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OF

OBSTETRICS AND GYNECOLOGY

VOLUME FIVE

GYNECOLOGICAL DIAGNOSIS

GENERAL

GYNECOLOGICAL THERAPEUSIS

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*** ELECTRICITY

IN

GYNECOLOGY AND OBSTETRICS

BY

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OBSTETRIC SURGEON TO THE NEW YORK MATERNITY HOSPITAL.

WITH ONE HUNDRED AND SIXTY FINE WOOD-ENGRAVINGS.

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CHAPTER I.

GENERAL CONSIDERATIONS AND DESCRIPTION OF APPARATUS.

UNTIL quite recently electricity has been used in the treatment of the diseases of women only after a spasmodic fashion, so to speak, and only by a few gynecologists, the majority not resorting to it at all, largely on the score of the preconceived notion that it was not of much benefit. A glance at any one of the standard treatises on the diseases of women proves how little the worth of this agent has been appreciated, for where reference is made to it at all it is largely for the purpose of summarily dismissing it in favor of other therapeutic methods apparently more active and necessitating the expenditure of less time. Doubtless, also, many gynecologists have been deterred from the use of electricity owing to the belief that its application necessitated a thorough knowledge of the physics of the agent, and for this study they have neither had the time nor the inclination. We believe, however, that, given a knowledge of the first principles of electrical phenomena, the practitioner is in a position to use the agent intelligently and to obtain good results, although we would not be understood as underestimating the value of closer study in leading to more scientific application.

French observers have contributed much of value to the subject of the electro-therapeutics of the female sexual organs. Tripier has intelligently worked in this direction, and in particular Apostoli of Paris, to whom indeed belongs much of the credit for laying the foundation of what may be termed with justice new methods of applying electricity to the female sexual organs, methods which promise to prove valuable adjuncts to our routine measures of treatment of many of the inflammatory and non-inflammatory diseases of women. German and English writers on gynecology are as yet content to leave electricity largely unnoticed, but in this country numerous observers are beginning to report their results, and many a quiet worker is satisfying himself that there is value

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in what has been so long neglected, the full measure of which the near future will with certainty determine. The time is not ripe as yet for great enthusiasm; the road is only being marked out; much of the old will have to be thrown aside, and much rather startling in its novelty will have to be accepted; but, if we mistake not the signs of the time, the scientific use of electricity is going to curtail to a considerable extent the sphere of usefulness of many an agent, such as the intra-uterine applicator for instance, and abdominal section in case of certain inflammatory affections of the pelvic organs will grow as markedly infrequent in the future as it has rather alarmingly increased in the past.

In order to attain this end or even to approximate it, it is essential that the gynecologist shall approach the study of electricity from a far different route from that followed by the neurologist. The latter resorts to electricity for diagnostic and for prognostic as well as for therapeutic purposes. He deals mainly with the effect of the agent on nerves and with the reaction of muscle. In his hands the fluid is ordinarily disseminated over wide tracts and surfaces. His electrical tests must be delicate even as is the tissue with which he is chiefly occupied. He must work indirectly, so to speak, in order to reach the organs he would treat, and he must above all avoid strong currents in the instances in which the relatively sound nerve tissue is at all implicated. The gynecologist, on the other hand, does not resort to electricity for the formation of his diagnosis. It is not with him a question of the determination of nerve force or of muscle reaction. The organs which he aims at subjecting to the electric current are closely grouped together in the pelvis, and it is here that the current is localized. He deals chiefly with perverted local nutrition, with local congestion or its consequences. His knowledge, hence, of the physics of electricity need not be so exhaustive as that of the neurologist. Sufficient for him if he knows the peculiar properties of the forms of electricity at his disposal, if he constantly bears in mind the different action of the poles, and then, having made his diagnosis, all that is necessary is the intelligent application of the special property which in the given case seems called for. In short, if he wishes to stimulate, to congest, he must know which current and which pole will do this, and similarly where he aims at sedation, absorption, cauterization, or local anesthesiation.

Although we are simply on the verge of the development of a new era

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in the application of electricity to the diseases of women, and although the possibilities in this direction cannot as yet be distinctly formulated, still the elementary principles on which this application depends are established, and the aim in the following pages is to tersely state these principles, and to point out their application to the diseases of women. Knowledge of these principles is essential in order that electricity when it is used at all may be used with proper understanding, and not blindly and with disappointment as has been the case in the past, and is still largely so to-day in the hands of many who occasionally endeavor to reinforce time-honored routine methods by electricity.

The contributions to the special electro-therapeutics of the diseases of women are largely scattered in medical journals and in special monographs. While endeavoring to do justice to all it is but fair to state that in the elaboration of these pages we have in particular utilized the writings of Apostoli, of Paris, and of Engelmann, of St. Louis, who may fairly claim to be the pioneers in the direction of systematizing the rational use of electricity in the diseases of women, and who, above all, teach us the extent to which it is justifiable to utilize the incalculable power of the agent when localized in the pelvis, and yet not inflict damage on our patients. Our purpose, then, is to gather our knowledge within a convenient compass, stating such deductions as appear at present justifiable without attempt at dogmatism, for the time is hardly ripe as yet for positive statement except in connection with certain conditions, and enthusiasm must still be greatly tempered. The obtainable results are sometimes, true enough, little short of marvellous, but again, as yet, they are often disappointing.

It must be apparent to every gynecologist, and to the general practitioner in the habit of treating the diseases of the female pelvic organs, that our routine methods are often slow in action, are frequently nugatory as regards cure, and, exceptionally true enough where requisite precautions are taken, carry with them considerable risk to the patient. The tendency of to-day, indeed, is to limit the sphere of applicability of many of these methods, in particular applications to the interior of the uterus, and purely vaginal medication is in the hands of many being largely substituted. By vaginal medication is understood chiefly the use of the dry or wet tampon, the aim of which is, ordinarily, the relief of pelvic congestion, and the equalization of the peri- and the uterine circulation,

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both of which aims are accomplished mainly through the support given to the uterus and its adnexa. Support by the tampon, depletion by glycerin, improvement of nutrition by one or another agent applied to the vaginal vault, such are the routine non-surgical methods favored to-day by many of the leaders in the specialty. There can be no question but that the intra-uterine applicator and the pessary are far less frequently resorted to than was the case only a few years ago, and the reason is that in the hands of many these agents very often disappoint well-grounded expectations, even as they frequently fall far short of effecting a cure. What we seek is an adjuvant method which will yield speedier results and more permanent if not always lasting ones; and the wonder is that, in view of the favorable data derivable from a study of what electricity accomplishes in other departments of medicine, this agent has not, until quite recent date, begun to be systematically used in gynecology. It improves nutrition elsewhere, it stimulates, it allays pain, it causes absorption in other regions of the body, and it surely hence would not be irrational to claim these same properties for it when applied to the pelvic organs, even if the experience of as yet only a limited number of observers had not amply proved the vast superiority of this agent alone or when associated with routine methods over these methods apart from resort to electricity. The teachings of Tripier, Apostoli, Mundé, Engelmann, and others, are gradually gaining acceptance, and the day is not far distant when electricity will become a very prominent factor in the relief and the cure of morbid changes in the female sexual organs. A vast advance has already been made towards the attainment of more general recognition of the value of this agent in routine gynecological practice, since it has been proved that its intelligent and satisfactory use requires scarcely more time than many of our routine methods, for thereby an often-expressed objection has been overthrown. Assuming then, and in this we are to-day justified, that electricity, as applied to the female sexual organs, is safe, easy of application, painless practically, and often curative, its general acceptance can no longer be deferred. Every gynecologist must learn how to use the agent in accordance with the developing methods of the present, if he would not be left far behind in the race for successful results.

The varieties of electricity of value in the routine treatment of the diseases of the female genital organs are the galvanic and the faradic, and

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these varieties with the essential apparatus we will describe in turn with sufficient explicitness, we trust, to enable the reader unfamiliar with electrical appliances and properties to understandingly utilize them in his practice. For exhaustive detail and theoretical amplification we are forced to refer to works which treat of the physics of the subject. Static electricity we will not refer to, since we are considering purely routine local methods which come within the sphere of the gynecologist, and since, furthermore, however valuable this variety of electricity be to the neurologist, data in regard to its value in the diseases of women are not at our disposal.

The gynecologist should possess the following apparatus: A galvanic battery, a milliampèremeter, a faradic battery, a set of electrodes for external and internal applications, a rheostat.

Galvanism.

The galvanic battery is the source of a chemical, continuous current, and the properties of this current are very different from that furnished by the faradic battery. The current results from the immersion of two dissimilar metals in some solution which will decompose them. One of the metal plates is more readily affected than the other, and when the plates are connected together the current starts from the affected plate towards the one least affected. This latter plate receives the electricity and gives it off, whence its external extremity is known as the positive pole, the external extremity of the other plate to which the current returns being called the negative pole. The effect of the current received from one or the other of these poles is markedly different, and on the thorough appreciation of these differences will depend the therapeutic results obtained from the use of the galvanic current. The characteristics of these poles may be expressed as follows: The *negative pole* is more active than the positive, the chemical effect being greater; it is the painful, irritating, caustic pole, and its tendency is to destroy, to produce hemorrhage. The *positive pole* is anesthetic, the least painful, causes absorption and tends to check hemorrhage. Apostoli has shown that the cicatrix formed by the positive pole is essentially different from that formed by the negative. From the former we have "a hard, retractile," from the latter "a soft, non-retractile" cicatrix, and these differences in caustic

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action may, as we will see, be used to great advantages in certain morbid conditions of the female genitals.

It is not *per se* a very essential matter as to what special form or make of galvanic battery the gynecologist possesses. This is a matter which will depend on the taste and the means of the individual. It is, however, of prime importance to own a battery containing an ample number of elements for routine purposes, and it is wise to select a cell which will require the least possible attention. The batteries which we figure are those with which we are personally familiar, and the implication is not

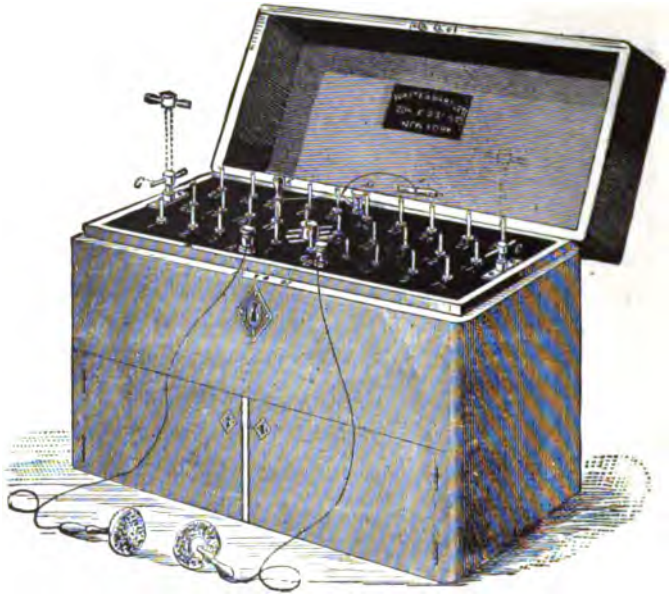

FIG. 1.—PORTABLE GALVANIC BATTERY.

that they are superior to those of other manufacturers. It is desirable to have at least thirty-six to forty cells at one's command, especially when the generating fluid is of the kind which requires frequent renewal, and where the cell is not sealed, and therefore where there is constant loss by evaporation. Individual taste may be consulted as to whether the battery shall be portable or stationary, although where electricity is used in routine daily practice it is, for obvious reasons, advisable to possess both forms. In the stationary battery the elements may be either enclosed in a case or cabinet, or else, where in particular the Leclanché cells are used, they may be placed in the cellar or closet and thence connected with a

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key-board on the office wall. Many of the stationary batteries furnish both the galvanic and faradic currents, and are so arranged that the galvanic may be readily interrupted, thus placing at our disposal the galvano-faradic current. Obviously it is advantageous to possess a combination battery provided only that the faradic elements are independent of the galvanic. Every battery is furnished with a current selector which enables us to bring as many of the elements as is desired into the circuit.

FIG. 2.—STATIONARY BATTERY.

Whatever the form of battery it should be carefully attended to in order that the connections be kept clean and the instrument not damaged by dust or moisture, otherwise the instrument will fail in what is required of it and there will be inevitable disappointment in the obtained results.

Beyond these general remarks we do not deem it necessary to speak about the elementary principles which underlie the use of the battery. The manner of making connections, of immersing the elements, of filling the cells, etc., are points which can best be learned practically and must

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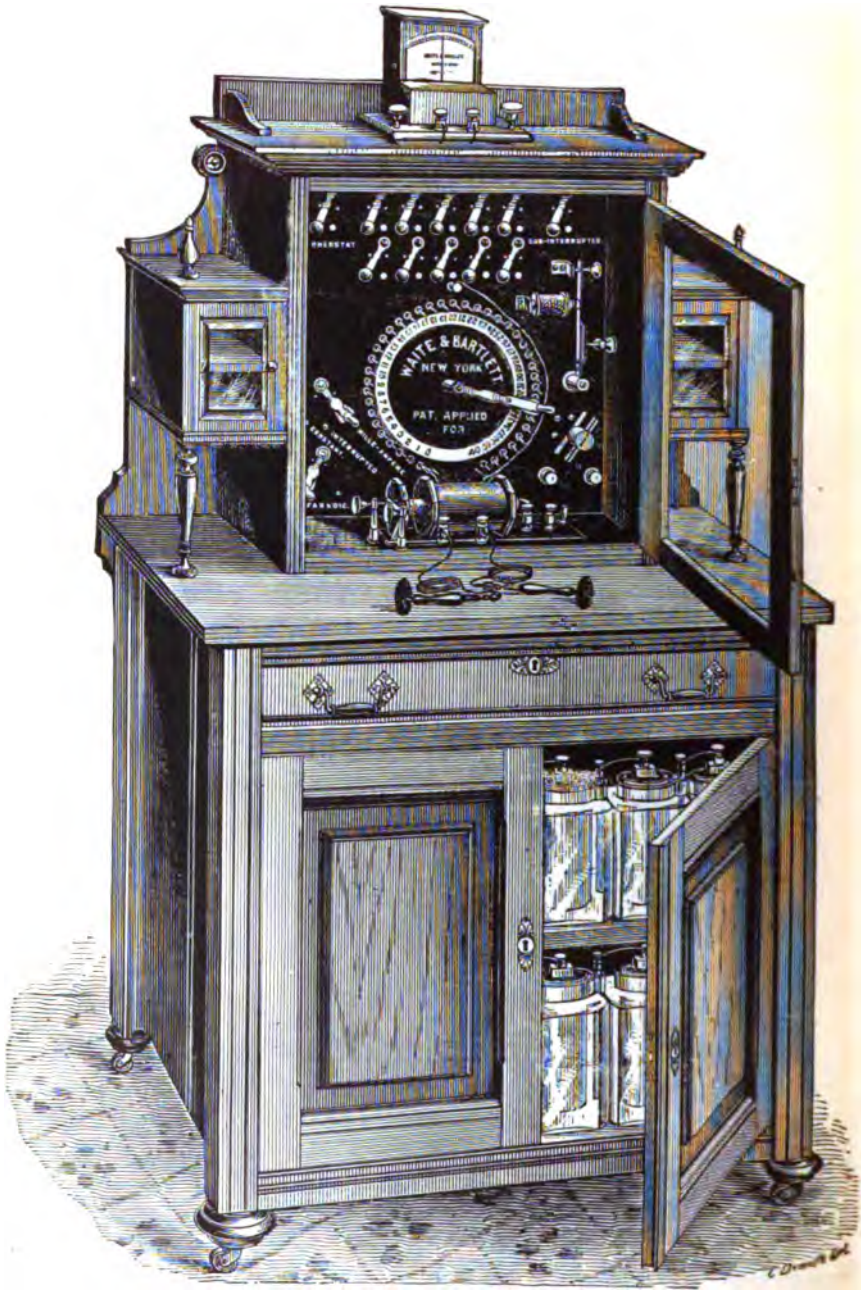

FIG. 8.—CABINET BATTERY.

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be so learned before the force generated can be used intelligently. The gynecologist must know his battery and how to use it and not misuse it, even as the engineer must know his engine in order to obtain the requisite speed without injury to the source. A very essential point, on which we would lay renewed stress, is the strict necessity of recognizing and of

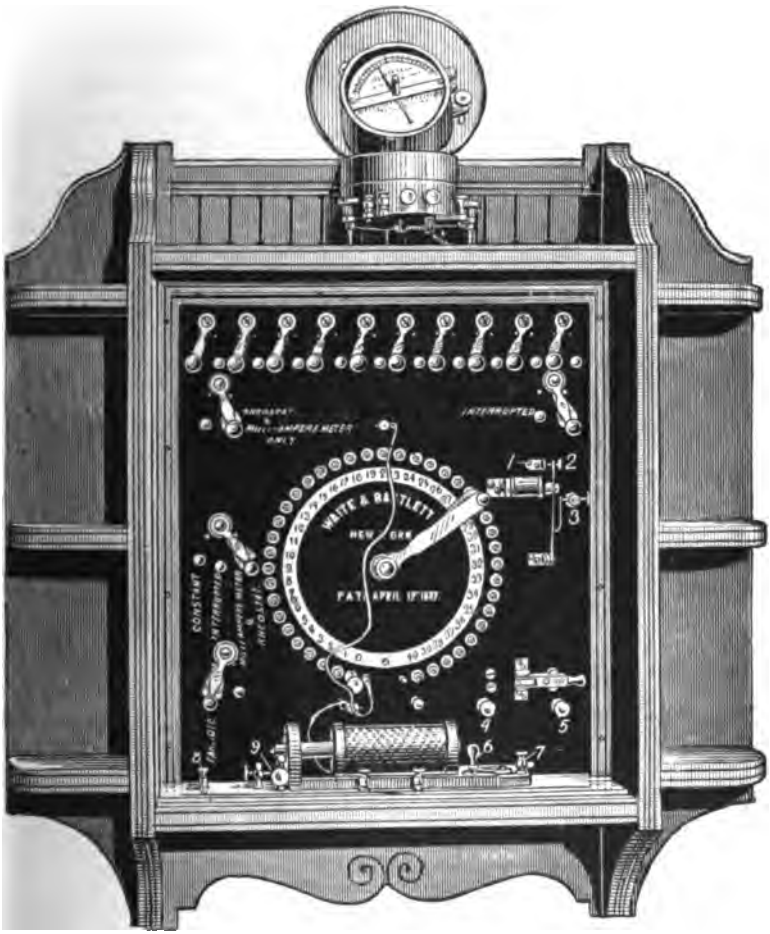

FIG. 4.—KEY-BOARD

differentiating the positive from the negative pole. The majority of galvanic batteries in use to-day are provided with a so-called pole-changer which will tell us at a glance which is the negative and which the positive pole, and which also enables us to change these poles at will, something which in gynecology is rarely advisable during the application of elec-

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tricity. At the outset we should determine which pole we wish to utilize as the active one to meet the special indications, and it should remain the active one unless the indications change. When the properties of the galvanic current are thoroughly understood, the operator, bearing in mind the peculiar properties of the two poles, will have no difficulty in selecting the active one for the special case. Thus, in general, when he wishes to lessen congestion, to check hemorrhages or leucorrheal discharges, to allay pain, he will choose the positive pole as the active one: on the other hand, when he aims at cauterization, at stimulation, at causing absorption, he will select the negative as the active pole. The effect of these poles, in degree, will vary, of course, with the intensity of the current, a point to which we will refer somewhat at length further on. By the term active pole we mean the one which is directly applied to the organ or part which we aim at affecting, and this we will amply illustrate in the discussion of the special uses of electricity.

