge pessary, small at first, increasing to a more suitable size as the uterus rises to the normal line. Tincture of iodine to the fundus of the vagina."

Displacements in General.—Tripier's rules were for *Anteversion* and *Anteflexion.* Recto-uterine faradization. Séance of three minutes daily, at first. More frequent and shorter sittings in versions; longer sittings but less frequent in flexions. *Retroflexion* and *Retroversion.* Vesico-uterine faradization. *Prolapsus.* Uterine faradization. Alternate, according to the indications furnished by the conditions of the ligaments and vagina, bi-abdominal-uterine, bi-inguino-uterine and vagino-uterine faradization. Rockwell (*Am. System of Gynæcology*) says: "As the effects we desire in these cases are purely mechanical, the

faradic current is the form indicated. The simplest and probably the least efficacious method is to introduce one electrode behind the os uteri, while the other is applied externally over either the pubes or the sacrum. As the internal electrode is larger than that employed in intra-uterine applications, and the mucous surface not so sensitive, a much stronger current can be employed; and so far forth this method has an advantage over applications to the interior of the uterus. In prolapsus uteri much benefit has often followed this method of treatment by the tone imparted to the relaxed vaginal walls. A more effective localization of the current is accomplished by introducing one electrode into the uterus, while the other is placed externally; but more effective still is the internal use of both poles. In cases of anteflexion one pole, the curve of its stem corresponding to that of the sacrum, is introduced into the rectum up to the point nearest the posterior wall of the uterus. In this way the current is quite accurately localized in the posterior uterine wall, causing contraction and improving nutrition. In retroflexion the first electrode, instead of being passed into the rectum, is introduced into the bladder, and applied to the anterior wall of the uterus. When the faradic current is used—and this form is chiefly indicated—the relative positions of the poles would seem to be of no special importance, although for the intra-uterine electrode the anode is preferred by some, on the theory that it has a greater power over unstriped muscular fibre. Tripier, however, recommends that the negative pole be placed in the uterus, because it is the stronger (in the sense of being more powerfully felt). The pain is sometimes considerable, and is due to two causes: first, the concentrated action of the electricity on the mucous membrane; second, the contraction of the uterine fibres. In other cases very little discomfort is produced. By beginning with a very weak current, and gradually increasing it, a much greater strength can be endured than if this precaution is not observed. In this connection it may be pertinent to the subject to say that when voluntary muscles are subjected to the action of the poles of either a galvanic or electro-magnetic battery, contractions

instantly occur. These contractions continue, as is well known, during the passage of the faradic current, but quickly relax after the first shock of the galvanic. When, on the contrary, involuntary muscular fibre, of which the uterus is composed, is subjected to the influence of the electric current, movements are not induced until a certain time after the tissues have been acted upon. The movements thus excited continue for a time after the cessation of the current, and do not, as in the case of voluntary muscles, cease as soon as the electrodes are removed." I have for a number of years been accustomed to treat all cases of malposition of the uterus that consulted me with the use of electricity alone, generally using the faradic current ; and from the time of my first writing on the subject, ten years ago, until now, I see no reason to regret my routine. My results have always been satisfactory. A great many shafts were flown at me when I rejected pessaries and stated my reasons for so doing. I have not inserted one since that time, and never propose returning to the practice. I consider them abominable inventions, unscientific, formulated upon no physical laws of accuracy, and the sources of endless mischief. In those cases of "fixed" retroversion, with great tenderness around the utero sacral ligaments, I always commence with a positive galvanic pole within the vagina, over the tender spot, and the negative pole on the abdomen. I alternate this with a uterine positive galvanic application ; and when the tenderness is gone I commence the faradic treatment. In cases demanding it I supplement the electric routine with other means, a consideration of which is not within the scope of this work. Pessaries are not in as high favour as they were some years ago. No one *ever* maintained that they could cure a severe flexion by using them, or by any other means known to the gynæcologist. With vaginal or bi-manual massage and electricity, if we do not bring about a cure in all cases, we give the patient a measure of relief far in excess of that obtained under the old system. Some cases may be absolutely relieved others symptomatically—all will be benefited in degrees varying with the intensity of the malposition, and this without the possibility of engendering irritating changes in the vaginal mucosa. In

backward displacements, even when bound in place by adhesions —cases in which pessaries are especially worthless—massage and electricity are crutches that will serve us in excellent stead. The levator ani muscle and the vaginal walls are both stimulated to assume their proper *rôles.* The vascular pressure is equalized, so that the sagging of the uterus is reduced to a minimum. All women have not the same "*health line,*" as Emmet long ago showed us. The aim is to restore the uterus to such a position as will occasion the woman the least possible inconvenience.

APPENDIX.

JUST on the eve of sending my manuscript to the publisher, I have received the January number of the *Annals of Gynæcology* (Dr. E. W. Cushing, editor), which contains the full report of Dr. Bradford's paper, to which I have already called attention, with the discussion following it. I reproduce it in full :—

Dr. T. HEWSON BRADFORD read "Notes of Gynæcological Cases treated by Electricity."

"Recently so much matter has been brought before the profession regarding the use of electricity in gynæcology, that I wish to present to the Society some notes respecting the practical application of the battery upon patients in my work at the gynæcological out-patient department of the Pennsylvania Hospital. The number of patients so far is small, but covers a large field in diseases of women. In each case I have marked the results of the use of the battery and the extent of the time applied. In the beginning the treatment was with the acid portable battery of thirty cells, used in the hospital wards; but later the Board of Managers kindly provided a seventy-cell Law battery, with controller and milliampère-metre. The abdominal dispersing pole is the clay electrode of Apostoli, and the intra-uterine electrode is the platinum sound insulated with shellac, as devised by Dr. G. Betton Massey. The efficacy of the work is largely due to the services of Dr. Massey and Dr. Robert H. Hamill, both of whom are associated with me in the department.

"*Case I.*—Stenosis of cervix. Æt. 30 years. No children. No miscarriages. Menses irregular, scant, and with some pain. Os, pin-hole in appearance. July 14th, Simpson's sound introduced with great difficulty, and positive cauterization of eighty milliampères applied for four minutes. Treatment continued at stated intervals

until September 15th, with a total of six applications. She menstruated September 22nd, normal induration, less painful; and again on October 26th, when flow was very free and pain very slight. She considers herself entirely well, the last visit being November 13th.

"*Case II.*—Anteflexion. Æt. 21 years. Single. One week before she came to us she lifted a heavy weight, and at once felt a severe pain in the back, accompanied by a feeling of nausea. Uterus sharply anteflexed. Cavity two and one half inches. First visit October 30th; sound introduced and fundus brought to normal position. November 6th, positive cauterization, eighty milliampères, two minutes. Patient returned November 8th, 13th, 20th, 22nd, 24th, and 27th, and treatment continued with varying strengths and length of application. On the two last-named dates, sound showed uterus in normal position.