Faradism.

The faradic current is chiefly mechanical in its effects, although, in general, it possesses similar properties to those of the galvanic current in a less degree It is an interrupted, to and fro current, instead of being constant, continuous. Its chemical action is very weak, if it exist at all, and its main utility is for causing contraction and thence stimulating. The action of the battery depends on the principle that "if the conjunctive wire of the battery (galvanic), coiled on itself and properly insulated, is laid on an insulated surface, and in its immediate neighborhood is placed another coil of insulated wire, connected with a galvano-multiplier, it is found that when a current is passed through the former the needle of the multiplier is on the instant deflected, then it oscillates a little, and presently comes to rest. If now the circuit is opened the needle is again deflected, but this time in the opposite direction. Instantaneous currents are, therefore, induced in one wire by a galvanic current passing in another wire near it. The wire connected with the battery transmits an inducing current; the secondary wire transmits an induced current."[1] Now by rolling these wires into coils these currents are rendered more powerful, and the current derived from the induction coil is intensified

[1] Bartholow: Medical Electricity.

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by placing pieces of soft iron in the centre of the coil, which, becoming magnetized, as the current traverses the coil, induce instantaneous currents in the coil at the moment of acquiring and of losing its own magnetism. (Bartholow.) The faradic battery then is composed essentially of the galvanic cell, of two or more coils, and of an apparatus for interrupting the current which is called a rheotome. The current is formed at the time of breaking and of contact, and aside from the construction and the number of the coils, its effect is dependent on the

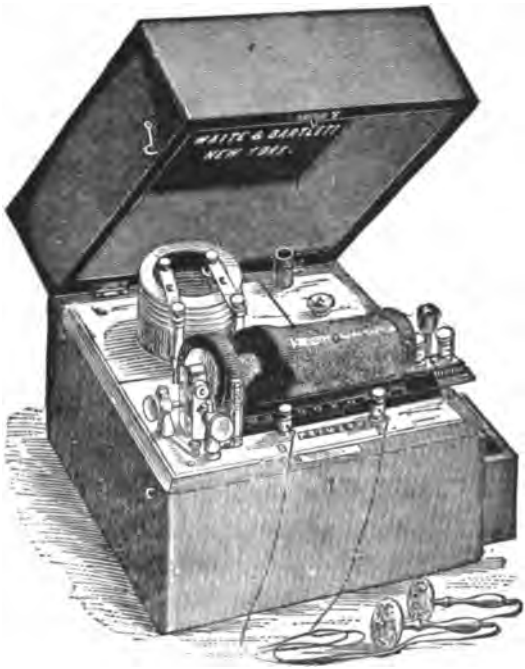

FIG. 5.—FARADIC BATTERY.

rapidity of the interruptions. The difference between the poles is not so marked as in case of the galvanic current; the positive pole, however, is more sedative, and the negative more stimulating.

The coils of the faradic battery are different in construction, and the therapeutic effects obtainable from one coil are not similar to those of the other. One coil, the primary, is composed of short thick wire, and the other, the secondary, of long thin wire. The coil of thick wire gives a quantity current, and is especially useful for exciting muscular contractions; the coil of thin wire gives a tension current and has a marked

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sedative effect. These differences in the utility of the faradic current have been in particular emphasized by Apostoli in connection with the electro-therapeutics of the female genital organs.

The gynecologist should either possess a separate portable faradic

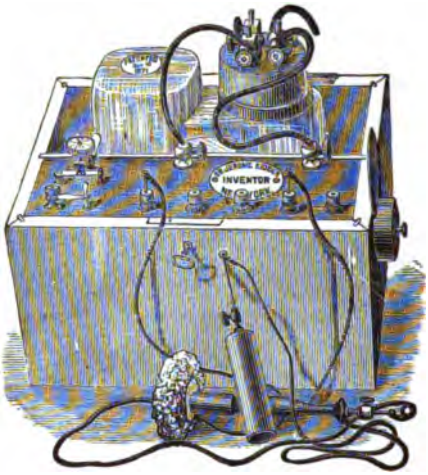

FIG. 6.—KIDDER TIP-CUP BATTERY.

machine, or else a combination galvano-faradic battery. There are so many excellent faradic apparatuses obtainable now-a-days that the difficulty will not lie in obtaining a good one but rather in selecting one from others equally good. One of the cleanest and most readily managed is

FIG. 7.—STANLEY BATTERY.

the Kidder tip cup. The Gaiffe, or one of its numerous modifications, or the recently devised Stanley battery, will also be found valuable, especially, as will be noted further on, for use in obstetrical practice, the latter and the Gaiffe because, being so compact, they may be carried without difficulty in the ordinary obstetric bag. The Stanley battery has

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further the special advantage of being readily handled without the least risk of spilling the contents of the cell.

These faradic machines we will not specially describe, nor enter into details in regard to their management, for the reason, even as with the galvanic battery, that these are points which can alone be properly learned practically. Where electricity is used as a routine measure in gynecological practice we believe it preferable to possess one of the combination apparatuses, because, although only exceptionally useful, it may be desirable to utilize both currents at once.

The Milliampèremeter.

The next instrument which the gynecologist should possess, in order to use electricity intelligently, is a galvanometer, an instrument by means

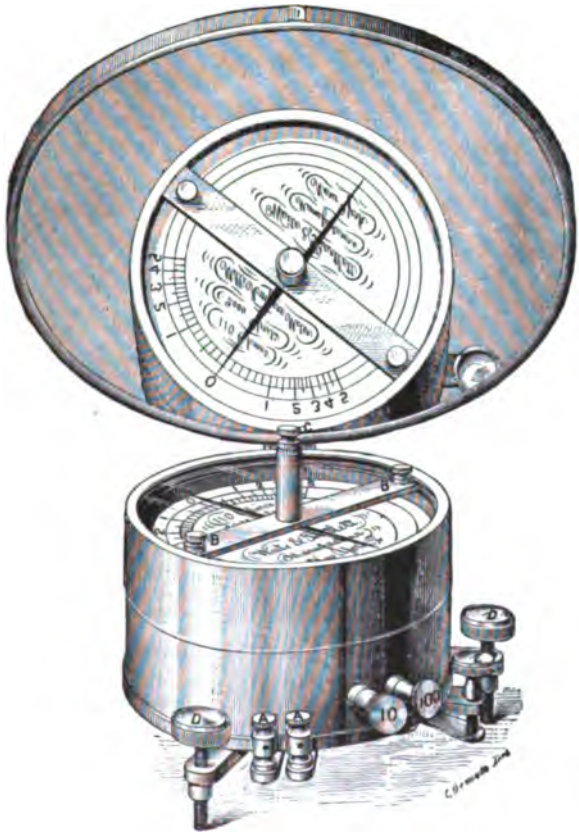

Fig. 8.—The Galvanometer.

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of which the intensity of the current may be measured, so that he may be enabled to estimate accurately the dosage administered to the patient. It was formerly the custom, and is still largely so among gynecologists, to use as a guide the number of cells brought into the circuit, but this is a rough method and inaccurate, seeing that the internal and external resistances vary so markedly. To check our results, therefore, and to know exactly what we are doing, it is essential to include a galvanometer in the circuit. We are speaking now purely of the galvanic current, for the measurement of which alone is the instrument of utility.

The galvanometer is subdivided into milliampères, the unit of electrical measurement, and the instrument is, therefore, ordinarily spoken of as a milliampèremeter. For routine purposes, an instrument registering from forty to fifty milliampères is sufficient, unless, indeed, it should prove expedient to follow in the footsteps of Apostoli and Engelmann, who use intensities as high as two hundred milliampères and over, as we will note when we speak more in detail of the selection and the strength of the current. Sufficient here the statement that, except where electrolysis is aimed at, a subject which will be considered in a separate chapter, forty to fifty milliampères will answer for routine work.

The Rheostat.

A further instrument to which we will refer, although it is not strictly essential to the gynecologist, is the rheostat, which subserves the purpose of interposing resistances in the circuit so as to modify the strength of the current. It is an instrument of greater utility, however, to the neurologist than to the gynecologist, seeing that the latter need not concern himself so much about slight modifications in the intensity of the current. The simplest and most practical form is the water rheostat, which consists in a column of water, interposed in the circuit, "and so arranged that the distances between the extremities of the metals that close the circuit through the water can be increased or diminished at pleasure."[1]

[1] Beard and Rockwell: Practical Treatise on the Medical and Surgical uses of Electricity.

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Electrodes and their General Application.

Having briefly sketched the nature of the electric currents of use in gynecology, their general applications and the means for measuring and modifying them, it remains to speak of the agents by which these currents may be brought to bear on the pelvic organs. These agents are called electrodes.

The electrodes are internal and external, and it is of prime importance that they should be well constructed, else they prove bad conductors,

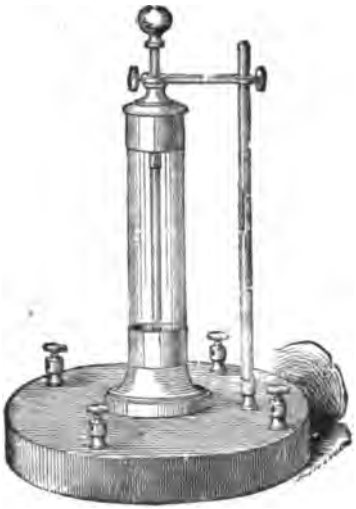

Fig. 8.—The Water Rheostat.

and, even though we have secured the proper current and have carefully measured the dosage, our therapeutic aim is defeated through the loss of a great portion of the current.

The external electrode in general use consists of a sponge imbedded in rubber sheeting to protect the clothing of the patient. This sponge electrode has, however, been rejected by the advanced workers in gynecological electro-therapy for the reason that it is bulky, dirty, and a source of loss of current, owing to the considerable resistance which it opposes to the passage. In its place have been substituted plates of block tin or of sheet lead, which Engelmann has had perforated with holes one line in diameter and one inch apart. These plates, being pliable, readily adapt themselves to inequalities of the surface on which they are applied, and

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they are covered with a thin layer of absorbent cotton, with chamois, with punk (Engelmann), or with rough towelling. The towelling may be cut in sizes to cover the plates, and is held in place by pieces of tape. A further advantage of these plate electrodes is that the material which covers them may be changed for each patient, a much more cleanly method than the use of a sponge. Apostoli covers the abdomen with a layer of potter's clay, but the plates are much more convenient and fully as effective. These plates should vary in size from four to ten inches in diameter, the general rule as to choice in size being simply that the greater the number of milliampères used, the larger should be the plate, since the wider the external surface over which the current is disseminated the less the pain. Engelmann uses external electrodes with the following measurements:[1] 6¼ by 9¼ inches; 4½ by 6½ inches; 3½ by 4½ inches. The smaller electrode he does not use with currents over 20 milliampères; the medium with currents over 60 milliampères; and the larger with currents over this number. Where electrolysis is aimed at, the external electrode should be large enough to cover as great a surface as is possible, in order to effectively disperse the current at the non-active pole, and this object Apostoli attains through the use of potter's clay.

These plate electrodes are in general applied over the abdomen or the sacrum. Where the object is indirect electrization both these regions are covered; where the aim is direct electrization the abdomen is, in general, the preferable site. They should be moistened in warm water in order to increase their conductivity and to diminish the resistance of the tissues, for a dry surface offers greater resistance than a moist. It is customary to use salt water for moistening the electrodes in order to intensify the superficial revulsive effect of the galvanic current. Engelmann rejects this practice, and says:[2] "Salt must be avoided; it is not necessary as it was for the poorly conducting sponge electrode, the instrument which I suggest being a much better conductor, and salt is injurious to patient and to instrument. When used upon electrodes by which currents of high intensity are applied, the electrolytic action of the galvanic current decomposes the salt, and chlorine is developed at the positive pole, by

[1] The Use of Electricity in Gynecological practice. *Trans. Am. Gyn. Soc.*, Volume XI.

[2] The Polar Method of Electrotherapy in Gynecology. *Medical News*, May 14, *et seq.*

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which the amount of pain may be increased and the electrode is corroded." Beard and Rockwell,[1] on the other hand, claim that the use of salt water is an excellent check against the administration of too strong currents, salt water being a much better conductor than simple water, and hence a patient will sensitively feel a current where salt is used which otherwise she would not notice at all. Where, however, a galvanometer is used to gauge the strength of the current, and a large electrode for dispersing it externally, it would seem preferable to dispense with salt, except where we desire the patient to be conscious of the passage of the current for the moral effect, for otherwise in gynecology it is desirable that our manipulations should be as painless as is consistent with therapeutic effect.

The internal electrodes are either vaginal, cervical, uterine, rectal, vesical, since it is obviously possible and desirable to utilize all the cavi-

FIG. 10. VAGINAL ELECTRODE.

ties adjacent or in connection with the pelvic organs for the localization of the electric current. These electrodes should be covered with chamois or absorbent cotton, except where caustic effects are desired.

The vaginal electrode shown in Fig. 10 is of use for making applications to the walls of this canal, or else we may use a sound (Fig. 11), on the end of which metal balls of various sizes are screwed, this latter form being especially applicable to instances where we wish to localize the current at a special point of the vaginal vault. This same sound with the

FIG. 11.—BALL ELECTRODE.

smaller ball attached may also be used as a vesical or a rectal electrode, and on account of its small size it is peculiarly adapted to virgins. The metal staff may be effectively insulated by slipping a piece of gum elastic catheter or of rubber tubing over it. A convenient rectal electrode has an olive tip (Fig. 12). For the cervix a cup-shaped electrode answers well, and in the cervical canal, where it is patulous, the small ball electrode may also be used.

[1] Loc. cit.

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For intra-uterine electrization there are a number of electrodes at our disposal. They are differently insulated according as it is desired to act on the entire endometrium or only on the fundus. In the first instance the insulation is to within 2½ inches of the tip, and in the second up to about ¼ of an inch. In certain instances, as will be noted in its proper place, it is desirable to confine the current entirely to the uterus, and

FIG. 12.—RECTAL ELECTRODE.

FIG. 13.—INTRA-UTERINE ELECTRODE.

FIG. 14.—BEARD'S UTERINE ELECTRODE.

then a special electrode is needed. It is in this connection that Apostoli has devised a double or bi-polar electrode, which in his hands has proved serviceable. It contains the two poles, the one carefully insulated from the other. The stem of the electrode is composed of two metallic cylinders, and each appears separately at the extremity of the sound. In Fig. 15 four models are shown, the larger being intended for cases where the uterus is large and its cavity widely dilated. The special ad-

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vantages he claims for this electrode are: "Suppression of the cutaneous pole; concentration within the uterus of the entire electrical action; diminution of pain owing to the absence of any application of the current to the skin; its greater efficacy, since the highest degree of uterine contractility is obtainable with ease and the least pain from the use of stronger currents, of greater intensity, and consequently more active."[1]

FIG. 15.—APOSTOLI'S BI-POLAR ELECTRODES.

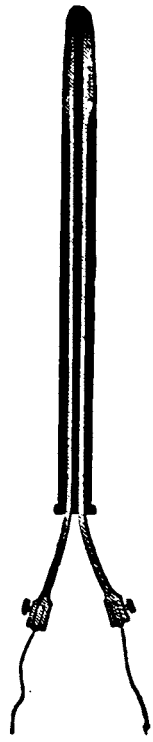

FIG. 16.—TRIPIER'S DOUBLE UTERINE EXCITOR.

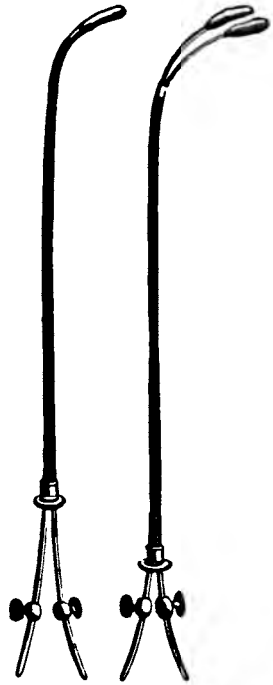

FIG. 17.—DUCHENNE'S DOUBLE UTERINE EXCITOR.

The electrodes are connected with the battery by means of conducting cords of different colors in order that the operator may recognize at a glance the negative from the positive pole. As we have already stated, the poles of a galvanic battery are essentially different in their effects, and their individual properties must ever be utilized according to strict indication. The diagnosis once made the operator should select the pole which he desires to utilize, and the intensity of the current should be

[1] Am. Journ. of Obst., September, 1884.

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drawn from it, the current from the other pole being spread over a large surface and thus neutralized. We are speaking now, of course, of direct electrization, where one electrode is internal and the other external. The electrodes should always be placed in position before the circuit is closed, and they should never be removed until the circuit has been opened. The closing and opening, further, should ever be gradual, the aim being always to avoid unnecessary shock to the patient.

Important questions which we must now consider are in regard to the proper intensity of the current and the duration of the application, questions which are in a rather unsettled state, and which further experience is necessary to finally settle. Until quite recently weak currents and long séances were the rule, and have yielded quite satisfactory results. Mundé says,[1] "a mild, steady, absolutely painless current from a galvanic battery will answer every therapeutical purpose, and is in every way preferable to a powerful or interrupted constant current, which causes painful shock and gives positive pain. . . . . The faradic current, on the other hand, is effectual exactly in proportion to its strength. . . . . In order to obtain permanent relief, in fact in order to obtain any appreciable relief from galvanism, it must be given often, steadily, and for a long time. . . . . The sittings should vary from fifteen to thirty minutes each." This quotation fairly well expresses the practice of the majority of gynecologists who have busied themselves at all with electricity. Latterly, however, a number of observers have published results obtained from the use of stronger currents in far less time, and a study of those results forces the conclusion that in gynecology we have been travelling rather more slowly than is at all requisite, for no one will gainsay the assertion that if a given result is obtainable in less time from the use of strong currents these should be resorted to by preference, provided it can be shown that they are painless and do not injure the patient. The electro-therapeutics of the female genital organs are, however, as we have indicated, in a very unsettled state, owing largely to the fact that instruments for precise measurements of intensities are only beginning to be used by gynecologists, and therefore data derivable from experience in the past, when measurements were rarely made and electricity was used empirically rather than scientifically, cannot be utilized for drawing

[1] Electricity as a Therapeutical Agent in Gynecology. Am. Journ. of Obst., December, 1885.

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deductions of value. The latest writer on the subject of the use of electricity in gynecology says, "there can be no question but that too weak currents have hitherto been used in the treatment of many of the diseases of the female sexual apparatus. Various conditions which I formerly failed to relieve have of late years responded far more readily to treatment simply because of the greater intensity of current that I have, with increased boldness, attempted."[1] He admits, however, that there is scope for difference of opinion in regard to the number of milliampères necessary to accomplish a given object, and for routine purposes he is for the present satisfied not to exceed fifty milliampères.

Engelmann is the most pronounced advocate in this country of high currents in the routine treatment of the diseases of women, and we instance his views by the following extracts from his recent paper:[2]

"It seems but natural that a current of sufficient intensity to accomplish the desired result in the shortest possible time, without injury to the patient, should be used.

"Hitherto currents altogether too weak to be effective have been used, and to this we must, among other reasons, ascribe the incompleteness of results; it is evident that when a feeble remedy is indiscriminately used, and widely dispersed at that, but little can be expected. Tripier, it may be recalled, speaks of a current of from 8 to 15 milliampères as one of average strength, and calls all over 20 excessive, and Ranney says that 'no patients will endure a current of over 20 milliampères through a high resistance, and that very few will bear over 12 milliampères.' What he calls a high resistance he does not state, and vague assertions such as this merely aggravate the existing confusion.

"How weak the currents used, even by scientific operators, are, is evident from the fact that many galvanometers are not made to register over 20 milliampères, few as high as 40 milliampères, and the highest those of Gaiffe, register not over 50 milliampères.

"To Apostoli is due the credit of boldly passing boundaries which seemed already fixed by practice; in his work hitherto recorded he has used as high as 100 milliampères, and last fall, during my attendance upon his clinic, he had begun to overstep this then most extreme limit, using up to 120 milliampères, and had ordered an instrument which

[1] Rockwell: Am. Syst. of Gyn., Vol. I. [2] Am. Gyn. Trans., Vol. XI.

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should .ndicate 150 milliampères. I did the same, but during my winter's work, I found that even this intensity, hitherto unknown in medical electro-therapeutics, seemed insufficient, and that I could accomplish results more readily and more effectively by currents even stronger. As far as I could judge by the limited range of my galvanometer, and by the aid of the rheostat, I had used up to 200 milliampères! I have since obtained an instrument indicating 250 milliampères, and a recent letter from Apostoli informs me that his experience has been precisely similar, which confirms my belief that a wide range of possibilities is open to electro-therapeutics.

"Such intensities are possible and called for in gynecological electro-therapeutics, where we are generally dealing with circumscribed parts, provided the localized polar method be adopted, by which we obtain low resistance and limitation of the current. I must again emphasize that in all I have said I have had reference to electricity in gynecological practice, and only to galvanic and faradic electricity, not to static electricity, or to large quantity galvanism as used for the cautery.

"I do not claim that such high intensity of current is always judicious or necessary. I sometimes use only 1 or 2 milliampères, often from 20 to 40, more generally from 40 to 80, and merely wish to establish the fact that if desirable, if necessary to accomplish the effect intended, currents of greater strength can be used without injury to the patient, without causing undue pain, and without the use of anesthetics."

These views of Engelmann, re-enforced as they are by the report of numerous cases in which they were practically tested, deserve serious consideration. For the present it may be stated that much stronger currents may be used than have hitherto been deemed safe, and thereby not only is the time requisite for their administration much lessened, but the use of electricity is rendered less irksome both to the gynecologist and his patient. Furthermore, in view of the unquestionable fact that much benefit has in the past been derived from the application of weak currents, the future holds out the hope of permanent relief, in case of certain inflammatory affections of the uterine appendages, from resort to strong currents, something which from other routine measures we have never been justified in predicating. It is sufficiently apparent that definite rules for the choice of low or high intensities cannot be exactly formulated. This is a point which each observer must determine for himself

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in individual cases. It should ever be borne in mind, however, that electricity must be considered, in its routine applications, simply as an adjuvant to other methods of treatment, and that while some of the agents at present in use may probably be largely dispensed with, there are others which are simply rendered more efficient by the scientific application of electricity. These points it will be our endeavor to exemplify in the discussion of the individual affections in the treatment of which electricity has proved of value.

Contra-indications to the Use of Electricity.

In the present state of our knowledge of the electro-therapeutics of the female sexual organs it does not appear advisable to resort to electrization in the presence of any specially acute process. Sub-acute inflammatory affections may be very cautiously so treated, even as care is called for in the application of any of our routine methods. Such, in brief, seems to be the safe position to-day. Engelmann is somewhat bolder. The only strict contra-indication which he appears to recognize is the idiosyncrasy of the patient. He is inclined to think that the opinion that the presence of active inflammation contra-indicates the use of electricity is the result of our as yet insufficient knowledge, and although he nowhere seems to disregard this view in his practice he is evidently hopeful that the future will prove it too absolute. Whether this will prove the case or not, it is wise to-day to limit the application of electricity to chronic processes, and when exceptionally it is tested in the presence of sub-acute processes it should be done with extreme caution, and by preference at the house of the patient, where prolonged rest in bed may be enforced.

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CHAPTER II.

THE APPLICATIONS OF ELECTRICITY IN ROUTINE GYNECOLOGICAL PRACTICE.

EVEN as in the choice of any other therapeutic agent, so with electricity is it essential to consider separately the affections in which resort to it is indicated. In so doing we will aim, where possible, at a comparative estimate of the value of this and other therapeutic means in the affection under consideration.

Amenorrhea.

Under the term amenorrhea are included instances where, between the age of puberty and of the menopause, there is entire absence of the menstrual discharge; or else, if present, where it is scanty and irregular. Aside from pregnancy and lactation, when amenorrhea is physiological, the chief causes are absence or imperfect development of the essential organs of generation, impoverished conditions of the blood or nervous system, certain organic diseases.

Electricity in one or another form has always been a favorite therapeutic agent in case of amenorrhea. It has been used indiscriminately, without, usually, special individualization of the cause of the symptom, and hence, while results have at times been satisfactory, very frequently they have been disappointing. In dealing with the symptom, amenorrhea, with the end in view of relieving it, it is of first importance to estimate the cause, for while certain forms of amenorrhea yield to the persistent application of electricity, in case of others but little hope of relief can be fostered, and in others still positive harm may be done.

Of the instances where electricity is indicated, and yet where it cannot be predicated at all as to what the outcome from its use will be, cases of imperfect development of the essential sexual organs hold the front rank.

Where careful examination, by preference under an anesthetic, satisfies us that the uterus, the ovaries, and the tubes, are present and purely

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imperfectly developed, then the inference is warrantable that if we can stimulate development we may be able to establish the function the outward manifestation of which is the regularly recurring menstrual flow. There is one factor which considerably aids us in these instances in estimating the probable outcome of the treatment instituted, and this is the presence or absence of molimina. If the woman has never had any of the subjective sensations which accompany the appearance of the menstrual flow—if, in other words, we can gain from her no history which will lead us to think that the sexual system is only dormant, as it were, and only needs stimulus for full development and action—then the outlook for success from the application of electricity or other stimulant and nutrient agents is very gloomy. Still, even here, seeing that we are dealing with the function which chiefly differentiates the woman from the man, however improbable the result, resort to the methods shortly to be indicated is but doing full justice to the woman. It should be stated, however, that these are the instances where the attainment of our aim is highly improbable, and where electricity and other agents scarcely ever yield other than negative results.

A further class of cases where amenorrhea either absolute or relative is present, are those where the essential sexual organs are apparently normally developed, where the history tells us of irregularly recurring molimina, and yet the woman has either never menstruated, or else scantily or irregularly, or else regularly for a while, when, without cause specially apparent, menstruation has ceased. Such instances are to be sharply differentiated into those where the cause is an impoverished condition of the blood or nervous system, or the presence of some organic disease, or else where the only determinable cause, and this an hypothetical one, is a lack of tone in the sexual organs Electricity here may be productive of good or of harm according to the case.

Amenorrhœa in the presence of anemia, chlorosis, tuberculosis, or Bright's disease, is not a symptom calling for local treatment by electricity or otherwise, but is rather to be regarded as a symptom which strictly contra-indicates local measures for instituting the flow. The amenorrhea is here, in truth, conservative, for these patients have not the blood to lose. In case of anemia and chlorosis stimulation of the pelvic organs should only be resorted to after the general state has been improved and the blood has been made richer by such constitutional measures as sug-

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gest themselves. In case of organic diseases which of themselves undermine the system and sap the strength, we question the utility of resort to any measures which tend to restore or to awaken function in organs which are quiescent to the very advantage of the patient.

We have left for consideration, then, that large class of cases where the amenorrhea is said to be dependent on lack of nerve force or tone, the so-called atonic amenorrhea in which latterly the bin-oxide of manganese has often proved of such marked utility. It is in this class that electrization is most effective and gives the most brilliant results. The patients vary very markedly in their characteristics. At times it is a young girl who presents herself, of eighteen to twenty years of age, that is to say, one who has passed the average pubescent age, of good local and general development, free from constitutional disease or taint, with a history of marked molimina recurring each month, neither anemic nor chlorotic and yet amenorrheic. At other times the woman has previously menstruated normally and with regularity, but has ceased to do so as the result, apparently, of sudden, intense nervous shock, or else on change of residence—a type so constantly met with in emigrants. In both these instances there seems to be lacking the normal stimulus to menstruation, at least such is the hypothetical explanation which we are forced to fall back upon. At other times, finally, the woman, previously regular, notices a gradual decrease in the amount of discharge at the periods and a lengthening in the intervals, until menstruation ceases altogether, and concomitantly with these phenomena there occurs rather rapid development of adipose—that is to say, the stimulus requisite for the regular and proper function of the genital system is apparently diverted towards making fat.

From this rapid survey of the main varieties of amenorrhea, which has seemed essential in order to make clear in what instances electricity is likely to prove of value and in what not, it is apparent that before resorting to the agent strict differentiation of the probable cause of the amenorrhea is requisite. In brief, the statements may be made that: where there is considerable lack of development of the sexual organs and complete absence of molimina we cannot hope for any result from electricity; in the presence of anemia and of chlorosis resort to local electrization, at any rate, is strictly contra-indicated until the impoverished blood has been made richer; certain constitutional diseases (tuberculosis,

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Bright's) associated with amenorrhea, are *per se* barriers to local electrization; where simply nerve tone is lacking or nervous stimulus is misdirected we can be quite confident of obtaining marked results from persistent, local and general electrization.

Seeing now that those forms of amenorrhea, which may suitably be subjected to electrization, are in general dependent on lack of general or local nerve tone, it is evident that it is on the faradic current that we should place our main dependence. Mechanical effects, not chemical, are essentially called for, and, as we have seen, it is the faradic current which furnishes us these mechanical effects. Such, indeed, is the aim of other methods which are popular in the routine treatment of amenorrhea. The repeated passage of the uterine sound, the application of stimulating agents to the endometrium, the insertion of tents and of stem pessaries, these means all aim at irritating the uterus, at causing congestion, and thereby leading to development and function. There are instances, however, where something more than mere stimulation is called for, where the local nutrition is at fault, and here galvanization, or preferably galvano-faradization, answers a better purpose than faradization alone. Where there exists imperfect development of the uterus and its appendages, cases which test our patience to an extreme degree, there is required, in particular, resort to both forms of electrization. Cases of amenorrhea characterized by the presence of molimina, and instances of relative amenorrhea, where there exists a scanty and irregularly recurrent flow, should by preference be subjected to electrization at the time of the molimina, and for a few days preceding their appearance. It is then that the essential sexual organs are endeavoring to functionate or are imperfectly doing so, and stimulation at this time tends to assist the effort. Where excessive development of adipose is a concomitant factor of the amenorrhea, it is self-suggestive that together with stimulation of the sexual organs means should be taken to correct this tendency to adipoiesis by diet, exercise, etc.

In case of amenorrhea, the sexual organs may be subjected to the electric current either directly or indirectly, and the former is the preferable method. General faradization should also be tested in those instances which do not yield readily to local. The external method of electrization is in particular applicable to virgins, and it should be tested faithfully in them before resorting to local. One pole is placed over the

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lower part of the abdomen and the other over the lumbar region or the sacrum. This method is never so efficient as the internal, whereby the mechanical effects are more strictly localized. Internal electrization may be resorted to with one pole in the vagina or in the uterus, and the other

FIG. 18.—BEARD'S DOUBLE INTRA-UTERINE ELECTRODE.

pole over the uterus and the ovarian regions. The cup electrode may be inserted over the cervix, or this organ may be clasped by an electrode similar to Duchenne's (Fig. 17), or else Beard and Rockwell's method of uterine faradization may be resorted as is represented in Fig. 19.

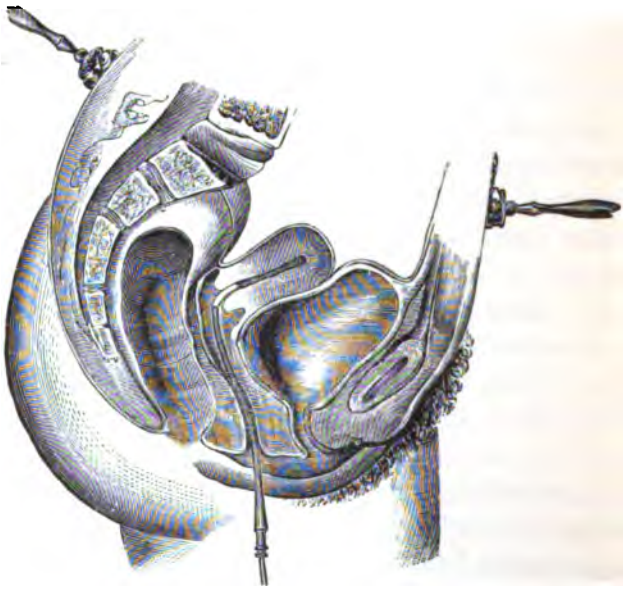

FIG. 19.—FARADIZATION OF THE UTERUS. One of the poles is connected with a bifurcated electrode, one branch of which is placed on the lumbar and the other on the hypogastric region. The other pole is applied in the cervix (or at the os), by an insulated uterine electrode.—(*Beard and Rockwell.*)

Further still, the current may be localized in the uterus by using an electrode similar to the one seen in Fig. 18.

In the choice of these methods, where the faradic current is employed, as in the vast majority of instances it will be, it matters not which pole is

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internal. Where the galvanic current is used, observers differ in regard to the pole, which by preference should be internal. Rockwell[1] expresses a decided preference for the positive pole as the internal, and he thinks that its superiority over the negative depends upon its more marked influence on unstriped muscular fibre. Engelmann,[2] on the other hand, is in the habit of using the negative pole on account of its decided hemorrhagic property. Probably both poles are useful internally, the positive by preference where there is lack of development of the uterus, and the negative where the organ is developed and needs only further stimulation. Where the negative pole of the galvanic current is used internally, to avoid caustic effects the current should be mild and the séance not protracted.

Local electrization after one or another of these methods will sometimes yield us the desired result in a very short time; in other instances, however, the treatment must extend over a long interval, and even then may fail altogether. Treatment should never be desisted from when the patient is caused to menstruate, but should be continued for awhile until the habit has been acquired or regained. All who have tested electricity in amenorrhea agree that when properly chosen and persistently used it will frequently give us better results, and in less time, than are attainable by other agents. Engelmann calls it *the* remedy, and to his recent papers, as also to the writings of Mundé, Beard and Rockwell, etc., we must refer the curious reader for the record of cases which exemplify the obtainable results.

Dysmenorrhea.

Painful menstruation is a concomitant symptom of such a large number of diseases of the female sexual organs that any consideration of its relief by electricity or other means must necessarily be deferred till we treat of the individual affections with which it is associated. There are instances, however, where dysmenorrhea exists and yet where careful local examination reveals no appreciable cause, such as displacement or distortion of the uterus, or inflammatory affection of the cellular tissue or peritoneum adjacent to this organ and its adnexa, or changes in the ovaries or the tubes. It is ordinarily in the unmarried that this variety of dysmenorrhea is met with, and for want of a better term the word

[1] Loc. cit. [2] Loc. cit.

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neuralgic is applied to it. There is present apparently a depressed nervous tone, a lack of nerve nutrition, a local hyperesthesia, which expresses itself in some by neuralgias in various parts of the body and in others by dysmenorrhea. The menses are often scanty, there is non-satisfaction of function, as it were. If we can make these women lose more blood at the menstrual periods, at the same time toning up the nervous system, we can often cure the dysmenorrhea. In other instances, again, the flow is profuse enough and free enough, but still the pain has the neuralgic type. The diagnosis of neuralgic dysmenorrhea must be reached purely by exclusion. Absence of evidence of local disease will point strongly to the pain being neuralgic in character.

In the treatment of this variety of dysmenorrhea such general constitutional measures as seem called for by the individual case hold unquestionably the first place. Electricity, however, properly utilized, will serve as a valuable adjunct. The sedative property of the galvanic current is obviously called for, and this is best attained by abdomino-vaginal galvanization, with mild currents; and it seems to us, with the positive pole internal, that its sedative effect may be more directly utilized. In virgins abdomino-lumbar galvanization should be tested before resort to internal. Very exceptionally, and this where the flow is scanty and insufficient stimulus is a probable source of the dysmenorrhea, the faradic current may be tested cautiously, in the hope that with increase in the flow the pain will diminish. In the vast majority of instances of the neuralgic type of dysmenorrhea, however, galvanism is preferable to faradism, and it aims both at sedation and at improvement of local nutrition, on the lack of which the pain in a measure depends. Electrization should, by preference, be resorted to daily, for the week preceding the onset of the flow, and may be depended upon for good results, although general constitutional measures, medicinal and hygienic, in this instance far outrank electricity in value; indeed neuralgic dysmenorrhea very frequently will not yield any more readily or permanently to electricity than it does to other general and local means.

Sub-involution of the Uterus and of the Vagina.

Under the term sub-involution we understand that relaxed, congested state of the uterus and the vagina which is so often met with after labor at term and abortion. The condition is a sub-acute one, as we speak of

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it here, and has not become chronic, when, as will be noted, electricity should be differently used. We are dealing with a passive hyperemia. 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 alone 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. Leucorrhea, 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 sub-involution from hyperplasia (chronic metritis), the method of using electricity in the one case differing essentially from that of use in the other.

In sub-involution 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 in so far improved. It is at once suggestive how amply electrization will fulfill 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 sub-involution they are unnecessary where electricity is used. The glycerin tampon, for support and depletion, is the measure which electricity markedly supplements.

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

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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 equalized.

It is apparent, and we desire to emphasize this, that electricity is advocated in case of sub-involution, 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 sub-involution 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 sub-involution 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 sub-involution 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 sub-involution, 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,[1] says that in most, if not all cases of sub-involution 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

[1] Am. System of Gyn.

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faradic current in recent sub-involution, where hemorrhage and leucorrhea 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 little difficulty in making his choice of current if he only bears in mind the essential differences between the two, the faradic being contractile and stimulating, the galvanic, while also contractile, being chiefly absorbent and sedative.

Super-involution.

This condition is the opposite of sub-involution. In the one there is incomplete retrograde metamorphosis, in the other there is excessive. The uterus is smaller than normal instead of larger; amenorrhea, instead of metrorrhagia, is an accompaniment. The amenorrhea 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 favorable 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 hemorrhagic 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 super-involution has existed for some time and there is complete absence of molimina, it is questionable

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if even persistent electrization will be of benefit, although it should always be given a faithful trial.

Chronic Ovaritis and Ovaralgia.

Under the term ovaritis is understood congestion or the result of congestion of the ovary. The organ, on the bi-manual, is found enlarged, sensitive, possibly at a lower level than normal. It is movable, not fixed. This definition is given for the reason that it is desirable to sharply differentiate simple oöphoritis from that which accompanies pelvic exudations or disease of the tubes. These latter forms will be considered under the head of chronic pelvic peritonitis. The enlarged, tender ovary we are at present considering, finds its analogue in orchitis in the male. For the relief of the condition there is nothing so effective as galvanism, and withal without the unpleasant after-effects which follow on resort to the only other practically effective means—the blister over the ovarian region.

Under repeated galvanization the pain and the congestion are often speedily relieved, and if the condition has not become complicated with pelvic peritonitis, etc., these symptoms may be effectually cured. The current should be mild, the positive pole internal, as near to the ovary as possible for its sedative effect.