"*Case III.*—Metrorrhagia. Æt. 22 years. No children. One abortion five months before. Menstruation occurred every three weeks lately, lasting four days; excessive in amount, with severe pain. Uterus small and in normal position. Os small. Sound enters two and one half inches. First visit September 18th. Applied positive cauterization, forty milliampères, four minutes. She returned at stated intervals until November 1st, and treatment continued. Menstruation, October 1st, normal, and but slight pain. Patient returned later, expressing herself well.

"*Case IV.*—Metrorrhagia. Æt. 45 years. No children. No miscarriages. Ill health has lasted for six years. Menstruation irregular, excessive, and very painful. Locomotion painful and difficult. Uterus enlarged, os patulous, cavity three inches. Ordinary treatment pursued from April 17th to June 7th. There then being no improvement, negative cauterization of twenty-five milliampères was given for seven minutes. The following day she felt severe uterine pains, but after these had left her she felt better than she had done for months. The bleeding continuing up to July 7th, it was decided to change to the positive cauterization. From this date until October 20th, a total of nine applications were made, varying in strength from seventy to two hundred milliampères, and lasting from one to three minutes. August 23rd, menstruation appeared and lasted six days; very profuse. November 1st, it again appeared, normal in all respects. She returned later, saying she felt entirely well in all respects. A review of this case is convincing that the results might have been obtained by less severe treatment than was used on several occasions.

"*Case V.*—Obstructive dysmenorrhœa. Æt. 32 years. One child three years ago. No miscarriages. Ill health since last pregnancy. A constant pain in sacral region. Menstruation irregular and painful; slight at first, but afterwards excessive and clotted. September 18th, uterus large, but movable; cervix stellate, laceration. Cavity three inches +. Positive cauterization, seventy milliampères, four minutes. Pain followed and lasted until September 20th, when it ceased on the appearance of flow. Treatment continued at stated intervals until November 24th, when menstruation appeared, lasting four days, with only slight pain on first day. Flow full and normal; only slight appearance of clots. Patient appears entirely well.

"*Case VI.*—Hyperplasia with dysmenorrhœa and retroflexion. Æt. 29 years. Single. Ill for three years, and has had severe pain in back all the time. Cervix had been removed, but symptoms only aggravated. Menstruation regular, free, and painful. Uterus presents a broad, truncated surface, and is retroflexed; cavity, two and one-half inches +, but broad. Negative cauterization, forty milliampères, five minutes. November 10th, positive cauterization substituted for negative, sixty milliampères, four minutes. November 15th, faradic current to vagina; retroflexion corrected. November 22nd, faradic intra-uterine, two minutes. December 4th, menstruation; first two days scant, last three days full and free. Less pain than for any time for three and one half years. Still under treatment. Faradic current used to stimulate relaxed vaginal walls.

"*Case VII.*—Subinvolution. Æt. 37 years. Eight children. Two miscarriages. Ill since last pregnancy, eighteen months ago. Ten days before coming for treatment had aborted a two-months' fœtus. October 4th, uterus subinvoluted, os patulous, cavity, three inches +. Treated with tampons of glycerine, hot-water injections, and tonic pills, until October 9th, when negative cauterization, one hundred and twenty-five milliampères, three minutes, was applied, producing slight pain. Bleeding continuing, strong faradic intra-uterine currents were used the 18th and 20th, and flow controlled completely. October 25th, discharged, cured. November 13th, still well.

"*Case VIII.*—Prolapse of left ovary, with adhesion. Æt. 26 years. Three children. One miscarriage. Last pregnancy four years ago, since when pain has become progressively worse. Dyspareunia intense. Menstruation regular but painful. Painful sanguineous discharge for four weeks. Uterus enlarged and placed to the right; right side very painful; both tubes enlarged. On the left a mass is felt—apparently a prolapse ovary, surrounded by exuda-

tion. September 22nd, bromide and ergot. September 27th, drugs stopped. Positive cauterization, forty milliampères, three minutes. October 4th, negative cauterization. Treatment continued to November 13th, when uterus measured two and one half inches; mass to left scarcely discernible. Has had pain at times, after application. November 20th, faradic intra-uterine application, three minutes. The notes of the treatment of this desperate case, for which abdominal section had been advised by several physicians, shows the care that must be exercised in electrical treatment, and the small currents that are at times best. The case is still under treatment.

"*Case IX.*—Submucous myoma and suppression of menstruation. Æt. 38. Seven children. Three miscarriages. Five years since last pregnancy. Duration of illness, five years. Menstruation irregular, scanty, and painful; leucorrhœa; locomotion at times painful; cystocele and rectocele; uterus hypertrophied, os patulous, cervix congested, vagina much inflamed. Sound enters four inches and encounters a projection, the size of a shellbark, on the posterior wall. First visit August 9th; negative cauterization, fifty milliampères, four minutes, after which she had severe pain. August 16th, severe pain in left ovarian region, and uterus tender. August 28th, menses, with severe bearing-down feeling, lasted four days. September 1st, much pain in left side; treatment continued, varying from positive to negative cauterization, and in strength and duration. September 20th, tumour still there; negative cauterization; one hundred and fifty milliampères; uterus measures three and one half inches. October 30th, menstruation on date, lasting six days; cavity two and one half inches +; projection reduced to a slight roughness. Still under treatment. Pain, after application, due to a six-mile street-car ride after each treatment.

"*Case X.*—Intramural fibroid. Æt. 24 years. One child. No miscarriage. Last pregnancy eleven years ago (?). Menstruation regular, scant, and painful; leucorrhœa profuse; fibroid uterus as large as an orange; cavity three inches. September 22nd, negative cauterization, fifty milliampères, four minutes. The same treatment was continued up to November 13th, the strength of the currents being increased to one hundred and fifty milliampères. Several positive cauterizations were given. Now the tenderness and purulent discharge is corrected, and the tumour is reduced to two-thirds its size. Still under treatment.

"*Case XI.*—Large intramural and subperitoneal fibroid. Æt. 38 years. Tumour first noted two years ago. A large, irregular fibroid

occupies the lower two-thirds of the abdomen; os patulous and difficult to reach; cervix lacerated; menstruation regular, profuse, and painful; locomotion difficult, and feet and legs swollen; nodule of tumour painful. August 14th, negative cauterization, sixty-five milliampères, four minutes, which caused, for some days, pain and continuous sanguineous discharge. August 16th, positive cauterization, one hundred and twenty-five milliampères, four minutes. Treatment, with negative and positive cauterization, varying up to one hundred and fifty milliampères, continued until October 18th, when tumour was an inch or more below umbilicus, and she could wear clothes four inches less in waist-circumference. Deep sulci between nodules. December 4th, since last visit has been feeling badly; sickness appeared November 28th, and lasted four days, profuse and painful. Every night since last visit she has had a thick discharge, accompanied with pain, similar to those of labour. Kneeling produces large discharge of white, stringy substance. Tumour has considerably diminished. It is probable that the shreds noticed by her are portions of the tumour. Still under treatment."