Similar remarks are applicable to oöphoralgia, the term which serves as a cloak for our ignorance in those cases where we can determine no appreciable local reason for the pain complained of, and yet which from its site seems to emanate from the ovary. Here, however, sometimes galvanism secures relief from the pain, but in other instances it does not while faradism does. The exact reason for this difference we cannot offer except that a neuralgia of the ovary is simply as erratic as are neuralgias of other organs of the body. Rockwell [1] gives us a guide, in regard to the choice of current, which is deduced from the effects of pressure. Where pressure intensifies the pain he has found that galvanism gives relief, and where the reverse holds true faradism is preferable. This principle in regard to pressure he has found of value in determining the current to be selected for the relief of external neuralgias, and he depends on it in case of ovaralgia. Engelmann has found the galvanic current as chiefly of value in the relief of pain in chronic cases, while a high tension faradic

[1] Loc. cit.

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current has seemed preferable in acute cases. The observer will have to test this question for himself in the individual case, beginning preferably with galvanism, and changing to faradism in case of failure.

Areolar Hyperplasia and Chronic Endometritis.

It will be convenient to consider these affections together, since their treatment by electricity by modern methods is very similar. Areolar hyperplasia, the so-called chronic metritis, is ordinarily the result of sub-involution. Exceptionally, however, it is met with in the unmarried and the sterile as the result of repeated congestion. We cannot better describe this condition than in the words of Thomas,[1] to whom we are indebted for the term which correctly expresses the chief alterations in the uterus which accompany the condition. "The condition ordinarily styled chronic metritis consists in an enlargement of the uterus due to hypergenesis of its tissues, especially of its connective tissue, which induces nervous irritability, and is accompanied by congestion. Decidedly the most frequent source of this state is interference with involution of the puerperal uterus. A very large proportion of the cases of so-called chronic parenchymatous metritis are really later stages of sub-involution. Areolar hyperplasia is often induced in a uterus which has once undergone the development of pregnancy, by displacement, endometritis, and other conditions inducing persistent hyperemia. However produced, the condition is one of vice of nutrition engendering hyperplasia of connective tissue as its most striking feature, and, although attended by many of the signs and symptoms of inflammation, it in no way partakes of the character of that process." Clinically the condition is met with under two forms, according to the stage of the affection. In the one, the uterus is enlarged, heavy, more or less succulent. The symptoms are chiefly hemorrhages and leucorrhea. In the other form the uterus is dense, contracted; there is little secretion from the endometrium; instead of hemorrhage, scanty menstruation is a factor; the chief symptoms, however, are the varied manifestations in different parts of the body to which the term hystero-neuroses is applicable. Every gynecologist knows how intractable to treatment areolar hyperplasia is, in its advanced stages particularly, and a proof of this is furnished by calling to mind the many

[1] A Practical Treatise on the Diseases of Women.

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and the varied methods of treatment which have from time to time been proposed. Leeching, scarification, intra-uterine applications of the stronger caustics, igni-puncture, the wedge-shaped excision, etc., etc., these measures have each and all been tested, and still frequently they fall far short of effecting a cure. Revulsion, derivation, absorption, is what they all, in the main, aim at, and from what has gone before it is at once apparent that the fulfillment of this aim may be best secured by electricity. In what follows in regard to the use of this agent, we take it for granted that in the treatment of any individual case any marked irritant and promotor of the hyperplasia, such as a laceration of the cervix, will be removed before resorting to electricity.

Hitherto it has been the custom in applying electricity to the hyperplastic uterus, to use by preference the faradic, or the galvanic current, by the vagino-abdominal method, and in the experience of those who have thus utilized electricity the results obtained have very frequently been of the most marked kind. Rockwell says[1] "The very disagreeable symptoms that are so often associated with this intractable condition are occasionally very much ameliorated by the persistent use of the galvanic current. The intra-uterine electrode may be used, but the current must be weak and the applications short, so as to avoid unpleasant electrolytic effects. As a rule, however, extra-uterine will accomplish quite as much as intra-uterine applications. The disadvantage of the applications by the former method that it is not so direct, is more than balanced by the far greater tension of current that can be used when with a large sponge-covered bulb electrode firm pressure is made around and above the os uteri." Mundé says:[2] "As a peculiarity of this condition, which is a very common consequence of sub-involution, is an excessive formation of areolar tissue, which gradually assumes a density similar to fibrous tissue, the object of treatment should be to promote the softening and ultimate absorption of this abnormal tissue. This is best done by long and frequent applications of the galvanic current, which should be passed through every part of the uterus as thoroughly as possible. As menstruation is usually scanty in marked cases of hyperplasia, inta-uterine galvanization is decidedly indicated, preciscly the reverse from sub-involution. But as there is no disease of the female reproductive organs more difficult to cure than inveterate hyperplasia of the uterus (Scanzoni, indeed, pro-

[1] Loc. cit. [2] Loc. cit.

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nounces it incurable), it is evident that only perseverance will insure improvement. And relapses are frequent. The current should be used as strong as the patient can bear it, twelve to eighteen cells, the negative pole being internal. But it should be borne in mind that the intra-uterine pole is uncovered metal, and that a milder current must be used than when the covered ball merely touches the cervix. A very strong negative current passing from a metal sound might easily cauterize or char the endometrium, and do serious injury."

These quotations exemplify the methods after which it has been customary to resort to electricity in case of hyperplasia, and we insert them here in order to bring out more strongly the radical nature of the methods which are favored by Apostoli and Engelmann, which if accepted promise to revolutionize our practice in case of this affection. The importance of these methods necessitates reference to them somewhat in detail.

The first method is that by electro-puncture, which Rockwell is apparently inclined to accept as preferable to the older routine methods, since he calls it "the most speedy and effective method of treating areolar hyperplasia."[1]

Electro-puncture is highly endorsed by Engelmann, and the method may be described in his words.[2] "In chronic metritis and hyperplasia we utilize the absorbent and electrolytic properties of the negative galvanic current and the chemical action of the negative pole; also the contracting and stimulating effect of the faradic currents of quality and low tension. These cases are frequently accompanied by a scanty menstrual flow and dysmenorrhea, hence the hemorrhagic tendencies of the negative pole are of service, as well as its electrolytic and cauterizing properties; the most effective treatment, if there is no contra-indication, is negative electro-puncture: passing a platinum needle into the indurated tissue parallel to the uterine canal, connecting this with the negative pole of the battery, placing the positive dispersing pole upon the abdomen, using a current of from 50 to 150 milliampères. The larger stylet may also be inserted, or four or five needles at a time surrounding the os, all connected with one and the same negative pole. If amenorrhea, painful menstruation, or narrowing of the canal, especially in case of endometritis, accompany the hyperplasia, it is, first of all, important to remedy these conditions, and cauterization takes the place of puncture; that is, the uterine sound

[1] Loc. cit. [2] Loc. cit.

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connected with the negative pole is used in the cavity, while the positive pole is in connection with the dispersing plate upon the abdomen.

"If weaker currents, from 40 to 60 milliampères are used, electro-puncture of the uterus may be repeated every third day; the application of currents of from 120 to 150 milliampères should be from four days to one week apart, as they are accompanied by a slight destruction of tissue, which at first leaves an open canal, but at the end of that time nothing but a slight depression in the cervical tissue at the point of puncture remains. . . . . Positive electro-puncture, the positive platinum pole in the uterine tissue, is to be tried only in case a greater destruction of tissue is desirable, an open canal remaining, through which detritus is discharged. The positive pole is more liable to produce a slough; hence, unless peculiar conditions exist which demand this procedure, the negative pole is far preferable on account of its electrolytic action, absorption is promoted in uterine and peri-uterine tissues, and the usually scant menstruation is increased."

As for the details of electro-puncture of the uterus, the same writer thus states them: "I would recommend that all the precautions advocated in the puncture of fibroids be here observed; but since we cannot fix the uterus as we can a fibroid by pressure of the hand upon the abdomen, I prefer to insert the needle or stylet through the speculum. The uterus is fixed by the bullet forceps, or vulcellum, if the former be not at hand, directly above the point of puncture, and the needle is then forced into the tissue; but since this is so firm that the ordinary platinum needle is liable to give, a somewhat heavier instrument is preferable; although I would hardly recommend the large stylet, as used in the fibroid and in cellulitic effusions. . . . . According to the density of the tissue and the size of the uterus, the stylet for puncture may vary from the size of an ordinary needle to that of a number 1 English catheter, which I call the small stylet, or a number 4, which I call the large stylet, and use in fibroids and parametric effusions. If an ordinary heavy needle be used it should be inserted at least to the depth of one inch, better still deeper. All accompanying symptoms should be carefully weighed before puncture is resorted to. An admirable device, but one rather difficult of execution, is to insert four or five needles at the same time into the cervical tissue in a circle about the os, all connected to the same reophore. After four or five applications, massage of the uterus, the contraction and stimula-

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tion by the proper faradic current, will rapidly further the attaining of the desired end."

This method of treatment by electro-puncture has been also highly endorsed by Ménière,[1] of Paris. He has thus treated fully one hundred cases, using, however, the positive pole for puncture. It cannot be questioned that puncture by the negative pole is preferable, seeing that the softening and absorbent effect of this pole is the most marked.

The method of treating areolar hyperplasia by puncture is, to judge from the recorded cases, safe and effective. It would seem, however, peculiarly adapted to those instances where the uterus is markedly indurated, that is to say, in old chronic cases where the greatest possible revulsive effect is desirable. In more recent cases, where the uterus is large, heavy, and menorrhagia and profuse leucorrhea are predominant symptoms, we question if abdomino-vaginal galvanization, or galvano-faradization, will not suffice. In these instances, although experience in the future may prove the assertion erroneous, we should prefer to precede electrical treatment by thorough curetting and cauterization of the endometrium, for the chief source of the hemorrhages and the discharges is the presence of vegetations, fungosities of the endometrium, and it seems rational to remove these radically at the outset, and then to proceed to abate congestion, to cause absorption, and to improve healthy nutrition, by electrization. The time has not come as yet, however, for dogmatic assertion; possibly the method of treating hyperplasia which we proceed to describe will prove, as is claimed for it, so ample in results as to forestall all other methods.

That indefatigable worker in the electrical treatment of the diseases of women, Apostoli, has quite recently called attention to a new method of applying electricity to cases of hyperplasia and of chronic endometritis, giving in detail the *rationale* of the method as deduced from an experience extending over four years. From his monograph[2] we take the following condensed account of the method and the reasoning on which its application depends.

Apostoli's new method aims at utilizing to the greatest possible degree the chemical and the trophic action of electricity, in order to destroy the

[1] Gazette de Gynecologie, February, 1886.

[2] Sur un nouveau traitement de la metrite chronique, et en particulier de l'endométrite par le galvano-caustique chimique intra-uterine. Paris, 1887.

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diseased endometrium and to exert a derivatory effect on the uterus. The routine methods generally resorted to for the cure of chronic endometritis and of hyperplasia one and all aim at altering vicious nutrition, at causing absorption of the hyperplastic tissue, at eliminating the pathological processes in the endometrium. These methods, it is the experience of all, are slow in action, often ineffective, and where efficient this is only after the lapse of considerable time. For these reasons Apostoli has rejected them, and after prolonged experience advocates the substitution of electricity as being, where proper precautions are taken, uniformly safer, and, where the current is properly utilized, as being followed by excellent results.

For the purpose of application of this new method, Apostoli uses special electrodes which we will briefly describe. The external electrode, he claims, must possess such qualities as will enable very intense currents to be used without causing discomfort or doing injury to the woman, and these qualities are obtainable by means which diminish to the greatest possible degree the resistance of the skin. In galvanization of the female genital organs it is ever to be borne in mind that they are not specially sensitive to the action of the current, no matter how intense, and that the problem simply is to neutralize the action of the current at the external electrode, which, as we have elsewhere stated, is accomplished by increasing the surface over which the current is disseminated externally. Soft, moist, adhesive, potter's clay is the material which, in Apostoli's hands, has answered best for the external electrode, and by means of it has been able to triple and quadruple the maximum current which it formerly deemed safe to employ. This clay must be plastic and soft in order to allow of accurate adaptation to the skin; it must retain its humidity, and the layer must be uniform in thickness and not too thick else it offers additional resistance to the passage of the current. Apostoli prepares this electrode as follows: In a wooden or metal mould, about centimetres high, he places a layer of wet tarletan, and then fills the mould with the worked clay exactly to the top. This clay-mass should be large enough to cover the entire abdomen, and before being applied the skin should be carefully examined for abrasions, and if one is found it should be covered with collodion, else the skin will be cauterized at this point. Connection is made with the battery by means of a metal plate fused to the rheophore, and this plate is pressed gently into the

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Apostoli's internal electrode, which he calls the *excitateur intra-uterin*, is in shape and size like the average uterine sound. The handle is about four inches long, and is constructed of celluloid, which is not only a poor conductor of electricity but also aseptic in that it does not absorb. This handle slips over the electrode proper so that the surface not in use is thoroughly insulated. This sound electrode is constructed of platinum, an agent which is not corroded when the positive pole is used. Before inserting the electrode into the uterus it should always be carefully disinfected, and it is introduced like the ordinary uterine sound.

In utilizing the chemical galvano-caustic action it is essential to remember the different effects of the positive and of the negative poles. In cases of hyperplasia or of endometritis, where hemorrhage and leucorrhea are marked symptoms, the internal electrode is to be connected with the positive pole, and in the reverse instances with the negative. To express the matter in Apostoli's words: "Although both poles favor retrogression and denutrition in case of uterine hypertrophies, associated with endometritis and congestive parenchymatous metritis, together with this general action there are indications peculiar to each pole: The positive pole, the acid pole, relieves congestion, is hemostatic in the highest degree, is useful particularly in the hemorrhagic, congestive, or ulcerative forms; it prevents the tendency to excessive vascularization, and by the same process it becomes the indirect remedy against persistent leucorrhea; the negative or basic pole, is diffluent, scarcely at all hemostatic, and tends to excite the sluggish or perverted circulation which is present in the old, atrophic, or indurated forms of chronic metritis, and it affects this by powerfully congesting the endometrium. It is the pole to be selected in cases of chronic indurated metritis, whether complicated by amenorrhea or by dysmenorrhea, and it is also applicable with similar success to the treatment of other inflammatory processes in which hemorrhage does not predominate."

Such being the special electrodes which Apostoli utilizes, and such being the reasons for the choice of one or another pole as the internal one, it remains to describe the method of application of the current, the intensity to be selected, the duration of the séance and the frequency of repetition.

The patient should occupy the dorsal position and be cautioned to keep absolutely quiet. The sound electrode is inserted to the fundus,

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guided by the finger in the vagina, and the celluloid sheath is pushed down to the cervix so as to thoroughly protect the vagina. This electrode is held and steadied by the hand during the entire séance. The layer of clay is uniformly adapted to the abdomen, and the metal plate is pressed gently into it. The rheophores are then connected, and after waiting awhile till all reaction induced by the insertion of the sound has disappeared, the current is very gently and gradually turned on, avoiding all shock. At the first séance Apostoli has found it advisable not to exceed 100 milliampères, but later, when he has tested the tolerance of the patient, he aims as high as 200, even 250 milliampères. During the passage of the current it is very important to keep the entire intra-uterine portion of the sound against the uterine wall, and to bring it as far as possible successively in contact with every portion of the endometrium in order to disseminate and to equalize the caustic action. In general the séance should last from three to ten minutes, the duration depending on the nature of the individual case and on the sensibility of the patient. The true guide to the dosage is the rule never to cause the patient much pain. The séance is ended, even as it began, gently, and avoiding any shock. After the séance, rest for a number of hours should be enjoined, and the patient will very likely suffer from uterine colic for a certain period, and for this reason the post-operative period is often much more painful than the operation itself. As regards the number of séances requisite, Apostoli has found that according to the recent or very chronic nature of the case they vary from three to thirty, the latter figure being only very exceptionally reached. If the patient belongs to the better classes and is able to rest for a sufficient length of time after each séance, she may be subjected to treatment two to three times a week, but where she belongs to the working class once or twice should be the limit.

Owing to the novelty of the method and its radical nature we will reproduce here Apostoli's answer to the objections which might be formulated against it:

"1. *The operation is a difficult one.*—My method being purely a species of therapeutic hysterometry, since it consists only in the introduction of a sound, which remains *in situ* for awhile and serves as the carrier of the current, this objection applies entirely to the introduction of this instrument. Without denying that there are cases where the introduction of the sound is a difficult matter, I may say that, in general,

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after a little experience, the insertion of the instrument is easy enough, and further it is simply a necessary accompaniment of gynecological practice, since diagnosis depends on the touch followed usually by hysterometry. As for the electrical technique the details into which I have entered should place its utilization within the power of all.

"2. *The operation is a cause of sterility.*—Even if this objection held, I do not think it would have more than a relative importance, and not sufficient to cause us to reject the method; in view indeed of the fact that we are dealing with an affection which *ipso facto* is often associated with sterility, and in view of the further fact that the affection literally often poisons the life of the patient and very frequently does not yield to classic measures of treatment, for these reasons, even though it entailed sterility, my method would be justified. Happily these fears of sterility are very much exaggerated, and for two reasons: I am in the first place able to affirm that sterility is not necessarily entailed, since I know of many cases where pregnancy has ensued after a series of chemical galvano-cauterizations of the endometrium; and then again all gynecologists who are in the habit of curetting the uterus testify that pregnancy may ensue after it. Now what is my method but a galvano-chemical curetting, less brutal and more progressive than surgical curetting, and leading similarly to exfoliation of the mucosa and to its regeneration.

"3. *The operation may cause atresia of the uterus and consecutive dysmenorrhea.*—It is possible, and frequently, that we may witness more or less complete and extensive atresia of the cervico-uterine canal as the result of a series of galvano-caustic intra-uterine applications, in particular the positive, and at the outset I agreed with Tripier in fearing this result; but observation of a large number of patients has taught me that dysmenorrhea was far from following on atresia of the canal, but that usually it was a nervous phenomenon, reflex from the ovaries. I purpose soon to prove this by the relation of numerous cases.

"4. *The operation is dangerous.*—This objection, the greatest of all, is the reflex of our modern gynecological customs, in particular the French; our therapeutics, in Paris, have been largely external and directed against the cervix. Nevertheless it is in France that the process of curetting the uterus saw the light; it is a Frenchman, Récamier, who first scientifically resorted to the procedure, and yet it is in the same country that it is actually least resorted to. Now if my operation is dangerous,

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à fortiori should be curetting, and yet here is what an authority among gynecologists, Carl Schröder, says: 'When resorted to under strict antiseptic precautions, this procedure is without danger. I have curetted and irrigated thousands of times in case of chronic endometritis; only one of my patients died of infection, and she before the antiseptic era. I have sometimes seen exacerbations of an existing perimetritis, but I have never, so to speak, seen this operation result in new inflammatory manifestations.' Remember too that curetting is a surgical procedure, in general badly supported, and that it, says Schröder, 'produces, as a rule, such pain, that it is preferable to administer chloroform, except where the patients are not specially hyperesthetic.' In view of this testimony, and it is in agreement with that of the majority of foreign gynecologists, in favor of a procedure more painful than mine, for I have never been obliged to anesthetize a single one of my patients suffering from metritis, what is the worth of the objection to my method that it is dangerous? Nothing to speak of. What weight indeed could a purely theoretical objection have, when I state that during the past five years I have resorted to galvano-caustic intra-uterine application with perfect security, as well in the treatment of fibroids as of metritis, nearly four thousand times. If there have been accidents, and I have hastened to report them, I alone am to blame and not the method; they were the result of inexperience while I was learning the way. In conclusion, the possible dangers associated with the intra-uterine use of the galvano-caustic properties of the electric current are similar to those that may follow the introduction of the sound, and with reference to this point De Sinety says: 'Many writers have claimed that the uterine sound was responsible for many accidents, but we believe that the operator is at fault rather than the method; this method of exploration in our hands has never been risky, but on the contrary has furnished us very valuable information.'