Dr. G. Bretton Massey said: "I had a special interest in watching these cases; and, experimenting to determine the justice of claims that have been made by Apostoli and others, at Dr. Bradford's request, I performed the electrical operations for him at his clinic. I think that we had good results in several cases; and if the cases had been summarized more briefly, this would doubtless have appeared more sharply in the case of stenosis of long duration. The application of a few positive cauterizations, at considerable intervals, seemed to result in a complete cure. The treatment extended over several months, but the applications were generally made at intervals of one or two weeks. But it is sometimes difficult to determine how frequently the applications should be repeated. My observation of these cases, and of others in private practice, has been that it is not wise to make applications of more than fifty milliampères oftener than twice a week.

"The second case—one of marked anteflexion of the third degree in a young girl, and probably the result of strain—is rather unique. She seems to have been cured by two or three positive cauterizations of fifty to eighty milliampères, lasting over a period of a few weeks. Several months have elapsed since the cessation of the treatment, and the uterus still maintains its normal curve. The idea was, if

we had a flexion of the uterus, due to muscular relaxation on one side, the galvanic current would throw it into a spasm and keep it there, and, at the same time, cauterize the M. M., and make the canal more patulous. I believe that the approved electrical treatment of flexion, at the present time, is by the bipolar faradic current to throw the uterus into contraction. I have, however, had no experience with this method. It is difficult to get a bipolar electrode that can be thoroughly cleaned.

"The third case was one of acute metrorrhagia, with an excellent result. Case VII. was also one of metrorrhagia. The lesson of these two cases, as has been stated in the paper, is, that galvanic treatment of a surgical nature (over thirty or forty milliampères) is rather harmful in the recently parturient womb. In the seventh case I think there was decided aggravation of the difficulty as the result of three cauterizations. The effect of the faradic current, monopolar, was very marked in arresting at least two-thirds of the hæmorrhage. The second application was followed by complete arrest.

"Case IV. deserves particular attention. It was one of protracted metrorrhagia in an elderly woman, with hyperplasia of the womb and evidently some endometritis. As was stated in the paper, this case was overtreated. I can recognize a stage in her case, in July or August, and in September, when she was practically cured, as the result of the application of a moderate current. In these months the cauterizations made her worse for a week. She is now entirely well.

"Case VIII. was much like one delineated by Dr. Taylor. There was a mass of induration in which, most likely, an ovary was included. The patient has apparently been benefited. It was particularly apparent in her case that nothing but very moderate currents, twenty to thirty milliampères, were immediately beneficial. Whether or not heavier currents would have been beneficial is a question. Even the introduction of the electrode was followed by pain and cramp. Low currents even, at times, aggravated the pain temporarily. There has finally been vast improvement. The fibroid cases have been well delineated in the paper. These cases showed a great lessening in the size of the tumours, and an amelioration of the symptoms accompanying them."

Dr. B. C. HIRST thought it was a gratifying fact that we were advancing in this branch of therapeutics. It seemed that for a time

we did lag behind other gynæcological centres. He had seen some of Dr. Massey's work. At Dr. Hirst's request he had applied the current at the Philadelphia Hospital on a patient with retarded involution, due to multiple fibroma, with good results. He tried electricity some time ago, but with very little result, because he had, he thought, used too weak a current, and because he did not thoroughly understand the application of electricity in gynæcology. He thought that much of the criticisms of this kind of treatment had been ill-considered. He had just read Mr. Tait's critcism in the *British Medical Journal*. Mr. Tait went to Paris to learn Apostoli's method, but when he got there he refused to visit Apostoli. He said that on inquiry he did not hear sufficient favourable reports to make it worth his while to go and see the method applied. This reminded him of the English gentleman who went to the West Indies to see the pitch lake, and on his arrival sent his steward to look at it for him. Dr. Hirst thought that in the future electricity must occupy a very prominent place in gynæcological treatment. With the excellent appliances that our prominent electricians possess, and the skill they have acquired by recent practice, we should accomplish as much in this direction here as has been done in other places.

Dr. J. M. Baldy said that he had never used electricity in his gynæcological practice, for the simple reason that he had not felt competent to get the best results, not being an electrician, nor had his observation of the work of others made him desirous of doing so. He had, however, done still better,—he had put himself in the way of observing the work of experts in this branch of practice. He thought that Mr. Tait's time had been well spent in not going to see Apostoli,—better than his own. Mr. Tait said that on inquiry amongst the patients of Apostoli, he found that there had been so little benefit that he did not consider it worth while to go to merely see the details of the application. He had hunted up the patients and studied them. What Dr. Baldy saw at Apostoli's clinic was entirely negative. The most conservative review of electricity in gynæcological practice that he had seen recently was that of Croom, of Edinburgh. Croom took the precaution of having the applications made by a gentleman specially skilled in electricity, Dr. Milne Murry. He continued the treatment one year, applying it specially to fibroids. He states that his results have been entirely negative. He has seen greater risk to life from the use of these applications

than from the knife in the removal of the uterine appendages. There are some details in the application which would strike one, as it did himself, not in the habit of using electricity very forcibly. Apostoli denies that there is pain. Dr. Baldy did not see a patient treated by Apostoli that did not cry out and squirm with pain. The same thing was noted and remarked upon by an English surgeon, who was there at the same time with himself. He had also observed this at the Pennsylvania Hospital, even under comparatively low currents. After the punctures in fibroid tumours, as seen in Paris, there were left nasty, ugly-looking, sloughing sores, requiring constant care, that they might not set up a bad septic trouble. Having seen none of these *annoyances* mentioned in reports, he was somewhat astonished.

He had followed with considerable interest the observations made at the Pennsylvania Hospital, but what he had seen had not influenced him to think much better of the treatment. In a number of the cases the patients were made worse. One was a case of papillomatous cyst, afterwards operated on, in which, after talking the matter over, it was decided that there would be great risk in continuing the treatment, as the patient had become so much worse after each of two applications. Another case, the one of pelvic inflammatory trouble, reported in the paper, had, he believed, not been improved up to the present time; and, if anything, was rather worse. One of the gentlemen connected with the clinic told him that he also believed that nothing but the knife would help her. The good results that Dr. Baldy did see, were just such results as he was in the habit of getting by free purgation and other treatment. Patients with a pelvic mass will often, after free purgation, come back so much relieved that they will consider themselves cured, and will refuse operation. This is exactly what he had seen from the use of electricity, and nothing more. In regard to fibroid tumours, one of the cases reported had told him that before the applications of the current she had had no hæmorrhage of any account, and that she had not obtained benefit from the treatment; but that her bleeding had become much worse. Subsequently he believed that she had progressed somewhat better. The diminution in the size of the tumour was so little that he could not determine it by the sight and touch. He was still open to conviction, if he could find anything which would make him think that permanent good could be obtained; but that he wanted more than the mere report of cases—he wanted to see the cases and judge for himself.