"The following, briefly stated, are the accidents to be feared:

"a. *The induction of miscarriage.*—If this should happen it is not the method but the operator who is to blame. For this reason conjugal relations should be proscribed during the application of the method of treatment, the first séance should be held as soon as possible after a menstrual period, a careful examination should precede each application.

"b. *Exacerbation of an existing peri-metritis.*—This may depend on the patient, on the operator, on the method: Galvano-cauterization may

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be resorted to too intensely or too frequently; sufficient attention may not be paid to antisepsis, or the sound may be introduced carelessly; the patient may exert herself too much after the operation, or may be subjected to repeated coitus.

"c. *Acute attack of peritonitis.*—In hysterical women, suffering from ovarian pain, it may happen that an operation, not intense, provokes sharp pains in the abdomen, which simulate to the inexperienced an attack of peritonitis; happily this is the rarest of all occurrences; the more sudden the storm and the more violent, the more readily it ceases spontaneously or yields to simple means, and it is here that my method of uterine, or if need be vaginal faradization, with a current of high tension and long continued, answers so markedly."

We have detailed thus at length this method of Apostoli's because, if it should prove as effective in the hands of others as it has in his, we will possess, what we still lack, an efficient method of treatment of aggravated cases of areolar hyperplasia and of chronic endometritis. As yet he has not recorded any of the numerous instances in which the method has been utilized, and although he makes a strong plea in favor of the method in the monograph from which we have liberally quoted, judgment must be deferred until the record which he promises can be carefully studied.

Uterine Displacements and Flexions.

Bearing in mind the properties of the electric current it suggests itself at once that in this agent we ought to find a powerful adjuvant in the treatment of uterine displacements, but it is hardly possible to make any definite statements in regard to its value, seeing that but few observers who have tested it have furnished us with their results. From what has gone before it is evident that where the displacement is the result of subinvolution, seeing that, through the use of electricity we can diminish the congestion and weight of the organ, we may in so far diminish the liability to sagging of the uterus; and further, from what is stated further on, it is apparent that where the displacement is complicated and maintained by adhesions we can through electricity render the uterus more movable; but the real question at issue here is as to whether we are in a position by means of electricity to *cure* cases of displacement where the causal factor is lack of tone and relaxation of the uterine ligaments. If we can do this then certainly a great step in advance has been made, for

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unquestionably our routine methods, by tampons and pessaries, while they generally palliate the symptoms the result of simple displacements, only very infrequently result in cure. Tripier has been an enthusiastic advocate of electricity in the treatment of displacements of the uterus. He used the faradic current, inserting one pole in the bladder in case of retro-displacement, and in the rectum in case of anterior displacements, his aim being to restore tone respectively to the utero-vesical, and to the utero-sacral ligaments. While theoretically this method seems plausible, we should not expect much from it practically seeing that we are not here dealing with true ligaments in the sense of bundles of muscular tissue, but simply with folds of peritoneum, containing but few muscular fibres, which are hardly susceptible of stimulation in the sense intended. Where the factor is rather a sagging downward of the uterus from relaxation of the pelvic floor, then, likely enough, vagino-abdominal electrization, by restoring tone to this floor, may aid in keeping the uterus at a higher level in the pelvis. This question of displacements of the uterus in reference to the value of electricity can only be answered positively as the result of more careful and general application than has yet been the case. Seeing that the majority of displacements are accompanied by congestive phenomena or their sequelæ, we are at the present, however, justified in looking upon electricity as a valuable adjuvant in their treatment.

As regards flexions of the uterus, although here also positive data from many sources are lacking, we are yet in a position to anticipate permanent results from the use of electricity. We have already seen what a powerful nutrient agent we possess in electricity, and in flexions of the uterus a prime factor in etiology is diminished nutrition of the uterine wall at the site of the flexion. Obviously we have in mind now cases of flexion which are not the result of inflammatory causes exterior to the uterus, but those instances where the distortion is dependent on a weakening, so to speak, of the uterine wall ordinarily at the level of the internal os. In the majority of instances where flexions exist there are complicating factors in addition, and these obviously call for special treatment, and the cases are exceptional indeed where the chief factor is the flexion, when the case presents itself to us for relief. The faradic current is in these rare cases the one which *à priori* should be selected. In case of retroflexion one electrode may be placed in the bladder against the uterine wall, and in case of anteflexion in the rectum, the object being to stimulate the uterus

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at the site of the flexion. The other electrode should, where possible, be introduced into the uterus. This is the method which Rockwell favors, and it is worthy of trial particularly, because if it succeeds—and we would emphasize the fact that we are by no means in a position to maintain that it will—the method is devoid of all risk, a statement which is not at all applicable to the treatment of flexions by means of the stem pessary. In the absence of sufficient data from which to deduce any justifiable conclusion, we should prefer to divulse the flexion thoroughly, under the ordinary requisite precautions, and afterwards to stimulate the uterus and improve its nutrition by means of intra-uterine faradization.

In regard to prolapsus uteri, seeing that in the vast majority of cases it follows on lesions which call for some surgical procedure, it will rarely be a question of resorting primarily to electricity for relief of the condition. In the lesser degrees of descent of the uterus, following chiefly on sub-involution of the organ and of the vagina, we can unquestionably derive benefit by resorting to electricity for the purpose of diminishing the congestion and of restoring tone to the pelvic floor, and here the faradic current or the galvano-faradic should be chosen. In general, however, the same opinion may be expressed in regard to the value of electricity in prolapsus as held for simple retro- and anterior displacements: while we may palliate the symptoms, we cannot hope to cure.

Chronic Inflammatory Affections of the Uterine Adnexa.

Under this term we include the various affections which follow on attacks of cellulitis or pelvic peritonitis—that is to say, those cases where clinically we detect thickening around the uterus, in the cellular tissue or uterine ligaments, (*chronic cellulitis, chronic pelvic peritonitis*), as also those cases where the ovaries and tubes are surrounded by remnants of exudation (*peri-oöphoritis, peri-salpingitis*), and are to a greater or less degree bound down to the floor of the pelvis. In such instances, whether the primary disease emanated from the uterus, or tubes, or the ovaries, or not, the condition is certainly aggravated by these so-called thickenings, and it is against these, in particular, that routine non-surgical methods of treatment have been directed. It must be confessed that, aside from simple chronic cellulitis, these means (iodine, glycerin tampons, the hot douche, etc.), almost always prove ineffectual, and there-

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fore it is why of late years laparotomy followed by the loosening of the adhesions and removal of the tubes and of the ovaries, has been so frequently, in the opinion of many too frequently, resorted to. There is to-day no question of greater importance to woman than as to whether in the instances under consideration there can be palliation short of laparotomy, especially since it is evident to-day that in no given case can it be asserted that laparotomy with its risk will certainly cure. The importance of this subject warrants detailed consideration, for if we can show that electricity can palliate as effectively as laparotomy, in the class of cases under consideration, then there will remain no justification for a measure which a not inconsiderable number of gynecologists are of the opinion has become too much a matter of routine.

At the outset, let it be understood that the remarks which follow are not at all applicable to cases where there exists an enlarged tube probably filled with pus, for here no one questions the justifiability of laparotomy. We are speaking purely of instances where careful examination reveals only thickening of or in the region of these organs—that is to say where, although the symptoms may be as aggravated, there is no ever-present risk of rupture of what may be termed an abscess into the peritoneal cavity. In other words the results of peritonitis are the main factors we are here concerned with, and to understand the *rationale* of any proposed method of treatment it is necessary to bear in mind the nature of the pathological changes which accompany the condition.

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

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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.

A brief recapitulation of the pathological changes which exist in these cases of chronic inflammatory affections of the uterine adnexa will assist us in estimating the probable worth of electricity as a palliative agent. We say palliative, for the reason that in many instances even laparotomy does not do more than this, and therefore we are not justified in speaking of *cure*.

Dr. R. H. Fitz, the Professor of Pathology at the Harvard Medical school, has furnished us with the following description of the *post-mortem* findings in the cases under consideration:

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 cretaceous 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.

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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 towards 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 therefore must 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 the ovaries, where the condition is mainly a chronic pelvic peritonitis, these methods, it is within the experience of all gynecologists, 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. The importance of this subject warrants us in appending a few illustrative cases taken from various sources, and thereby we also exemplify the manner after which the electricity is applied.

In Beard and Rockwell[1] is recorded the following case: In October,

[1] Loc. cit., page 541.

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1884, Mrs. S., aged thirty-four, came to me complaining of poor appetite, excessive constipation, dysmenorrhea, menorrhagia, sciatica, and partial paraplegia. She suffered in addition from a constant pain in the basilar region and a burning and pressure throughout the abdomen. She called attention also to a constant pain in the lower portion of the spine, while sharp neuralgic attacks in the uterine region contributed to make her life quite wretched. Upon examination I found the neck of the uterus crowded somewhat backwards and to the left side, while the left half of the os uteri was completely obliterated. The enlarged portion was larger than the surrounding tissue, but not acutely sensitive to moderate pressure. Pressure along the base of the swelling and posterior to the os caused greater pain. These objective symptoms, together with a previous history of acute cellular inflammation, rendered it evident that there was extensive exudation in the connective tissue. I therefore determined to subject her to persistent localized galvanization. For nearly a month the patient came every day, with the exception of Sundays, and subsequently she visited me about every other day for three months. The applications were made directly to the diseased part, and when menstruation appeared, some three weeks after the inauguration of the local treatment, the flow was not only markedly less in quantity, but attended by a very considerable decrease in pain. In a few weeks the distress along the sciatic nerve entirely disappeared, and the progress towards a fair degree of health was uninterrupted, until she was discharged as cured, after having received fifty-six local applications of the galvanic current. Under the absorptive influence of the current, the inflammatory exudation gradually disappeared, until in the end the finger could be swept entirely around the neck at its juncture with the body of the uterus. The readiness with which the sciatica disappeared indicates that it was caused by the pressure of the parametric exudation upon the pelvic floor.

Here then we have an instance of cure of what was largely a chronic pelvic cellulitis by the persistent use of galvanism, the negative pole being used internally, and the positive externally.

Mundé[1] reports the following cases, which we select from his monograph as instances of what may be expected from local galvanization, in addition to routine measures, in cases where laparotomy seems to be the only measure offering hope of alleviation or of cure.

[1] Loc. cit.

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The first case proves conclusively what may be achieved in the way of palliation: "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 hemorrhage 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 glycerin 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 dur-

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ing 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 certainly was 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. This, her husband informed me by letter last September, was not the case, since his wife continued "amazingly well" and was growing stout; they were just going on a trip abroad, and would call to see me on their return.

We select the following cases from this same monograph as instances of the beneficial effect of galvanism in cases of chronic pelvic cellulitis and in pelvic peritonitis: "Mrs. A. M., twenty-six years, married five years, childless, came to me from Athens, Ga., because a year previously I had cured her sister of an anal fissure, which, I was informed, had baffled her family physician. Mrs. M. had a history of pelvic inflammation four years before, since which time she had been an invalid, scarcely ever free from diffuse pelvic pains, ovaralgia, sacralgia, bearing down. She also had an anal fissure. She had consulted an eminent gynecologist of this city, who had advised oöphorectomy. I found the uterus retroverted, immovably adherent, vaginal roof solid, cervix low in vagina, vagina short, left ovary prolapsed, adherent, very tender, right ovary not distinctly palpable. I first cured her fissure by dilatation, thinking that possibly some of her pelvic pain might be reflex from the fissure. But while defecation became painless, the peculiar ovarian and supra-pubic pain and the bearing down persisted. So I began to use iodine to the vaginal vault, and iodoform and glycerin tampons. But the patient either did not bear the iodine well, or the pressure of the tampons distressed her. In fact I found that she could never wear more than one small glycerin tampon with comfort. I tried local galvanism, the large sponge first over the abdomen and then over the sacrum, the negative ball in the vagina; ten to sixteen cells, half an hour every other day. A plain

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glycerin tampon at the end of each sitting. After fifteen sittings the patient had improved so much that she could walk a mile or more, and scarcely ever had any pelvic pain; she wanted to return home, but before discharging her, I yielded to her solicitation to enlarge the external os, which one of her former physicians had told her was contracted, and was the cause of her sterility and dysmenorrhea. I did not agree with this view, but as the patient harped on this point, I though no harm could come by making a shallow crucial incision into the lips of the os, and trimming off the flaps, of course avoiding traction on the uterus, which was still immovable and retroverted. There was scarcely any pain now on pressure in the vaginal vault, and there seemed no danger of relighting the peritonitis of four years before. I enlarged the external os, carefully avoiding traction or dilatation (I had never dared to introduce the probe), and as a result set up a furious pelvic peritonitis which kept the patient in bed for six weeks, and put her precisely where she was before she came to me. As soon as she was able to come to my office, I recommenced the galvanism, and after about a month's treatment she was as well as ever, and was discharged last March, wearing a small, soft rubber Albert Smith pessary, which she thought gave her some support in walking. I gave her directions about the continuance of the galvanism, and have not heard from her since. Hence I infer that she is doing well, as she was of the kind of patients who would be sure to let me know if my treatment had not proved effectual."

The second case is stated as follows: "Mrs. S. B., twenty-seven years of age, nullipara, married five years, who, since a miscarriage four years before, which was followed by a very severe attack of pelvic peritonitis, had suffered from frequent attacks of pelvic pain, which was localized chiefly in the left ovarian region, and had had several exacerbations of peritonitis. She had grown rapidly stout, her menstruation was irregular and scanty (sometimes skipping four to five months), and she remained childless. I found the uterus immovably fixed, the vaginal vault rigid and tense, the left ovarian region exquisitely tender. Careful passage of a probe produced dangerous reaction, so that I never dared repeat it. Hence I have never been able to benefit her sterility. But frequent local galvanization gave such relief, each sitting being immediately followed by absence of pain, that for several months she insisted on a daily sitting. In course of time she improved so much that only once in a while now

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does she call on me, when her left side feels badly, and I am glad to say that I can immediately relieve her."

Instances similar in their results to the above might be inserted here, but these are sufficient to prove that in the galvanic current we possess a most valuable adjuvant means of treatment in cases of chronic cellulitis and peritonitis complicated or not with salpingitis or oöphoritis. It is also evident that in view of the possibility of thus alleviating the general and the local condition of these patients, laparotomy for the removal of the uterine appendages should not be resorted to before electricity has been faithfully tested, excepting, of course, in those instances where the bimanual reveals marked distension of the tube, a distension which the rational history of recurrent attacks of pelvic peritonitis teaches us is due to the presence of pus (pyosalpingitis). True enough we cannot speak of cure as the result of using electricity, but the accumulating testimony of individual observers points to the fact that neither can we predict cure in these chronic inflammatory affections after laparotomy. To quote the words of but a single operator:[1] "We are concerned now with the one symptom—pain, as a result of disease of the pelvic organs, exclusive of malignant disease. For the relief of pain supposed to be due, we will say, to ovarian or tubal disease, abdominal section is performed. The organs at fault are successfully removed, and the patient makes a good recovery. It may be a case in which both ovaries and tubes are removed, and as the disturbing element of menstruation is eliminated, the patient is encouraged to expect a cure. Three months elapse, and still the patient suffers, not from the old dysmenorrhea, but from a pain more or less constant. She is encouraged to wait patiently; but in some cases, which have probably occurred to all of us, time brings no relief, and pains of some kind persist, varying perhaps in degree at different times, but never entirely absent. There are a few cases in which the suffering after operation is even greater than it was before."

It remains to speak of a further method of treatment of these masses of exudation which has been proposed and is particularly favored by Apostoli: We refer to electro-puncture, and faradization combined with intra-uterine cauterization. Hitherto we have considered purely subacute or chronic inflammations around the uterus, but now we must also

[1] Jas. B. Hunter: "Persistent Pain after Abdominal Section." (Trans. Am. Gyn. So., 1886.)

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deal with acute, for Apostoli is much bolder than certainly the great majority of those who have resorted to electricity in the treatment of these affections, for he does not draw the line at acute processes. In the presence of the acute stage of an inflammatory affection around the uterus, he holds the view that the ordinary palliative means, rest in bed, opium, etc., resorted to, are worse than useless seeing that they effect nothing in the way of cure. In a paper read before the British Medical Association in 1877, he states his practice and the rules which govern him, and this may be summarized as follows: His chief aims are to relieve the pain from which the woman is suffering, and as far as possible to nip the inflammatory affection in the bud. In the acute stage he resorts to faradization under the following rules: He uses the current induced through a coil of long, thin wire, which is a current of tension or an anesthetic current, as opposed to that from a coil of thick, short wire—the quantity current. He thus avoids inflicting any pain on his patient whatsoever. The first applications are vaginal with a bi-polar electrode, and their aim is purely sedative, each sitting lasting from five to twenty-five minutes, according to the interval which elapses before the patient declares the pain lessened. In these applications the greatest gentleness and avoidance of all shock are requisite. The sittings may be repeated twice daily, and before and after each the vagina should be douched copiously with a solution of the bi-chloride of mercury. Such are the rules for the acute stage. When pain and tenderness have been markedly lessened, or the process has become sub-acute, Apostoli proceeds to intra-uterine electrization—that is to say, he counsels us to break without fear of untoward result that gynecological axiom which tells us never to touch the interior of the uterus in the presence of any specially active inflammatory process around the organ. He claims nothing but good results, however, and proceeds as follows: At the outset he resorts to utero-abdominal faradization, that is to say, one pole is in the uterus and the other on the abdomen, using currents of tension and gradually increasing them up to the point of individual tolerance. These uterine faradizations are repeated until there is evidence of decided amelioration in the local condition, when the galvanic current is substituted for the faradic. The galvanization is also intra-uterine, the chemical and stimulant properties of the constant current being utilized, with the end in view of causing absorption of the inflammatory exudation and of checking any tendency to suppuration.

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In the beginning, short séances, from three to five minutes, and currents up to forty milliampères are recommended. The séances may be repeated twice a week, and after each the patient should be confined to bed for a while. At first the positive pole is the internal on account of its greater sedative property, but eventually the negative pole is substituted for its derivative effects. Throughout this treatment Apostoli emphasizes the strict necessity of careful antisepsis and great caution in manipulation. When the condition has become chronic galvano-puncture is to be joined to galvano-cauterization. In this stage Apostoli claims that the cauterization of the endometrium should be as energetic as possible, and the inflammatory remnants must be subjected to the direct action of the current, which is only possible by means of puncture, utilizing the negative as the active pole. The following are the general rules as laid down by him as applicable to puncture: The procedure being a painful one, it is advisable to administer an anesthetic, although, where the patient is of a phlegmatic temperament and able to bear pain, it is preferable to dispense with anesthesia, since thus we have the sensations of the patient as a guide in regard to the intensity of the current which we may utilize. This intensity will vary from fifty to two hundred and fifty milliampères, and the séance may be prolonged to ten minutes. The number of séances necessary will vary with the case. Apostoli tells us that one puncture will sometimes suffice in case of slight parametritis, while in others ten to twelve may be requisite. While, in general, rest in bed after the puncture is preferable, still Apostoli has thus treated a number of cases without compelling them to desist from their usual avocations. Before resorting to puncture it is essential by careful examination to choose a site where there is no pulsation, and by preference the most projecting portion of the exudation. The depth of the puncture should be about one centimetre, hardly more, for fear of injuring the peritoneum; perfect antisepsis should accompany it; at the termination of the séance the vagina should be tamponed with iodoform gauze. As the result of the puncture an eschar is induced which separates about the eighth day, and a sinus is left whence derivation is procured. This sinus will remain open, according to its depth and extent, for from fifteen to eighty days, and as long as it remains the tamponing with iodoform gauze must be continued.