Dr. T. M. DRYSDALE had not intended to take part in the discussion, but he could not permit what Dr. Baldy had said to go unchallenged. He had had some experience in this matter, having been working at it pretty steadily for the past three years, and he intended shortly to give his results to the Society. He thought that the great mistake in regard to electricity was, that its advocates have claimed too much for it; but it must be admitted that many of these claims had been proven, and its positive value established, by the results of practice. It is certain, for instance, that in some forms of hæmorrhage from the uterus, there is no other agent that will take its place. He had seen it cure metrorrhagia when ergot, erigeron, local applications of iodine, and in fact everything else, has failed. Again, he had seen large plastic exudations in the pelvis entirely disappear under the use of currents of electricity. He had used it in only four conditions—pain, hæmorrhage, plastic exudations, and uterine fibroids; and experience had taught him that there was a good deal in the manner of application of this powerful agent. He had not adopted all of the methods of Apostoli; for instance, he never punctured a uterine fibroid, believing that the practice is a perilous one, and entirely unnecessary—for without it he had met with at least equal success with those who have used it. In his hands it had proved decidedly successful in the treatment of uterine fibroids, resulting, in many cases, not merely in arresting their growth and checking hæmorrhage, but in their entire cure. One of these cases in which there was a complete disappearance of a uterine fibroid was reported by Professor Skene, at the meeting of the Gynæcological Society at Washington. Six years ago a patient of his removed from Brooklyn to our city, and was sent by him to me. She was suffering from excessive hæmorrhage, the result of a submucous fibroid about the size of a small cocoa-nut, which he removed by enucleation. She afterwards returned to Brooklyn, and had no further trouble until two years ago, when she commenced bleeding again. After being treated by several physicians she came to him. On examination he found a soft, interstitial fibroid tumour, about three inches in diameter. She could not remain in Philadelphia at the time, but in three months she returned, when the tumour was found to be growing rapidly, while she was greatly reduced by repeated hæmorrhages. In October, 1887, the use of electricity was commenced, and in April, 1888, she returned to Brooklyn, and was examined by Professor Skene, who found the tumour had entirely disappeared. He could give

many other instances, but should reserve them for a future paper.

Dr. JOHN B. DEAVER would ask those gentlemen who have been using electricity in the treatment of plastic exudates, whether the *rationale* of the treatment is not the same as in the treatment of urethral stricture by electricity. In his hands this had proven utterly useless. Dr. Keys has written an elaborate paper in which he condemns it, concluding that it is without benefit.

Dr. JOSEPH PRICE thought it would be just as well if everyone would give us their bad results as well as their good. Many have had sad disasters with this method of treatment. He had once seen presented to the New York Obstetrical Society several fibroids which had sloughed out from the cul-de-sac of Douglas. Dr. F. A. Emmet at the time remarked that the good Lord had saved the patients in spite of the treatment. Dr. Baldy has stated what he saw at Apostoli's clinic. When Dr. Massey stated that he had used it from an exploratory and experimental point of view, he nearly struck the key-note of the whole business. He had himself given it a fair trial, but had found it wanting. His experience differed from Dr. Taylor's as regarded gonorrhœal infection. He had found, in almost every case, a gonorrhœal history in the father. In one case, a blind child had met him at the door, and he removed pus-tubes from the mother. The father confessed to having had the disease twice. This case he could duplicate many times, minus the blind child. He valued the bichloride more for the saving of eyes than for the saving of women; it was rare now that he ever had ophthalmia in children. Dr. Baldy had covered the points in regard to the bowel disturbance. In these cases of pelvic exudate—he called them pus-tubes—a saline would often completely relieve them temporarily. A fungoid condition of the uterus is rare. He rarely has to use a curette. The danger of electricity has been dwelt upon by a great number of men throughout the country, and most who have tried it have given it up for some milder application.

Dr. H. A. KELLY said this is a matter of great importance. There is outside the domain of abscesses and big tubes and ovaries a class of cases which still trouble us, and for which the profession has looked with hope for relief from the proper application of

electricity, which has not yet had a fair trial at the hands of gynæcologists. The great claims made by a few men at the outset have not yet been justified, and have been an injury to the whole subject. He had seen some good results, and felt that in a limited number of cases we shall be successful. The caption 'fixation of the uterus' is a convenient one, for it is often the first thing that attracts our attention. There are three ways in which fixation of the uterus is produced. One is by eccentric growth. The enlargement of the uterus itself fixes it in the pelvis. He recently performed abdominal section to determine whether or not a uterus enlarged by cancer was fixed by deposits in the broad ligament or the pelvis. Finding nothing, he closed the wound and removed the uterus by the vagina. The second cause of fixation is the presence of diseased tubes and ovaries; remove these and the uterus is free. Outside of these conditions there are cases of dysmenorrhœa where we are apt to diagnose stenosis or endometritis, in which the mobility of the lower part of the uterus is limited. In these cases he has learned a point which he thinks is one of the most valuable he has yet learned in gynæcology. Digital examination reveals a tenderness on the left side; on pressure there is no marked degree of resistance on the two sides, but we often note the left fornix obliterated or shallow. Determining exactly the nature of the trouble, and proceeding upon a plan of treatment for their cure, he has been able to throw an entirely new light upon such cases. It is to catch hold of the anterior lip of the cervix, draw it down, and then passing the finger behind the uterus, we feel on one side the broad ligament; but on the other side we now feel what we could not feel before—a distinct hard line, either in the broad ligament, the utero-sacral ligament, or both. He then employs massage to stretch this tissue. A patient recently came to him with a uterus thus fixed, and the ovary bound down on the left side. By drawing the uterus down and pressing upon the adhesions they were thus gently torn apart and separated; and by the aid of this treatment the patient has been cured of all distress, and the ovary is mobile. He had treated the case for months before by other methods without relief.

Dr. B. F. Baer said he was glad to hear and see the graphic description given by Dr. Kelly, as it supported the position which he had taken before the Society at the last meeting. Many of these cases are benefited and practically cured by this treatment, used with other remedies. He finds large retroflexed and fixed uteri

more difficult to manage than fixed tubes and ovaries. When it is determined that the tubes are incurably fixed or contain pus, they should be removed. He is a firm believer in the value of hot water as a stimulant to absorption of inflammatory exudate. He has used galvanism, and believes that it is an excellent stimulant to absorption. From what he saw while he was in Europe, he procured a battery of the same pattern as that of Apostoli, and had used it in many cases since his return. He had learned to look upon galvanism as an excellent stimulant, when given in small doses, in cases of exudation; but he questioned whether it was better than hot water, iodine, and massage. It is a powerful and dangerous remedy sometimes, when used in doses large enough to induce electrolysis, especially when puncture is used. Without puncture in large doses great pain is given; and unless the dose is large the process is slow and tedious. He who would hope to get good results from this treatment must use great patience. In a case of interstitial fibroid he had used the positive pole intra-uterine. After the second application the hæmorrhage ceased. He began the dose at eight milliampères and increased it to two hundred. The latter strength caused so much pain and tenesmus, that after a month's treatment, the capsule of the tumour beginning to break down and slough, he stopped it. He then tried to enucleate the tumour, but did not succeed, and the patient died from metritis. His mistake was want of patience in the use of electricity. In similar cases he was using lower strengths and giving more time. The patients are symptomatically improved, but the tumours do not rapidly decrease in size. He had removed by laparotomy a pedunculated fibroid, on which electricity had been faithfully tried by an expert for several months. He thought that the treatment had done more harm than good in this case, as it was subperitoneal and pedunculated. In a tumour of that character, electricity has little or no power, when applied without puncture; and to puncture in that case would have subjected the patient to greater danger than to remove it by laparotomy.

The PRESIDENT.—"I do not agree with that. You get electrolysis from the simple passage of the current, even if there is no puncture.'

Dr. BAER replied that he did not know the meaning of electrolysis if it was not the destruction of organized tissue by resolving it into its elements; and to get this action a higher power than one would be warranted in using must be applied.

There is another class of fibroids in which the curette for the control of the hæmorrhage is more rapid, safer, and just as efficient, if not more so, than electricity, which he would illustrate with a case. The patient complained of great hæmorrhage and pain. Examination revealed a hard, nodular mass connected with the womb. The end of a finger could enter the os, and the cavity was four inches deep. The cervix was dilated, and a large mass of fungoid growth was removed in five minutes. Iodine and carbolic acid were injected into the cavity. She is cured symptomatically, and the tumours are smaller and more mobile.

Dr. Geo. E. Shoemaker thought there was no doubt that the claims made for electricity were exaggerated. However, electricity will contract the capillaries, and lessen the size of any vascular tumour. Anyone can prove this by applying, when he has a coryza, one pole on each side of the nose, and passing a mild current. In a few moments the nose will be free. In the same manner it may temporarily lessen the size of the capillaries in these pelvic cases, and so temporarily diminish congestion.

"Dr. M. Price said that he had only found two forms of fixation of the uterus. One is non-inflammatory, the other bound down by inflammatory bands. It was absolutely useless to tell him that a uterus bound down by adhesions could be replaced. It would be as easy to believe that adherent fingers and toes, resulting from a burn or scald, could be relieved, as that electricity applied to the pelvis could release adhesions of the uterus, when it is all that we can do at times to tear them loose with the finger. In regard to massage, it is absolutely absurd to talk of any patient submitting, who has any decency, to a man fingering her vagina by the week. If there were inflammatory trouble it would do mischief. He had a case where electricity had been used, and where all sorts of applications had been made. He was positive that there was pus. The temperature was 103°.

Dr. Wm. Goodell could not allow the remarks which Dr. Price had just made to go unchallenged. He believed that massage of the fixed womb could be employed with propriety, and without the indecency alleged by Dr. Price. He had, with Dr. Taylor, treated a case in which a pelvic inflammation had been set up by treatment at the hands of an irregular practitioner. She almost died, but finally

recovered, with the roof of the pelvis feeling like a hard board. The womb was enlarged, and absolutely immovable. She had menorrhagia and constant pain. He began treatment by application of a mixture of carbolic acid, iodine, and chloral, and by using uterine massage. In doing this, one simply passes one or two fingers behind the womb, and catching it from above with the other hand, rocks it from side to side and backwards and forwards, stretching the adhesions, and separating them if possible. Dr. Taylor administered electricity locally. To-day she is in rude health. The discussion in regard to electricity reminded him of the old story of two knights approaching an image from opposite directions. The one insisted that it was gold, and the other that it was silver. From words they came to blows, and in their death-struggle they looked up and saw that the image had two sides to it, the one gold, the other silver. He thought this subject also had two sides to it. He had closely watched the growth of electricity, and had always felt that there were remedial virtues in the agent which would be developed. Yet while he believed that we could get a great deal of good from it, he did not believe that it would cure pus tubes or suppurating ovaries; neither does he believe it will remove organized adhesions, although he felt sure that it would cause the absorption of recently deposited lymph which is not organized. He knew from unquestionable facts that in fibroid tumours in which hæmorrhage is a prominent symptom, electricity is an admirable agent, but he was not ready to accept the statement that it will reduce the size of fibroid tumours, either permanently or without subjecting the patient to more risk than the operation of oöphorectomy. He knew of one of his friends who has had two deaths; another has had one if not more deaths; a third applied electricity to the womb of a lady in his office, and she died of inflammation a few days later. A fourth friend met with the same disaster, although he is an authority on electricity. On the other hand, he knew of the wife of a physician who had been treated in various ways, without benefit, for hæmorrhage coming from a fibroid tumour. The curette, however, had not been used. Three applications of electricity cured her. Her husband assured him that he had two or three other patients cured in the same way of hæmorrhage. He thinks that in fibroid tumours, when a current of from one hundred and fifty to two hundred milliampères is applied, we shall be likely to obtain the result which occurred in a case lately reported in the *American Journal of Obstetrics*; viz. an opening into the capsule of the tumour, and the

slow delivery of the latter by the vagina. If we decide to enucleate by vagina, it is far safer to incise the capsule, and remove the fibroid at one sitting. Such treatment prevents necrosis and its attendant dangers. He thinks there is a great future before electricity, especially in those cases in which operative procedures should not be resorted to, and in cases of recent pelvic exudates.

Dr. M. PRICE said that Dr. Goodell started out with a very pretty case indeed. The pelvic abscess was evacuated, and all that was risking her life was removed. Unless there was multiple abscess, the woman was safe after this discharge. Some years ago he had two cases of rupture of the abscess, one through the bowel and the other through the vagina. Both of these women are as healthy as any in this city, and neither electricity nor massage was used on them.

Dr. J. M. BALDY did not mean to deny that electricity would relieve pain and hæmorrhage in vascular tumour. Electricity is, however, a dangerous remedy used indiscriminately and in large doses, where we do not know the exact condition of affairs. The diagnosis in all abdominal troubles is obscure, and most so in pelvic growths. He considered that in hæmorrhage and pain we had safer remedies than electricity, and could accomplish just as much with them with much less risk. He realized that in fibroid tumour electricity will diminish the size, but he thinks that a study of the cases show that the effect is only temporary. The growth of the tumour could be stopped as well by other means as by electricity. It is the height of absurdity to talk of electricity removing organized adhesions without removing the patient also. In regard to the treatment of massage. If he attempted to so treat such a case as Dr. Kelly had so beautifully pictured on the board, and as had been talked of by other gentlemen, he would not say it would be indecent, but he was positive that he would lose the case; it would surely leave him and go to one of his fellow-practitioners. In such cases the patient will hardly permit of the necessary manipulation incident to an examination on account of the pain produced, and she would never tolerate for one moment such procedures as had been advocated. He did not believe that such treatment was at all feasible.