Such in outline is the method which Apostoli has practised and from

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which he claims excellent results. Puncture in case of exudations has been tested by Engelmann, who reports a number of instances treated with marked success. Baker, of Boston, reports[1] a single case in which he has tested it, and he states that the result was so satisfactory as to encourage him to give it a trial in other instances.

In weighing the evidence at our disposal, and for the present limiting our remarks purely to chronic cases, the assertion appears warrantable that in electricity we possess a most valuable adjuvant method of treatment of the stubborn affections under consideration, and that in justice to his patients and to his specialty, the gynecologist is in duty bound to test it faithfully and intelligently before resorting to laparotomy, which operation should be made the strict *dernier ressort* except where the physical examination gives unmistakable evidence of the presence of a tumor from the discharge of the contents of which into the peritoneal cavity a peritonitis may be predicated. To make one of these suffering women comfortable, if not to entirely cure her, by means of electricity, redounds more to the credit of the gynecologist than if he sterilizes her and still does not cure her. There is certainly ground for hopefulness that in the treatment of these chronic inflammatory affections of the uterine adnexa electricity will find one of its chief fields of usefulness.

Before dismissing this subject we would refer to an affection of the surroundings of the uterus to which but little attention has been paid and which has been but infrequently described, and this is pelvic lymphangitis and angeoleucitis. The affection has been described by Courty[2] at considerable length, and Mundé[3] has written a paper on the subject. On physical examination the lymphatic glands are detected as enlarged, tender, movable to a greater or less degree according to the amount of complicating cellulitis, and in marked cases the lymphatic vessels may be also felt. For the relief of this lymphangitis there are no means at our disposal more effective than galvanism. In two of the instances recorded by Mundé this agent alone gave permanent relief. The following case taken from his monograph on electricity in gynecology illustrates the affection and the result obtainable from this agent: "Mrs. G., twenty-four years, multipara, was sent me by Dr. Chas. Denison, of Denver, Col.

[1] Trans. Am. Gyn. So. Vol. XI.
[2] "Diseases of the Uterus," etc., (translated by Agnes McLaren.)
[3] Am. Journ. of Obst., October, 1883.

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She complained chiefly of severe and constant sacralgia, dating from an attack of pelvic peritonitis four years before. I found the uterus retroverted, firmly adherent and immovable; the left ovary prolapsed and adherent; behind the uterus a number (five or six) of small, very sensitive nodules, which could be very clearly mapped out through the rectum, and were evidently situated in the retro-cervical cellular tissue. These were evidently inflamed lymphatic glands. No pain was experienced on examination except when these nodules were touched, or the attempt was made to lift up the uterus. I found the patient exquisitely sensitive to all manipulations, for on passing the sound and gently testing with it the possibility of elevating the fundus uteri, she was seized with so severe pelvic pain that I was obliged to give her a hypodermic of morphine. Naturally I refrained from further active measures, and confined my efforts entirely to mild counter-irritant applications (iodine, iodoform, and glycerin) to the posterior vaginal vault, and to relieving the sacralgia by the galvanic current. I passed an olive-shaped electrode into the rectum, connected it with the positive pole, and placed the negative sponge on the abdomen. At times I placed the sponge on the sacrum for the purpose of including the sacral nerves in the current. Rapid improvement followed; the pain soon left entirely, and I could distinguish a decided diminution in size and tenderness of the retro-uterine nodules. The lady came every day at first, and later every other day, from Brooklyn, where she was staying with friends, and returned without the least discomfort, although it was winter. After about twenty sittings she expressed herself so much relieved that she felt she could safely return home. I have not heard from her since, but believe she or Dr. Denison would have informed me if her pain had returned."

Hematocele.—Pelvic Abscess.

In place of the treatment of these affections by incision and drainage Apostoli favors resort to electricity. The method he employs is that of galvano-puncture, connecting his needle with the negative pole. He thus utilizes the chemical-caustic quality of the galvanic current in making an opening into these tumors. The opening thus made is, in character, a non-retractile fistula, with tendency to remain open, and is accompanied by the formation of adhesions between the pathological cavity and the

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mucous membrane of the vagina—the puncture being made at the most salient portion of the tumor into this canal. The chief advantages from this method are that owing to the formation of adhesions, the risk from opening is lessened, and further, the fistula remains patent instead of its being necessary to keep it so. An after-effect claimed for this method is that the nutrition of these pathological cavities is modified and the retrograde metamorphosis is rapid. On the occasion of his report of the method to the *Association Française pour l'Avancement des Sciences* (1885), Apostoli had thus treated a single case of hematocele, and the excellent result obtained by him led him to the following conclusions: The method is safe, quick in action, and modifies the usual prognosis. It is in action double—it has a surgical effect and a medical effect.

The method commends itself as being theoretically a rational one. Obviously further experience is necessary before we can compare it at all with the routine surgical treatment.

Hystero-Neuroses.

This term is in general applicable to those varying symptoms which women complain of at the time of the menopause, and for the relief of which all our routine therapeutic measures are frequently unavailing. Not uncommonly, however, these neuroses accompany hyperplasia of the uterus or inflammatory remnants, and here obviously from what has gone before, in the application of electricity to these conditions the hystero-neurotic symptoms may be ameliorated and even caused entirely to disappear. In connection with this subject Engelmann reports marked instances of relief from the use of electricity. He states:[1] "For the speedy relief of many of the annoying reflex symptoms which accompany uterine disease, the galvanic current is the remedy above all others to be employed. We have no agent which equals it, and in the wonderful relief given lies, as I have already stated, one of the greatest dangers which accompanies the use of electricity; if any result follows, it is complete, and even instantaneous. Freed from suffering the patient believes herself to be well, and acts accordingly; increased exposure or exertion at once brings about that exacerbation of symptoms, a lighting up of slumbering fires, which we so often find in chronic pelvic disease after any

[1] *Loc. cit.*, page 128.

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slight indiscretion, against which the patient is guarded while cautioned by her pains; but free from these she no longer thinks of the underlying disease which has practically not been in any way bettered by the single application, though it has dispelled all suffering as if by magic. The electric current is the only agent which so rapidly overcomes the neuroses accompanying uterine disease, which are frequently of more importance in the eyes of the patient than the causative morbid condition; hence the value of electricity in gynecological treatment, even when not used for the relief of the local condition, as an aid to such applications as may be made; but where electricity is used for the treatment of the disease itself it serves a secondary, but to the patient far more important purpose —that of relieving her from distressing symptoms." Engelmann records a number of instances where marked relief from the hystero-neurotic symptoms was obtained through the use of electricity. The following case, in particular, where pruritus vulvæ was the form under which the neurosis manifested itself, is worthy of record. It is taken from his monograph on "Electricity in Gynecology," to which we have repeatedly referred: "The patient came under treatment December 2d, having suffered for six years, ever since the appearance of the menopause, since which time she has been more or less constantly under treatment; for months at times in the hospital; eased now and then but never relieved; the apparent cause of the annoying pruritus was a profuse discharge from a partially prolapsed uterus. The dry treatment, bismuth and plain tampons in vagina and vulva, were used with success, and the patient left completely cured in February. March 1st, she returned with aggravated itching, all the symptoms again appearing with increased severity after a cold from wet feet. Neither the former treatment nor any other relieved the ugly and annoying eczema, which covered a space the size of an ordinary sheet of note paper on either side of the vulva. The local condition as well as the suffering of the patient increased, notwithstanding all efforts, and on May 12th, the galvanic current was used. Cotton-covered metal ball electrodes were used, with from 4 to 6 milliampères, the poles being moved about within the surface affected, remaining for perhaps half a minute in one place. At the point of any excoriation excessive burning was caused. On May 14th, when the patient returned, she was improved beyond recognition; the itching had entirely disappeared; she had slept throughout the night, the time during which her

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suffering was most agonizing before, and the ugly, deep-red surface, covered by heavy patches of the size of a nickel, was now smooth, with the exception of one single slight blotch, which was of a pale brown color and smooth. This treatment was continued on alternate days, and on May 21st she was again discharged, the skin normal, with the exception of a few thin scabs."

Erosions of the Cervix.

Simple catarrhal erosion of the cervix, the cause, whether discharge from the uterus or disease of the vagina, having been removed, will often readily become covered with new epithelium as the result of the application of nitrate of silver solutions. At times, however, especially when the erosion is of a more aggravated type, it is a very difficult matter to start the healing process, and here the galvanic current may prove of utility. In reference to this point Mundé states, "I have found the negative pole of the galvanic battery, applied to the erosion by means of a metal ball, uncovered, sufficient current being used to produce a mildly caustic effect, to have a beneficial influence towards starting cicatrization. Only a few such applications should be made, and as soon as the erosion begins to heal from the edges, finely powdered iodoform, or a solution of nitrate of silver (ʒ i to ʒ i) should be substituted.'

Affections of the Rectum and of the Urethra.

Engelmann has utilized galvanism in case of hemorrhoids and of prolapse of the rectum. In case of the former he states: "In case of smaller hemorrhoidal tumors, as in thickening or prolapse of the membrane, I have used recto-abdominal galvanism, the positive ball electrode firmly pressed against the part to be affected either within or without the rectum; a medium-sized or large plate upon the abdomen as the dispersing negative electrode; according to patient and condition, currents of from 6 to 30 milliampères may be used. Larger hemorrhoidal tumors are treated by positive electro-puncture with the platinum needle. It is one of the few cases in which we use the positive pole in electro-puncture, but it is here desirable on account of its coagulating and destructive effect. In small hemorrhoidal tumors I have used currents of 30 to 40 milliampères with admirable result, and I shall test the treatment in larger tumors, the

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puncture being made with several needles at the same time." The same writer has also obtained good results from galvanization in case of *prolapsus recti*.

In chronic constipation, as an adjuvant to other methods, electricity has not been sufficiently utilized. Here faradism is of unquestionable value in restoring tone to the torpid intestines.

As regards affections of the bladder and the urethra, simple irritability may at times be relieved by mild abdomino-spinal, or abdomino-urethral galvanization. Where frequency of micturition is dependent on hyperesthesia of the neck of the bladder, the positive pole may be inserted into the urethra as far as the neck of the bladder. In case of urethral caruncles Engelmann uses galvanism, applying the uncovered negative pole to the growth, a current of from 10 to 20 milliampères being sufficient to destroy them.

Stenosis of the Cervical Canal.

For the treatment of stenosis (including atresia) of the cervical canal the galvanic current would seem, from the testimony of those who have tested it, to be preferable to either incision or dilatation. Engelmann claims that it is the "mainstay of the surgeon." Comparing it with other methods he says: "For the relief of stenosis, acute or chronic, whether of recent date or of years' standing, this method is preferable to all others; it is not only painless, but at once eases if it does not completely relieve such pain as may at the time exist. Compare with it other means of treatment; slow or rapid dilatation, the tent, sponge or tupelo, or the steel dilator. The tent is of little use in a very narrow canal, impossible often, and when used causes great pain, necessitates the bed, and results in hardly more than a temporary dilatation; when applied directly before the menstrual period it gives relief, but it must be used steadily for a time, and such treatment confines the patient to bed, and the result is but temporary. Likewise that of the steel dilator, an instrument which causes suffering at the time, and to be effective confines the patient to her bed. The knife gives comparatively favorable results, but this necessitates a small operation, and cicatricial contraction may even do away with all benefit accomplished."[1] In his hands 100

[1] *Loc. cit.*, page 112.

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milliampères have proved necessary for "positive effective action," the negative being, of course, the internal pole. He records a number of cases where stenosis was thus cured. Rockwell also favors the method, but he deems 50 milliampères used for five minutes, ample. In the cases he has thus treated he has found from six to twenty-five applications sufficient to effect a cure.

Although these statements speak strongly in favor of electricity they do not warrant the inference that the permanent results are at all better than those obtainable from thorough divulsion. The chief advantage, indeed, which the former would seem to possess over the latter, is the fact that it neither requires anesthesia nor rest in bed. The preferable method we think is to divulse and then to improve nutrition by frequent galvanization. In this connection, however, as elsewhere when speaking of electricity as applied to the diseases of women, the time is not ripe for definite statement, since only a very limited number of observers have at all tested the agent.

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CHAPTER III.

ELECTROLYSIS.

ALTHOUGH in connection with certain of the subjects already spoken of we have in truth dealt with the electrolytic effects of galvanism, it seems proper to consider this subject separately in its application chiefly to fibroid and ovarian tumors.

Electrolysis is thus defined by Beard and Rockwell:[1] "The term electrolysis is a general one and signifies decomposition by electricity. As such it applies to the electrical decomposition of inorganic as well as of organic substances, and of animal tissues, whether in health or in disease, living or dead. Practically, however, the term is now pretty well restricted, in electro-therapeutical language, to the electrical decomposition of morbid growths, or to parts affected by chronic inflammation, by means of some form of needle electrodes, and, although more or less electrolytic action takes place in all applications of the galvanic current externally or internally, yet the term when applied to any electrical operation is understood to imply that electrolytic action was the leading effect sought for, and that it was obtained by needles, or at least by some form of metallic electrode more or less pointed at the extremity.

"On the other hand, when electrodes with very large surfaces are used, with a view to chemical effect, and the transfer of fluids with absorption, the process is called *catalysis*. Catalysis depends, in part, at least, on electrolysis, and the distinction between the terms, which has been observed by electro-therapeutists is practical rather than scientific. . . . . When needles connected with the poles of a galvanic battery are inserted into a tumor, a three-fold action is produced.

"1. *Decomposition of its fluid constituents.*—Hydrogen and alkalies, soda, potassa, etc., go to the negative, and oxygen and acids to the positive. The special character of these electrolytic phenomena will depend

[1] *Loc. cit*, page 66

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on the character of the tumor, and the rapidity of the action will be proportioned to the relative amount of its fluid constituents. As the body is mostly composed of water, holding salts of potass, soda, etc., in solution, it is a good electrolytic, and in most of the conditions of disease undergoes rapid decomposition. Schirrus and fibroids, when hard and firm, require considerable strength of current, and are electrolyzed with comparative slowness. Erectile tumors, which are almost entirely of fluid composition, can be electrolyzed very rapidly. Although electrolytic action takes place at both poles when inserted in tumors, as when inserted into inorganic substances, yet this action on the whole appears to be the more vigorous and more effective for causing absorption and disintegration at the negative pole, and in practice this pole is usually found to be the more efficacious, although successful results are obtained by the positive pole or by both combined. Epithelioma being largely composed of water also decomposes rapidly. . . . .

"2. *Absorption.*—Absorption may be hastened both by the chemical changes that take place, and also by the mechanically irritating effect of the needles and the transference of the anions and cations. This absorption takes place both during and after the treatment. In some cases it is not at all observed during the operation, but goes on slowly for weeks following. Stimulation of absorption is especially marked when electricity acts on hydrocele and cystic tumors. . . . .

"3. *Disintegration and atrophy.*—As a result of the decomposition and absorption, and associated with them, the tissues become dried, separated, shrivelled, and the tumor decreases in bulk and may entirely disappear."

For the purpose of causing the above electrolytic effects a galvanic battery arranged for quantity rather than for intensity is preferred by Cutter, whose experience in the treatment of fibroid tumors by electrolysis is larger than that of any other individual operator in this country. The battery he uses[1] is the Stœhrer, consisting of eight large plates of carbon, and a similar number of zinc, arranged so that the zincs come on the outside, securing by means of these large plates quantity of current as far as possible. Other observers do not lay so much stress on this question of quantity as obtained through large elements. Beard and Rockwell state:[2] "For purposes of electrolysis tension with moderate or fair

[1] *Vide* Am. Journ. of Obst., February, 1887, *et seq.*

[2] *Loc. cit.*, page 663.

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quantity is required, such as is obtained by a considerable number of elements of medium size." Bartholow says:[1] "For the purpose of electrolysis the battery should have sufficient intensity. The zinc-carbon combination of Stöhrer for portable use is well adapted for electrolysis, the number of elements used not more than twenty, as the electro-motive force required will not exceed the power of this combination. It is held by some of the most experienced operators (Anderson, Duncan, Althaus) that heating power must also be regarded, and hence the larger cells of

FIG. 20.—BATTERY AND ELECTRODES USED BY CUTTER.

Stöhrer are recommended, but this statement cannot be accepted without qualification. Smee's elements may also be employed for electrolysis, but Daniell's, Siemen's and Halske's, Hill's, etc., are not adapted for this purpose. The caustic battery of the Partz electric company of Philadelphia is a very convenient and powerful machine, exceedingly well suited to the purpose." Amory, in his recent treatise[2] on electrolysis thus sums up the matter in its application to tumors: "It is assumed that the electrolytical action is due to the interference with cell proliferation; if then the current should be too strong to effect this interference and should

[1] *Loc. cit.*, page 251.

[2] Wood's Library Standard Medical Authors, 1886.

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excite an inflammation, suppuration will ensue and the action of the electricity as a caustic may be localized upon the parts of the tissue immediately in contact with the electrodes. The products of suppuration prevent the transfer of the electrical action to any distance from the point of application. The effect of a localized inflammation in the tissue surrounding a tumor causes the attraction of a larger amount of blood than will suffice for the simple nutrition of the tumor. Consequently as there is an increased amount of nutritive material, the tumor has the tendency to grow larger. For these reasons the strength of current required to effect the slow absorption of tumors should have a feeble tension and small chemical action, and the duration of each sitting should be prolonged." Engelmann and Apostoli, on the other hand, claim that for effective electrolytic action high intensities are requisite, and short sittings are preferable. The former is in the habit of using from 50 to 250 milliampères continued from three to eight minutes.

It is apparent what difficulty there is in making definite statement in regard to the strength of current which it is essential to use in the electrolytic treatment of fibroid tumors. The data for drawing our conclusions are entirely too vague, seeing that operators, with few exceptions, do not state the current strength used in milliampères. Sufficient the statement for the present that results have been obtained both from feeble currents and long sittings, and from high currents and short sittings. This subject is one in which as yet each individual must experimentally work out his own deductions. We shall describe, somewhat in detail, the method advocated by Cutter, and next that favored by Apostoli and Engelmann, in the application of electricity to fibroid tumors. First, however, we must speak of the needles by means of which the growths are punctured. Beard and Rockwell[1] thus describe these necessary adjuncts: "For producing electrolysis in tissues beneath the skin fine needles of gold or gilded steel are used. The advantage of the gold is that it resists oxidation better than any other metal. Gold or gilded needles can, however, be used only with the negative pole, since with the positive they would be acted on. The conductors may be composed of two, four, six, eight or more needles. The needles may be insulated with hard rubber or collodion, or shellac, for about one-third of their length, so that when introduced into a tumor the skin may not be acted on and inflammation excited."