Dr. J. PRICE said that, in regard to the mortality, Dr. Chadwick,

of Boston, says that he has had two fatal cases out of eighteen, and that he has given up its use. With thirty-one hysterectomies in Tait's experience and no deaths, and thirty-eight in Keith's with three deaths, we see that the mortality following electricity has been greater than that of hysterectomy in the hands of such men as Tait, Keith, Bantock, Thornton, and others. He had had a case similar to the one of Dr. Goodell's. The pus was evacuated. He did not attempt to release the fixed uterus. The woman is now pregnant.

Dr. TAYLOR said that his experience had been chiefly with pelvic deposits. He had used electricity very little in anteflexion. In these cases rapid dilatation has relieved the trouble in a shorter time. In menorrhagia, or metrorrhagia, the curette answers the purpose sufficiently well, and in 70 per cent. of the cases it relieves the trouble. In regard to gonorrhœa, he would simply state that he did not deny that it may be a cause of pelvic trouble. He was very glad to hear of Dr. Drysdale's success in the treatment of fibroids, but he did not think we did conceive of an electrolytic action sufficiently extensive to cause breaking down of a fibroid unless there was an electro-puncture.

Dr. T. H. BRADFORD said that if Dr. Baldy had seen the cases to which he had referred at a later period, he would have found that they had been benefited. The case of papilloma of the right broad ligament was one which nothing but operation could relieve. He was satisfied that great good could be done in some of these cases by the use of electricity. The result so far obtained has been satisfactory. Out of eleven cases there have been several cures, and all have been benefited. He would continue to use this remedy, and would, at a later period, give the Society the results.

I have been working with Apostoli since last October; and, with four exceptions, I have never seen a woman complain of unbearable pain, and I never saw one "writhe or squirm," as figured by Dr. Baldy. I never saw a slough or unsightly wound. I submitted Dr. Baldy's comments to Dr. Smith (U.S.N.), Drs. Van Pelt, Hall, Bunts, Johnston and Matos, all of whom expressed great surprise that he should have had an experience so entirely different from that which has fallen to the lot of other medical gentlemen who have been constant attendants upon this clinic. However, the work

needs no defence. It has passed beyond the limits of experimentation. Its literature is as full and satisfactory as that of any branch of surgery or medicine. Its results cannot be gainsaid. I do not believe that Keith, or Sir Spencer Wells, or Webb, or Playfair, saw the sights at Apostoli's clinic which Dr. Baldy mentions. If such were the case, they certainly would not practise the method. The work is going on with great enthusiasm, and even the giants may not arrest its progress. From a letter written in October or November, 1888, by Dr. Baldy to Dr. Apostoli, I gather that he only visited the clinic once or twice, so that, of course, his judgment is hasty and unreliable.

Dr. Bunts, of Cleveland, Ohio, has kindly given me the history of a case of membranous dysmenorrhœa treated by him: "Mrs. J., age 26, mother of five children, had suffered since her last confinement (twins) with most excruciatingly painful membranous dysmenorrhœa for about seven months, each month passing an almost perfect membrane. She had been treated continually by the various ordinary methods during that time; but without a particle of relief. When she came under my care I decided to try the effect of electricity, and to that end gave her two intra-uterine treatments weekly, for six weeks. At the end of the first two weeks she brought me a fine, large membrane which she had passed. As soon as her menstruation had ceased I began treatment again, and continued it until her next period, through which she passed with very little pain and no membrane. It is now more than a year since my treatment, and she has had no return of the trouble. The intra-uterine electrode was connected with the negative pole of a continued current, varying from forty to sixty milliampères; the abdominal plate consisted of folds of moistened lint covered with a flexible copper plate. The sittings lasted from six to ten minutes. She bore the treatment well, complaining only of a considerable 'discharge' for several days after the treatment."

On February 11th, 1888, Dr. Apostoli presented to the Medical Society of Paris a patient successfully treated by him for hydrosalpingitis. The history of the case is, in brief, this:

Madame Tresse, married, 25 years old, living at 12, Rue de Metz, Paris; came to the clinic October 22nd, 1887.

Antecedent History.—No hereditary disease. Menstruated at twelve. Dysmenorrhœa always. Three normal labours at 21, 22, and 22½ years; one miscarriage; July 7th, 1887. Twenty days after, fell on her back. Metrorrhagia and violent pain followed,

most in abdomen and right side. Began to grow thin and weak, and could not work.

Actual Condition, October 22nd, 1887.—Small woman, very pale, walks with difficulty, complains of acute pain in right iliac fossa. Skin hot and has chills.

Local Examination.—Excessive sensibility over both iliac fossæ—more pronounced in right side. Cul-de-sacs, except the anterior, painful upon pressure. Right cul-de-sac shortened, with very perceptible resistance. Very painful. Fluctuation easily made out. Shape and feel like a hen's egg. On left side, no fluctuation, and symptoms not so pronounced.

Diagnosis.—Double salpingitis—suppurating or cystic; inflammation on left side; commencing pelvic peritonitis.

October 27th, 1887.—First galvano-puncture, vaginal, negative, over the most prominent part of the swelling, under chloroform and full antisepsis. Puncture made on left side with a small trocar, entering one centimètre; one hundred milliampères—five minutes. No hæmorrhage. Patient remained two days in bed at the clinic. During this time the temperature was from 38·5° to 39°. This chloroform delirium alternated with a quieter state of mind. On October 28th she slept well, and on the following morning was much better. October 29th she got up, for local examination, and walked without difficulty. Pressure provoked much less pain, and even deep pressure was not unbearable. Great amelioration of left side, but right side remains the same. She walked home, a long distance, and in consequence had a bad night. The pain seemed to be entirely in the right side. On the 31st she walked to the clinic, saying she felt better and had less pain.

November 8th.—Second galvano-puncture, vaginal, negative in middle of right cul-de-sac. Trocar inserted to a depth of half-centimètre; one hundred and forty milliampères, five minutes; chloroform. Two days in bed at the clinic. Complained occasionally of sharp pains in the right side, which went away shortly after. Vaginal tampon dry and unstained. No sensibility upon pressure, no swelling. November 10th.—Much against our wish, she returned in carriage to her home, and was much jolted on the way. Went immediately to bed, completely exhausted. While quiet in bed, she suddenly felt a *discharge* of a *clear, transparent* liquid like water, which ran painlessly from the vagina. It had no trace of blood. The pains ceased at once, she slept well, and the next morning felt very comfortable November 12th.—She

seems physically transformed, has an excellent colour and good appetite. Entire disappearance of tenderness from both cul-de-sacs. The swelling in the right side is diminished to a small, painless, rather hard mass, close to the uterus. Left side presents the same anatomical changes. Two dessert-spoonsful of a transparent inodorous liquid were wrung out of the tampon. There was no doubt that on the right side there had been a cystic condition of the tube, and upon the left side there was simply inflammation and no cyst. November 15th, 17th, 24th, and 29th.—Rapidly improving. December 3rd.—All symptoms disappearing. On December 7th, 1888, patient presented no lesions to rectal or vaginal touch.

Dr. Apostoli gives very full and elaborate anatomical details of the various examinations, which I cannot reproduce here. From this case Dr. Apostoli drew the following conclusions :—

1. Fever and inflammation are not contra-indications, necessarily so, in gynæcology, for the intelligent application of the galvanic current.

2. Non-suppurating inflammation of the adnexa can be satisfactorily treated by the galvanic current during the first stages of congestion, but not if the case be one of suppuration, except in the case where the electric cautery serves to create for the tube an issue in the neighbourhood of the vaginal wall, more suitable.

3. This galvano-caustic penetration serves a double purpose : (i) It arrests the evolution of the inflammatory process ; (ii) allows easy and free evacuation of the liquid.

4. All galvano-caustic punctures of exudates in the vaginal cul-de-sac (with the exceptions that I shall give later) are justifiable.

5. In salpingitis and hydro-salpinx this process is efficacious and free from danger, especially if the tumour and vaginal wall are closely juxtaposed.

6. Antiseptic precautions, the seat and depth of puncture, are factors of observance of the greatest importance.

7. Two punctures are sufficient in cases such as the foregoing.

I would call especial attention to the paper of Dr. La Torre upon Apostoli's methods in uterine fibroids, already cited in the Preface; the reflections are worth reading. Also to a paper read by Dr. Apostoli, April 3rd, 1888, before the Academy of Medicine, Paris : "Sur Galvanisation en Gynécologie." The paper of Dr. Deletang, of Nantes, is also a most important contribution to the subject, since it covèrs details of so many cases. I cannot, of course, reproduce

them, as it would swell this book to an undue size; but he who will can obtain the literature, and he would do well to read and weigh it before pronouncing a judgment. In an article written for the *Lancet*, December 22nd, 1888, "Apostoli and his Work," I expressed my views upon the ethics of any argument of scientific value. Personal equations must be lost sight of; good, for good's sake, and not for the reputation of the individual, should be the guiding-star. It matters little whether the originator of the idea receives the attention that of right belongs to him, provided the idea lives for the comfort of humanity. As members of a corporate body we share equally the glory that attaches itself to any professional brother who achieves something for the perpetual benefit of the species. I commend the conservative remarks and the just deductions of a mighty man among surgeons, of one who, like Bayard, is *sans peur et sans reproche*—Dr. Goodell, in his discussion of Dr. Bradford's paper—to all fair-minded people. He is perfectly right in the matter of pus tubes. As yet we cannot handle them well. Old adhesions, however, *are* satisfactorily treated by galvanism. I do not understand how so many bad results occur in the practices of other gentlemen when nothing of the kind ever happens here. It must be that the cases are not properly selected, or the applications are not properly made. I have seen so many tumours reduced in size by electricity that I must, of course, accept the evidence of my eyes.

Augustus H. Goelet, M.D., writes ("Electrolysis in Gynæcology," *North Carolina Medical Journal*, 1888): "*Conservatism is gaining ground, and the fashion of laparotomy has seen its best days.*"

Professor E. Nœggerath, M.D., Wiesbaden, in his paper on the theory and practice of electric treatment of uterine fibroids, which appeared in the *Berlin Klinische Wochenschrift*, No. 8, 1889, under the title of "Zur Theorie und Praxis der Elektrischen Behandlung der Fibroide des Uterus," says:—If we now consider that Apostoli himself has published a monograph on the treatment of chronic metritis by electricity, we shall at once admit that the controversy is at an end. I may add, moreover, that in the course of the three weeks of my stay in Paris, in September 1888, I had an opportunity of satisfying myself that Apostoli's skill and experience are amply sufficient to enable him to discriminate between chronic inflammation of the womb and cases of fibroid. No doubt with him, as with every one of us, it may happen that in a difficult case he may mistake the

actual location and position of things; yet as his diagnosis always proceeds *coram publico*, while medical men in attendance can not only check his conclusions, but are invited to express an opinion, the risk of error is reduced to an infinitesimal minimum. Among the large number of cases presented for examination, I found only one that gave rise to a difference of opinion. This was a case of very considerable hypertrophy of the uterus, with marked anteflexion. When, after reducing the bend with a sound, the diagnosis of a fibroid was excluded, Apostoli at once showed his willingness to pronounce it a case of metritis. Let me here emphatically declare that, though an enthusiast, Apostoli is a reliable, impartial observer and explorer, deserving our implicit confidence."

Dr. Laphorn Smith, of Montreal, in the *American Journal of Obstetrics* for June 1888, writes: "Electricity, especially in its faradic form, is the rationally indicated remedy in all forms of displacement."

In the August number of the *American Journal of Obstetrics*, 1888, Dr. Mary Putnam Jacobi cites a case of a uterine intramural fibroid which had been forced out of the uterine cavity, and was extruded *per vias naturales*.

Sir Spencer Wells, in the *Medical Record* of June 9th, 1888, says: "Dr. Apostoli explained to me his views, and demonstrated his mode of procedure. He threw open the records of his daily practice, and gave me the opportunity of verifying his diagnosis, and witnessing his treatment of the cases actually under his care. Besides this, he mustered for my inspection about sixty of the patients who had passed through his hands. I heard many of their histories in their own words, and could contrast for myself their actual condition of good health and activity with the symptoms reported in the early notes of their attendance, etc., etc. I spent many laborious hours in what, I may say, was a rigidly sceptical examination of the evidence before me, seeking for weak points in the system, and the resolution of theoretical objections. . . . The conviction was irresistible, that, though the method might not have reached its point of perfection, the work so far as it went, was good."

Dr. J. R. Buist has an article of peculiar interest in the March number (1889) of this same journal: "A Review of the Treatment

of Uterine Diseases by Electricity," from which I culled the preceding extract. One of the most valuable articles on this subject which has ever been written is the prize essay of Dr. A. H. Buckmaster, "The Galvanic Treatment of Fibro-Myomata," published in the *Brookiyn Medical Journal*, November and December, 1888. Under the subdivision, "How does Galvanism affect the Fibroid?" Dr. Buckmaster says: "The use of the term electrolysis, as applied to the form of treatment considered in this essay, has been avoided because, when used as a distinctive application, it is misleading. There is no more justification for the term as applied to the treatment of fibroid tumours, than there is for the use of the expression for the application of the galvanic current for the relief of a sciatica. Electricity is conducted by the metals, and only such fluids as it can decompose. The tissues of the body only become conductors when fluid is present. The decomposition that takes place at the poles, and the changes that occur between them, are those of atomic rearrangement. For example, if a current is applied to decompose a certain amount of water, as represented by—$H_2^{I}O^{i}$, $H_2^{II}O^{II}$, $H_2^{III}O^{III}$, $H^{IV}O^{IV}$ +, the first molecule is decomposed, the H^{I} going off as a gas to the negative pole. Molecule H_2O^{IV} is also decomposed, the O^{IV} passing off as a gas at the positive pole; this would necessitate an entire rearrangement, so that the following condition would be present: H^{I} free and $—H_2^{II}O^{I}$, $H_2^{III}O^{ii}$, $H_2^{IV}O^{III}$ + free O^{IV}. This change would continually take place until all the water had become decomposed. It makes no difference whether the molecule be a simple one like water, or a complicated organic combination. This rearrangement is, as far as we know, the only chemical change that takes place; so that the term electrolysis, used to indicate some peculiar disintegration that is not always present, is clearly misapplied; electrolysis occurs whenever a current is used. In attempting to answer the question of how galvanism affects fibroids, writers have indulged in idle speculations rather than attempted experimental research. The riddle is no easy one to solve, for the tumours vary, not only in position, form, and blood supply, but differ widely as to their constituent parts. They differ not only among themselves, but the same fibroid presents marked differences at different times. During the menstrual period they may be enlarged and soft, and when it is past, relapse into their former hard condition. They often enlarge very markedly during pregnancy, and disappear as the uterus undergoes involution, as has been observed by Emmet, Lorain, Pagan, and Hanks. They disappear at times, without any