[1] Loc. cit., p. 664.

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Cutter[1] thus describes the electrodes he is in the habit of using: "An ordinary surgeon's director was taken, its point and edges were sharpened, an ebony handle was fitted to the flattened end, and two inches of the

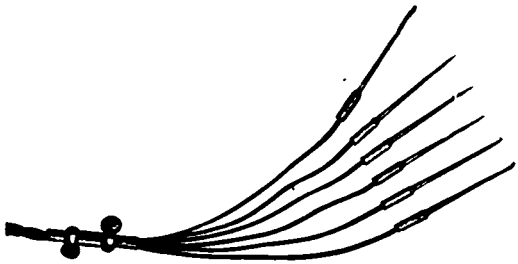

FIG. 21.— CONDUCTOR FOR ELECTROLYSIS.

FIG. 22. — ROCKWELL'S LONG NEEDLE FOR ELECTROLYSIS OF UTERUS THROUGH THE VAGINA OR THE WALLS OF THE ABDOMEN.

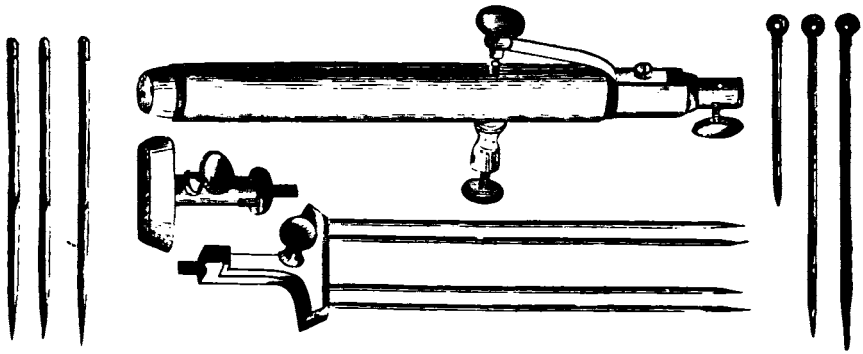

FIG. 23.—NEEDLES FOR ELECTROLYSIS, WITH ROCKWELL'S NEEDLE HOLDERS.

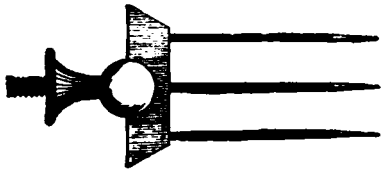

FIG. 24.—NEEDLES FOR ELECTROLYSIS.

larger end were japanned for insulation. The dimensions are as follows: Length of instrument over all, eight and one-half inches; of blade, four

[1] Loc. cit., p. 115.

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and seven-eighths inches; width of blade at widest part, three-eighths of an inch. The angle made by the two wings of the blade may be represented in section by the letter V. The point of the angle is made dull. The effect of this arrangement is to draw the tissues over the sharp edges, represented by the free ends of the letter V, and thus cause a ready section of the tissues penetrated. It is evident also, that the union of the two blades at this angle offers a great resistance to bending in any direction." The patient having been anesthetized Cutter inserts these electrodes deep into the tumor. The point of insertion depends on the location of the tumor. "If unilobar and in the cavity of the abdomen, one electrode is passed through the skin in on one side of the tumor, and the other in on the other side of the tumor. Or if the lobe or tumor is small, one electrode may be passed under the other at a distance of half an inch. If the tumor occupies the cavity of the pelvis and has several lobes in the abdomen, one electrode may be pushed in from the rectum or from the vagina, and the other electrode may be passed in through the abdominal walls. If the fibroid is confined to the pelvis, both electrodes are to be introduced through the rectum or vagina. Care should be taken to avoid any strongly pulsating vessel." In Cutter's reported series of cases the applications varied from three to fifteen minutes in duration, and the best results were obtained after the shorter interval. "The length of time was adjudged from the systemic symptoms. If the pulse became accelerated, the respiration hurried, the face pinched, the countenance hippocratic, and the skin sweaty and cold, it was thought time to stop. Etherization masks these symptoms somewhat, and should be allowed for, that is not to push the time too far. The first operation should be short, and, if well borne, the time may be increased in future operations."[1] The applications were repeated once a week, or every fortnight, in certain instances every day. The after-treatment consisted in confining the patient to bed for a few days.

Of the fifty cases recorded by Cutter the following is the *resumé* of the results: in seven cases there was no arrest of the growth; in four cases, there was a fatal result; in twenty-five cases the growth was arrested; in three cases, the symptoms were relieved; in eleven cases, there was cure.

[1] Cutter, loc. cit.

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In the transactions of the American Gynecological Society for 1886, Baker, of Boston, reports the conclusions he has reached in regard to the value of electrolysis in the treatment of fibroid tumors. The method he has followed is essentially that of Cutter and of Kimball, although in a number of details he is at variance with them. He has tested electrolysis in fourteen instances with the result of causing entire disappearance of the tumor once, and in twelve diminution from one-third to one-half. In the remaining instance, although the symptoms were greatly modified, there was no appreciable effect on the size of the tumor. In common with many others Baker does not approve of the form of battery which Cutter favors. He states that "the resistance of the body or of the tumor to the galvanic current being great, all authorities agree that the size of the cells should be moderate, or small and numerous, in order that the intensity of the current may be increased, and thus the resistance overcome; whereas in the battery described (by Cutter) the surface of the plates is so great that the quantity of galvanism generated is large, which is valuable when thermic action is desired, but the intensity of the current is so low that the power of such a battery in conveying a galvanic current through a tumor would be small." He hence uses a Fleming and Talbot battery of thirty cells, and steel electrodes japanned to within one inch of the tip, this being gold-plated. His experience leads him to formulate the following rules: 1. It is best to select a time for resort to electrolysis other than during, or for a week before, the menstrual period. 2. An anesthetic should always be administered. 3. Electrolytic needles should be used for both positive and negative poles. 4. The needles must be absolutely clean. 5. They should be buried deep in the tumor so that the current may be entirely limited to the growth. 6. The needles should be inserted at the most prominent point of the tumor, either through the abdominal walls, the vagina, the interior of the uterus, and the two needles should not be too nearly approximated. 7. The two electrodes being in the growth, one externally and the other internally, it matters not whether the positive needle or the negative is internal. 8. The needles having been inserted, the circuit should be completed, and, beginning with four to six cells, we should within two or three minutes gradually increase the number to from eighteen to thirty cells of an ordinary battery, the number required varying much with the cleanliness of the battery and the freshness of the fluid. 9. The length of time oc-

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cupied in the application should be from ten to twenty minutes, to be determined by the character of the pulse; and when this is found to be much more slow than normal and weak, the current should be either entirely discontinued, or the number of cells in use diminished. 10. There should be no interruption of the current during the application, and this should be gradually diminished and the circuit opened before withdrawing the electrodes. 11. The application should never be made in one's office, for the patient should always at once be put to bed and remain there for one week.

Baker has never found it necessary to make frequent applications. As a rule he waits a number of months after the first before repeating it. Only in one instance of the fourteen was he obliged to make three applications. Mundé's experience is in the same direction. In a case of large sub-peritoneal fibroid in which he tested electrolysis, puncturing through the vagina with the negative pole, and using a large abdominal electrode for the positive pole, although after two applications the patient refused further treatment, when he saw her about one year afterwards the tumor had disappeared. Freeman, of Brooklyn, is another advocate of electrolysis, particularly in case of interstitial and sub-peritoneal fibroids. He has treated eight cases,[1] and his conclusions[2] are as follows: "All, or nearly all, non-malignant growths of the uterus may be cured by electrolysis without endangering life, if taken at an early stage. I have not attempted to cure in this way those immense fibroids, measuring more than twelve inches in diameter. The kind and form of needle and the manner of introduction are of the greatest importance. That for the negative pole should be of steel, properly tempered, and strong enough not to break, insulated to within one-half or one inch from the point, the whole perfectly smooth and round, and brought to a fine point without any cutting edge. This needle may be passed through any of the tissues without harm, as it separates but does not divide them. It is to be passed through the abdominal wall into the tumor from the most convenient point, always avoiding the intestines and bladder, or, in case of post-uterine fibroids it may be passed through the vaginal wall into the tumor, making sure, in every case, that the un-insulated portion of the

[1] Supplement to Martin's paper read at the seventh annual meeting of the Am. Med. Ass., at Chicago, 1887.

[2] Personal communication

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needle is entirely buried in the morbid growth. Hydrogen gas collects at this pole and keeps the needle always bright. The positive pole should never be attached to the needle that is passed through the peritoneum into the tumor. It should be attached either to a platinum probe of large size, insulated and inserted well into the cavity of the uterus, or to a slightly curved and insulated platinum needle which is passed through the os uteri and thrust into the base of the tumor. A spring clamp should be used to connect the needles with the conducting wires so as to

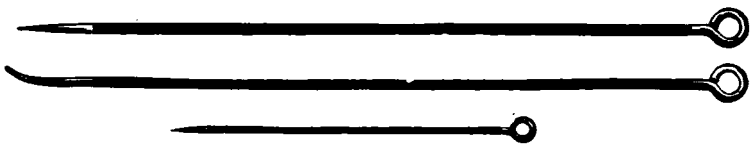

FIG. 25.—FREEMAN'S NEEDLES.

prevent frequent accidental openings and closing of the circuit. Sixteen to thirty ordinary zinc-carbon cells is as strong a current as I would advise, and from fifteen to forty minutes the limit of time. An anesthetic should always be used, though the patient may be kept very lightly under its influence after the needles are introduced and connection is made with the battery, as the pain is not severe except at the opening and closing of the circuit. It is better to give plenty of time between the operations than to be in too great a hurry. Once, or at most twice, between the menstrual periods is often enough, and in some cases too often.'

In Martin's paper,[1] three cases are recorded where satisfactory results

FIG. 26.—FREEMAN'S PROBE.

were obtained without puncture. He used a current of high tension and of small quantity, the negative electrode being placed in the rectum, vagina, or uterus, and the external, the positive electrode, on the abdomen in such a way as to cause the current to pass through the largest diameter of the growth.

Apostoli and Engelmann pursue a different method in the electrolytic treatment of fibroids. The practice of the former and the results ob-

[1] Loc. cit.

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tained have been described by Carlet.[1] Currents of very high intensity are used, the external electrode consisting of the layer of potter's clay to which we have already referred. In his choice of the internal electrode he is guided by the fact as to whether meno- or metrorrhagia is an accompanying symptom or not, the positive pole being internal, on account of its anti-hemorrhagic property, where hemorrhage is a symptom, but otherwise the negative. The internal pole chosen is introduced into the cavity of the uterus where possible; if not an opening is made into the tumor *per vaginam* by means of the negative pole and its caustic, derivative action is utilized. The séances are frequent in number, of short duration, and some time elapses before any special effect on the tumor is noted, but the method is said to be free from danger if the operator is careful in its application and proceeds slowly. At the time of the writing of Carlet's monograph the method had been on trial for two years. Absolute cure had never been attained, but cessation of or diminution in growth had frequently been noted. The method had then been tested in one hundred and eighteen cases, and since this number has been largely increased.

This method of Apostoli's has been accepted by Engelmann and he has utilized it with certain modifications. Since this method suggests itself as safer than that advocated by Cutter and Kimball, we cannot do better than insert here Engelmann's description of and remarks on the method as they appear in his recent monograph:[2] "Electrolysis proper is the typical treatment for the reduction of neoplasms, especially of uterine fibroids, in which we utilize both the polar and interpolar effect; the polar action of the metal catbode within the tissues of the growth, the most useful chemical effect of galvanism, and the catalectrotonic action, that of the current emanating in concentrated form from this negative pole, as it passes through the tissue and is dispersed upon the opposite surface in the large neutral electrode.

"We may also puncture from both sides, using a penetrating needle in connection with both the positive and negative poles. This is admissible in external growths readily attacked from all sides. In the case of uterine fibroids, intra-mural or sub-serous, I consider negative electro-

[1] Du traitement electrique des tumeurs fibreuses de l'uterus. Paris, Octave Doin, 1884.

[2] Loc. cit., p. 79 *et seq.*

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puncture *per vaginam*, through the tissue of the cervix if possible, by far preferable to puncture by both negative and positive electrodes through the vaginal and abdominal portion; I object to any puncture through the abdomen, unless the tumor be agglutinated to the parietes, on account of the most unnecessary danger and suffering which invariably accompanies this proceeding. The puncture of such a tumor through the cervical tissue, or even through the vagina, avoids the peritoneum and causes but very little pain. The current can be dispersed by a sufficiently large electrode upon the abdomen, so as to make the treatment very bearable and possible in the office, even if the highest intensities are used. If we puncture through the abdomen an anesthetic is necessary; the peritoneum and abdominal cavity are penetrated, and the danger of inflammation is at hand, as fluid is liable to exude into the cavity. This very serious risk accompanies the abdominal puncture in addition to minor dangers—such as the possibility of opening a large vessel—which we have equally in the vaginal puncture, but which seems to exist rather in theory than in practice, as I have seen no such results. The abdominal puncture assumes the dignity of an operation, necessitates anesthesia, and offers no corresponding advantages over the vaginal method. Among the comparatively small number of operations of this kind performed, cases of peritonitis, perimetritis, and death have occurred. If bi-polar electrolysis is desirable, this may be effected altogether through the vagina; but, as a rule, negative electro-puncture is advisable in preference to bi-polar electrolysis—the insertion of both positive and negative needles into the tumor *per vaginam*—because the pain and danger is diminished by one-half, one puncture being made instead of two.

"In electrolysis an intensity of from 50 to 250 milliampères may be used for from three to eight minutes. All possible precautions must be taken in the first sitting in order to discover any idiosyncrasy of the patient, and a current of 50 milliampères will suffice, attained by slow increase. The patient should lie down quietly for several hours after the application. If an intensity as high as 100 milliampères is used at the first sitting, it is preferable that she remain in bed for the first twenty-four hours, and that a cold compress or an ice-bag be placed upon the abdomen, to overcome any tendency to inflammatory reaction which may occur; hence the attention to details which is necessary, and the precautions desirable in a first puncture, until the sufferance of the individual

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patient is tested. I have used as high as 250 milliampères in my office, allowing the patient to return home in the street cars after an hour's rest; but such intensities must be attained only by gradual increase, and where we see any indication of inflammatory action the patient should remain in bed for a day or two, using the cold compress or the ice bag. The application is repeated according to the demands of the case and the severity of the treatment once or twice a week. Hemorrhage occasionally follows, sometimes soon after the treatment, sometimes not until six or eight hours have elapsed. This may be either from the uterine cavity, the fluidifying effect of the negative pole, or from a large vessel in the line of puncture, which has been temporarily closed by cauterization during the action of the agent.

"On account of the hemorrhagic tendencies of the negative pole, this treatment is only applicable in cases unaccompanied by hemorrhage—a frequent symptom of uterine fibroids; if scanty menstruation, dysmenorrhea, or profuse discharge be present, negative electro-puncture, though not contra-indicated, should be preceded by negative electro-cauterization of high intensity; the uterine sound attached to the negative pole within the cavity, the large plate of the positive dispersing electrode upon the abdomen; we thus achieve an absorbent electrolytic action upon the tumor, though in a less degree, and overcome the co-existing symptoms, favoring an increase of the catamenial flow, overcoming the endometritis, relieving the dysmenorrhea, if any exist. An intensity of from 50 to 100 milliampères should be used, or even 150 to 200 milliampères, if decided action on the fibroid is desired.

"In fibroids accompanied by menorrhagia or metrorrhagia this must be first overcome by positive electro-cauterization of the uterine cavity; a platinum sound as the positive pole in the uterus, a large negative dispersing electrode upon the abdomen. It must not be forgotten that when a metal electrode is used in connection with the positive pole in the tissues it must be of platinum or of gold, lest it be corroded and imbedded in the organ. If high intensities be used this is an absolute necessity; let this be remembered as applicable to the treatment of all possible affections. If the ordinary silver or copper probe be used in the uterine cavity as the positive pole, and a current of only 10 or 20 milliampères is passed, the instrument will be found fixed; and when we attempt to withdraw it after a few minutes, some force is requisite for its removal; if we

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then examine it we find the surface corroded, roughened, and darkened. This is due to the action of acids which accumulate at the positive pole. Should, by some oversight, a corrodable metal be used in this way, the current is gradually reduced and reversed, and, after a negative current of greater strength has been passed for a time, we can then withdraw the sound with ease. In case of hemorrhagic fibroids the positive electro-cauterization of the uterine cavity with the platinum sound, with a current of from 100 to 150 milliampères, should precede electrolysis proper or negative electro-puncture, until all unusual flow has been overcome. In this treatment of fibroids, where the highest intensities are used, we must apply the electric current with the utmost circumspection, taking into consideration all the accompanying conditions, those most to be guarded against being hemorrhage and inflammation.

"*Method of application.*—I will briefly recall what I have already said as to the method of application, since attention to the minutest details is necessary to success and to the comfort and safety of the patient. The consent of the patient must of course be obtained, as in case of any operative interference, and she should be given an idea of the treatment, that she may not be nervous and restless, but remain perfectly quiet during the action of the remedy. She may be promised that she will receive no shock, which embodies the idea of electricity to the laity, and is what ladies dread most; she can be assured that she will suffer no unbearable pain; that she will experience no discomfort whatsoever within, but that there will be a burning, not excessive, outside upon the abdomen. The corset is removed, the skirts loosened so that respiration may be free, and the abdominal plate, warm and well moistened in simple hot water, is snugly adapted. The patient takes her place upon a gynecological operating table or chair, in the dorsal decubitus, the thighs flexed precisely as for ordinary treatment. The electrodes needed are a gold or platinum sound of ordinary dimensions, and a needle or stylet of the same material (though the steel instrument may be used) well fixed in a firm handle; for puncture through the vagina, this instrument should be of a length equal to that of other gynecological instruments, sound or applicator; for both sound and stylet we must have a separate insulator of heavy rubber, better still of glass, which may be kept more thoroughly aseptic. The abdominal or dispersing electrode is a thin plate of lead or tin alloy, as large as it can be used upon the abdomen, averaging six by nine

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inches, covered with a thin layer of sculptors' clay, held in place by gauze, or with punk or absorbent cotton and a soft thin buckskin cover, which is equally good.

"The shape which admits of the use of the largest possible plate is the oval, or, better still, the modified form of my plate, oval with convexities to avoid the thighs. This electrode is thoroughly soaked in water as warm as is comfortably borne, and snugly adapted to the abdomen, that it may rest in place a few minutes before treatment is begun, the current then passing more readily, with less pain; the friction, as I may say, caused by the efforts of the electric current to pass the resistance offered by the dry epidermis being possibly a source of pain, certainly lessening the effect of the current by loss of intensity in overcoming the greater resistance. If this precaution is not observed, the operator will find an intense burning during the first few minutes, which lessens, however, as the tissues become soaked; the desired intensity having been attained, notwithstanding that no more cells are inserted into the circuit, the galvanometer will indicate an increase in high intensities of as much as 10 milliampères, and yet the pain lessens decidedly if the positive be the dispersing pole. I have seen it rise from 50 to 100 milliampères, without augmenting the number of cells, when the abdominal plate had not been placed until the last moment, so that the dry epidermis offered a resistance at first difficult to overcome. In other words, when the epidermis becomes soaked, less resistance is offered, more electricity passes, and if the positive be the dispersing pole the pain is lessened by the anesthetic effect of the pole, diminished at times to a minimum, though the intensity of the current be increased. Before placing this plate we must examine the abdomen to see if it shows any abrasions or excrescences; if so they may be covered with a small piece of oiled silk or plaster, as such a spot would be the centre of intense pain if not guarded. An abrasion, a small blister where the epidermis is removed, centres upon itself much of the electric force, which always seeks the best conductor; or if an excrescence, the increased pressure would cause a concentration of the current at this point. The plate having been placed, it is covered by a warm dry towel, or a piece of oiled silk, to guard all garments in contact with it from moisture, which may lead to serious colds, to injury as well as mere discomfort.