known reason, even in young women; but this is of so rare an occurrence that it need scarcely be considered when dealing with statistics of their treatment. . . . Prof. Playfair says that the 'action of the negative galvanic current in electrolysis is probably simply that of a strong stimulus to absorption.' The nutrition of a fibroid may be affected in one of several ways, or by all of them combined.

"1st. By affecting the blood-vessels and absorbents.

"2nd. By affecting the muscular tissue.

"3rd. By affecting the nerves.

"4th. By affecting the connective tissues.

"5th. By affecting the cells directly.

"That the blood-vessels and absorbents play an important *rôle* several facts abundantly attest. . . . The effect of a current of fifty milliampères can be well studied by passing it through a portion of bared intestine of a living animal. The tissue between the poles becomes blanched, and continues in this condition for some time after the current is broken. I have observed this several times, and there is undoubtedly an intense contraction of the vessels. Another important effect of the current is its cataphoric action. This takes place during the passage of an electric current through a porous body. The fluids are transferred toward the negative pole, about which they accumulate. This can be nicely seen in the above-mentioned experiment, where the tissue about the negative pole bulges up from its excess of fluid. The activity of the cataphoric action is much greater with stronger currents, and with more poorly conducting mediums. (Erb.). . . . If a muscle through which the blood is circulating be exposed to the action of heat at 118° F., to distilled water, to acids, even of the weaker kind, such as carbonic acid, to various chemical bodies, and the effects of freezing and thawing, it passes into a state known as *rigor mortis*. In this condition it is devoid of irritability. It is strongly contracted in the direction of its length, and is less elastic; it has a whitish, curdled appearance, and an acid reaction. The previously transparent muscle tubes appear opaque and flocculent, and their contents solid. The essential process in rigor is a contraction of the contents of the muscle tubes whereby they become solid. The analogy between rigor and the active state is very close, and it has been assumed that coagulation does take place when a muscle is in motion, and that the product is rapidly disposed of, or that perhaps the myosin is generated with such rapidity that it has not time to pass at once into the state

of gelatinous solution, but enters for a moment into the undissolved condition which does not appear under slower decomposition until considerable concentration (Gamgee). Recognising the fact that *rigor mortis* can occur in muscular tissue while the circulation is maintained, the writer desired to ascertain if this condition was brought about by very strong galvanic currents. A dog was thoroughly anæsthetised, and a current of seventy-five milliampères passed through the wall of the left ventricle, one electrode being placed in contact with the diaphragm and the other over, and in contact with the pericardium. A piece of the muscle that was in a direct line with the current was excised, and a fresh section prepared. Another section of the ventricle, outside of the direct line of current, was also prepared in the same manner, and they were compared and the following differences noted: In the section affected by the current the transverse striæ were much less distinct than in the other section, seeming granular, and the tube seemed much more opaque. The fibres were also less regular. The tendency of this experiment is toward the fact that there is a direct effect on the muscle cells with the seventy-five milliampère current. Whether this change be due to *rigor mortis* remains to be seen."

Under the caption "Historical References," Dr. Buckmaster says: "For this we are indebted to the indefatigable industry and ingenuity of Dr. G. Apostoli, of Paris, for some years a surgeon in the French army; and his attention was directed to the subject of electrical therapeusis by Dr. Tripier. In 1884 he presented a memoir to the Academy of Medicine, giving an account of his manner of treatment. He revolutionised the matter, or, rather, he infused into it new life by two things: one was the use of the galvanometer, so that the current strength could be accurately measured, and the other was to so diffuse the current over the abdomen, by means of a broad electrode of clay, that the patients were able to bear very powerful currents without puncture. He also made use of a platinum electrode in the uterus. He placed the method on a scientific basis, and it would be much more reasonable to call it Apostoli's Method than the treatment of fibroids by electrolysis, which is a very misleading application of the term."

In conclusion, I quote from a very remarkable article by Thomas Keith, M.D., LL.D., in the *British Medical Journal*, June 8th, 1889:—

"What I now plead for is, that for a time all bloody operations

for the treatment of uterine fibroids should cease, and that Dr. Apostoli's treatment, as practised by him, should have a fair trial. Those who have hitherto most resisted the introduction of electricity are the surgeons who are the best competent to carry it out. They are accustomed to manipulate in the pelvis, and they will not make mistakes of diagnosis, or make them as seldom as it is possible to do. Hysterectomy, remember, which is performed every day for a complaint that rarely of itself shortens life, kills every fourth or fifth woman who is subjected to it. This mortality must cease; it is not a question of surgery, it is a question of humanity. Every time that any disease can be cured without resorting to a bloody and dangerous operation, such as hysterectomy, progress is made in our art, and there is a gain to humanity, while surgery is the better for being purged of a deadly operation. Even the fact that in my cases of hysterectomy the removal of the uterus and ovaries was sooner or later followed by insanity in 10 per cent. of the whole number is enough for me to condemn any operation that removes these organs.

"It may seem strange to some, that after the results I got in hysterectomy—results that almost made it justifiable—I should now begin to throw stones at the operation instead of trying still farther to improve upon it; and but for Dr. Apostoli, I should now be doing so. I would give something to have back again those sixty-four women that I did hysterectomy for, that I might have a trial of Dr. Apostoli's treatment upon them; and I would give something never to have had the tear and wear of flesh and spirit that these operations cost me, for in scarcely one of them was the operation simple.

"I have, in the meantime, said my say, and it must not be forgotten that the opinion here expressed as to the value of Dr. Apostoli's treatment is not that of an unsuccessful surgeon, but is the deliberate opinion of one who was the first to lower to a minimum the mortality that so long followed abdominal surgery, and who, by the best results yet obtained in hysterectomy—results that Dr. Playfair is pleased to call almost phenomenal—still retains the position."

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