"The stylet or sound, whichever is to be used, is steeped in a strong

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antiseptic solution, as is also the glass or rubber insulator; the vagina also should be cleansed. For electro-cauterization, the sound, covered up to two inches of the point by the insulator, is introduced into the uterine cavity with the utmost care; if possible it is preferable to introduce the sound by the sense of touch. If the stylet is used for electro-puncture, the point of entry having been carefully decided upon, the instrument is introduced, the point guarded by the index finger of the left hand, the handle grasped firmly by the right, counter pressure being made upon the abdominal protuberance. The puncture is then made for a depth of from one to three inches, according to the size of the tumor, the insulating cover is moved close against the vaginal and cervical membrane, and care must be taken that the entire surface of the instrument not in action is guarded. The activity of the battery is now tested, the rheophores are attached to the electrodes and the screws firmly bound; the galvanometer needle must point directly to zero. The abdominal plate, evenly adapted everywhere, is held down with gentle pressure by the hands of the patient, while the operator either fixes the sound or stylet with an absolutely steady hand, or rests it upon some suitable support, as the slightest motion, any jarring of cords or battery, in portable batteries, must be avoided. The patient must breathe evenly and steadily, and allow her hands to follow the respiratory heavings of the abdomen; we must see that the thighs nowhere touch the edge of the electrode, and if perchance the probe is to be passed through a speculum the slightest contact of its metal surface with the pole must be avoided. When any pain or discomfort that may have been caused by the introduction of the instrument has ceased, the current is established and gently increased, in the first sitting, in the course of a minute up to 50 or 100 milliampères; later, when the sensibilities of the patient have been tested, 150 to 200, and even 250 milliampères may be attained in the same time. For very sensitive patients I use the water rheostat, by means of which we can attain the desired intensity, increase and diminish the current without even the slight shock caused by the addition of element after element; a resistance of 500 or 1000 ohms are inserted, the number of cells probably needed thus brought into action, and the intensity gradually attained by decreasing the resistance in the rheostat; for the breaking of the current the resistance is increased until it surpasses the intensity of the elements in the circuit.

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"The first sitting should not be continued beyond five minutes, the current remaining at its height three minutes, then being slowly reduced. Currents of 200 milliampères I have continued for eight minutes in later stages of the treatment. During the passage of the current the operator must constantly observe both the galvanometer and his patient. The needle should remain perfectly steady; during the first minute it will show an increase of a few milliampères, but there must be no oscillation which indicates jarring or shock. The face of the patient and the galvanometer must be constantly observed, and the operator must be on the lookout for any evidence of irregularity: a momentary contact of sound and speculum would produce a terrific shock. If the bare sound should touch the vaginal membrane it would burrow its way and leave a grayish bed; if the thighs touch the edge of the abdominal plate, which must always be covered by the overlapping conductor, an intense burning is experienced; if not so covered, a shock; and these shocks are trying if not dangerous with such intensities. The most intense shock is caused by a carelessness, of which no one who ventures upon this treatment should be guilty, the sudden breaking of any one of the connections in the circuit, the dropping of the rheophore from the binding post at the battery or from the electrode, or the moving of one of the switches of the battery. In a portable battery, especial care must be taken lest disturbance be caused, the slightest jar of the battery causing undulations of the current and shock. At the point at which the stylet is inserted, a grayish-yellow foam will accumulate, its mass depending upon the intensity and duration of the current.

"After the full intensity has been attained and continued as long as seems necessary, the current is slowly reduced from cell to cell, with the utmost evenness and gentleness, and the circuit opened when at 0. If the patient be very sensitive we may diminish the current by slowly increasing the resistance by the water-rheostat. When the current has been broken the rheophores are detached and the active inter-pelvic pole is first removed, with the utmost caution; the abdominal plate is then taken off, the speculum inserted, and the vagina cleansed.

"I am in the habit of dusting iodoform over the cervix, and inserting a tampon of salycilated or borated cotton; in case of puncture I use the styptic iron cotton directly upon the point of attack, and pack it firmly to counteract the possibility of hemorrhage as far as possible. The

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patient should then lie down or go to bed, if at her home, and if not, as soon as she reaches it; but in all events she must rest in the office long enough to thoroughly dry her garments, which are more or less moistened by contact with the electrodes, notwithstanding all care; in cold weather this precaution must be invariably observed, as serious injury may follow neglect. A twenty-four hours' rest is generally all that is needed, but in individuals more susceptible it is well that they use the ice-bag upon the abdomen and remain in bed several days. The inflammatory swelling which sometimes follows is thus best counteracted and most rapidly reduced; but even when it does occur, I have never seen it accompanied by constitutional disturbance or elevation of temperature.

"The puncture should if possible be made through the cervix into the mass of the tumor; if the first is above the os, the next should be below, followed by one to the right and then to the left; if this is not feasible, we seek the point of greatest projection, towards the vagina, avoiding the peritoneum. In some cases a gush of blood, very profuse while it lasts, but not of long duration, may take place within the ten hours following the application, and the patient must be forewarned that she may not be alarmed. The firmly packed iron cotton tampon is the best preventive, but the hot-water injection should also be recommended, as the patient will be much better satisfied to have some means at hand to counteract this apparently threatening symptom.

"I have entered so fully into the mechanical details of the treatment to recall them distinctly to mind, as they are absolutely essential in these cases, and will serve as a guide in all other applications, and once understood I need not enter again and again upon the same points.

"We must always warn the patient of what is coming; we must first apply the dispersing electrode to the abdomen, thoroughly moistened with warm water; we must have the intra-pelvic electrode aseptic, and introduce this with the greatest possible gentleness; we must thoroughly insulate all but the active portion of the instrument, avoiding metallic contact with vagina, vulva or speculum, and never establish the current until all intra-pelvic disturbance has ceased, always increasing the current very gradually, avoiding all pain at the site of the active pole, bearing in mind this most important and invariable law in gynecological electrotherapeutics that *the intra-uterine or intra-pelvic pole must never cause pain; in fact, should not be felt;* upon the site of the abdominal dispers-

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ing pole the burning can be lessened by increasing the size of the electrode. All shock must be avoided; the connections made before the current is established, and not severed until after it is broken.'

Beyond this minute description of this method, which we borrow from Engelmann, because he has practically worked it out under the guidance of Apostoli's experience, we are unfortunately in a position to make no positive statement. That the method, when attention is paid to minute detail, is not dangerous or very painful may be accepted as true, and in this respect it has the advantage over double puncture through the abdominal wall. What is wanted, however, is comparative evidence from a large number of observers that the method is effective, and this evidence is not as yet at our disposal. It is not claimed for the method that it will cause the disappearance of the tumors, but only that by means of it the growth of the tumor may be arrested, diminution in size acquired, and the symptoms palliated. If such is the fairly uniform result then obviously this method of electrolysis should be ever tested before subjecting a patient to that most dangerous of all abdominal operations, where the tumor is large, hysterectomy, as also before resorting to removal of the tubes and ovaries for the purpose of inducing early menopause and thus indirectly affecting the tumor. The method has the advantage over the injection of ergot in that, to judge from the reported cases, the effects are more speedy as regards palliation of the symptoms. The time is premature, however, for any further expression of opinion, and will remain so until gynecologists are educated up to the use of such high intensities as Apostoli and Engelmann claim are a *sine qua non*. So far as we are aware no deaths have been reported after the use of this method, while a number are directly traceable to that which is advocated by Cutter, Freeman and others, a method which it should be stated has never inspired much confidence in the profession and in regard to which many of the leading gynecologists have pronounced themselves as opponents.

Ovarian Cysts.

The electrolytic treatment of ovarian cysts has been described and practically tested in particular by Fieber, Von Ehrenstein, Ultzmann, Semeleder, and Mundé, and to the latter we are indebted for an elaborate analysis[1] of the recorded cases and for the deductions which have rele-

[1] Trans. Am. Gyn. Society, Vol. II.

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gated the practice to its proper sphere in surgical gynecology. Semeleder has proved himself one of the most enthusiastic of the advocates of the method, and, were it not that there is a safer method of treatment for these cysts, the cases which he has recorded would justify its general acceptance. In his papers[1] to which we have had access he has reported twenty-seven cases, seventeen of which were completely cured. Similar results, however, have never been obtained by other operators, at least they have not published, for Von Ehrenstein has never substantiated his claim, that of several hundred ovarian cysts subjected to electrolysis nearly fifty were cured. In Mundé's monograph fifty-one cases are collected and analyzed with the following results: Cures, twenty-five; permanent improvement, three; temporary improvement, four; negative result, six; peritonitis with recovery, four; deaths, nine. While no one will question the possibility of curing ovarian cysts by subjecting them to electrolysis, the question to-day is as to whether the method has advantages over ovariotomy when considered in the light of possible dangers and of mortality. When Mundé's analysis was made he was able to draw the following comparison between the two methods: "Notwithstanding these undoubted cures the percentage of success of oöphoro-electrolysis (55 per cent.) compares unfavorably with that of ovariotomy (70 to 80 per cent.); Spencer Wells 78 per cent.—in 1876 as high as 91 per cent.; and so also do the deaths by electrolysis (17.6 per cent.) nearly equal those following ovariotomy in recent years (20 to 30 per cent., to 22 per cent.), and far exceeding those occurring in the last series of fifty-five cases of Spencer Wells." In the nine years which have elapsed since these comparative statistics were given the mortality rate from ovariotomy when performed with the requisite precautions has sunk so low that it has become an operation which *per se* carries with it scarcely any risk at all, except in the highly unfavorable cases in which *à priori* no better result could be predicated from electrolysis. While resort to the method, therefore, cannot by any means be considered unjustifiable, it is none the less true that but few operators of to-day would sanction it in preference to ovariotomy.

The technique of electrolysis as applied to ovarian cysts does not differ from that usual in other instances where it is resorted to. Semeleder favors steel needles and punctures with the positive pole, applying the

[1] New York Med. Journ., June, 1876, and Am. Journ of Obst., July, 1882.

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negative at some distant part of the cyst. In the instances which he treated the number of séances requisite was from six to one hundred and three, and the treatment extended over from one to nine months. Those who care to test the method, therefore, must supply themselves beforehand with a plentiful stock of patience.

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CHAPTER IV.

ELECTRICITY IN OBSTETRICS.

ELECTRICITY has never been utilized in obstetrics to the extent to which *à priori* it would seen to be entitled. In treatises on the art reference is here and there made to its value, but the impression ordinarily given to the reader is that however useful the agent might be there is rarely an opportunity to prove this, seeing that the apparatus is not at hand when needed. A glance through the literature of the past few years, however, should serve to prove the advisability of the obstetrician having the agent ever at his disposal, for the multiplied experience of individual observers certifies to the fact that in certain of the complications of labor electricity ought to appear as an adjuvant far more frequently than it ever has. Seeing that the current which it is usually desirable to use is the faradic, the chief objection, hitherto brought against it, that the agent is not at hand when needed, does not hold, for there are a number of induction machines to be obtained to-day which are so small and compact as to be readily carried in the ordinary obstetrical bag. The Gaiffe and its modifications occupy but little space and may be very speedily set in action. A very convenient instrument is the Stanley faradic battery, since it is so readily handled without the annoyance of spilling the fluid. The current may be applied either with one electrode against the cervix and the other over the abdomen or sacrum, or else with one electrode over the abdomen and the other over the sacrum. Baird, of Texas, who is an earnest advocate of the use of electricity in obstetrics, has found the following method advantageous: A copper plate 1¼ inches wide and 5 inches long, covered with a wet napkin, is placed over the sacro-lumbar region and connected with the rheophore which belongs to the positive pole. The rheophore from the negative pole is attached to a wrist electrode worn by the accoucheur, so that by means of his hand, which closes the circuit over the patient's abdomen,

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he is able to note the effect of the current on the uterus.[1] The current may further be utilized by inserting one electrode into the rectum, a method which is peculiarly applicable to ectopic gestation.

In resorting to electricity during labor it may be generally stated that it is advisable to use a mild current and to take the precaution not to pass the current through both poles of the fœtal ovoid. The applications should be intermittent, even as are the normal uterine contractions. The current thus applied cannot be considered dangerous either to the mother or the fœtus, and it will usually evoke or re-enforce contractions.

In considering the applications of electricity in obstetrical practice it will be convenient to make two chief divisions of the subject: Electricity in ectopic gestation, and electricity as an oxytocic. It is unnecessary to do more than note the fact that the agent may prove of utility in allaying the nausea and vomiting of early pregnancy.

Electricity in Ectopic Gestation.

The earliest record of resort to electricity for the purpose of destroying the fœtus developing outside of the uterus is in the year 1853 when Bachetti and Burci used electro-puncture with the faradic current and successfully arrested gestation in the left Fallopian tube.[2] About thirteen years later Braxton-Hicks tested faradization in a case of abdominal pregnancy, of three and a half months' duration, then resorted to puncture of the cyst *per vaginam*, and the patient died a few days later from internal hemorrhage. In 1869, Allen, of Philadelphia, resorted to faradization in a case of abdominal pregnancy at the fourth month with success, and since this date the method may be said to have gradually gained ground, until to-day it has become the accepted procedure in instances of early ectopic gestation. It should be stated, however, that resort to electricity in this connection has remained almost entirely limited to this country. European obstetricians, with the exception of a few English, have held aloof from the method, preferring that by puncture of the cyst or the injection of narcotics, or latterly the very radical means of laparotomy for the removal of the sac (Veit, Tait, Martin, and others). In

[1] Am. Journ. of Obst., July, 1885, p. 741.

[2] For full report of this and the following case see Garrigue's article in Vol. VII. of the Trans. Am. Gyn. Society.

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this country, however, instances have multiplied so rapidly that in the neighborhood of fifty are now on record where electricity has been used with success in ectopic gestation, and at one time or another our most distinguished obstetricians have expressed their belief that it is the safest of all methods of treatment applicable to the anomaly in its early stages. The method indeed would need no defence, and at this date no lengthy exposition, were it not that latterly, owing to the strong operative tendency of the times, there appears to be a desire to substitute laparotomy for it, a substitution for which, it seems to us, in face of the recorded successes from electricity and the greater risk of laparotomy, there is no justification. Thomas, of New York, who has had such an exceptionally large experience in cases of extra-uterine pregnancy, states:[1] "The growing triumphs of abdominal surgery are apt to lead to the conviction that laparotomy should as a rule be the procedure of election in these cases. From this view I unqualifiedly dissent. In the electric current we appear to have an infanticide agent of reliable character, and, as in the woman, as Leopold has proved to be the case in the rabbit, the retained fœtus seems to be readily dealt with by the absorbent process of nature, this should be in the early months of pregnancy (I should say up to the fifth month) preferred to the more radical and dangerous procedure of laparotomy." In another paper the same gentleman says:[2] "It (electricity) has these great advantages; if an error of diagnosis has been made, this remedy will do no harm; if the diagnosis be correct, experience proves it to be sufficient in its effect; it is almost painless, and causes none of the nervous disturbances created by a cutting operation, and it requires no surgical skill in its use."

The objections which have been urged against resort to electricity are two in number. In the first place there is liability to rupture of the cyst, and, in the second place, we kill the fœtus and then leave it within the maternal abdomen where it may at any time suppurate and give rise to septicæmia. Both of these objections are purely theoretical, seeing that in the large number of cases in which electricity has been resorted to rupture of the sac has never occurred, nor, so far as we can find any reference, has the dead fœtus become a source of danger to the mother. The only case which would seem to speak against electricity is the one

[1] Trans. Am. Gyn. So., Vol. IX. [2] *Ibid*, Vol. VII.

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recently reported[1] by Janvrin, of New York, and for this reason we record the essentials here. It concerns a case of tubal pregnancy at about the seventh week, where a delay in the application of electricity was necessitated by the fact that the doctor had engagements out of town; on his return the patient was told about her condition, and that it would be necessary to resort to electricity for the destruction of the fœtus. To quote from the report, "While explaining to her what should be done, she was seized with intense pain in the right hypogastrium, severe vomiting, cold clammy perspiration, extreme pallor and rapid pulse, in fact the usual symptoms of collapse from shock. Hypodermics of morphine and brandy were given at once, and hot applications to the extremities, and after a couple of hours reaction began. I attributed the symptoms to nervous shock, partly the result of the first onset of colicky pains, and partly the result of mental excitement. I could hardly believe there had been any rupture of the sac, although the pallor and faintness seemed to indicate a loss of blood. During the night reaction came on gradually, and by morning there was considerable tenderness over the site of the sac, a rise in temperature to 101°, pulse 116, and still rather feeble, and slight tympanites. There was evidently some inflammation of the tube and broad ligament; but as the patient was gradually recovering from the shock, and the bleeding, if any had occurred, had ceased, the demand for laparotomy, which I had thought the previous evening would be called for within twenty-four hours, had passed for the time being." The localized pelvic inflammatory trouble yielded in a few days, and after consultation it was decided to resort to galvanism to destroy the fœtus. "On the 15th at 4 P.M., the first application was made, Dr. Rockwell applying the positive pole to the abdominal wall, over the site of the tube, and directing the amount of current, while I applied the negative pole *per vaginam*, to the lower part of the growth. Dr. Rockwell writes me as follows in reference to the current: "On account of the localized peritonitis that was supposed to exist, a rheostat was made use of in all the applications, so that the current might be increased to the maximum strength used without interruption, and consequently without shock, and in the same way gradually decreased. The highest strength of current used was about twenty volts," and each of the applications consumed ten minutes. I

[1] Trans. Am. Gyn. So., Vol. XI.

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will add here that this was the twelfth case of extra-uterine pregnancy in which Dr. Rockwell had made use of galvanism to destroy the fœtus, and in all of the other eleven cases the result had been perfectly successful both as regards the mother and the child. The application was repeated on the 16th and 17th. The fœtus was probably killed by the first application, but the two following were made use of simply to make its death perfectly certain. The patient was in good condition and spirits, and during the night of the 17th slept perfectly well, and awoke on the morning of the 18th feeling much refreshed. She had been kept in bed and perfectly quiet since the 9th (the day upon which she had experienced the severe shock), and was guarded very carefully in all respects, so as to avoid all exertion on her part. If there had been any hemorrhage on the 9th it was thought that sufficient time had elapsed between that date and the 15th to allow the surface to heal before galvanism was resorted to. The tenderness and other symptoms of peritonitis had passed away, and all the symptoms seemed favorable for a speedy recovery. Suddenly, at 9 A.M. of the 18th, she complained of feeling very weak, became cold and very pale, and the pulse extremely weak. The nurse immediately sent a messenger for me, but an hour elapsed before I was found and reached the patient. In the meantime a neighboring physician had been called, and he had made use of all the usual means for rallying the patient, but within an hour succeeding the appearance of the symptoms of hemorrhage death had taken place." At the autopsy the sac was found intact, with two large arteries crossing its anterior surface, and a number of smaller branches radiating from them. One of these branches had ruptured at the time of the first appearance of shock, and from this the secondary hemorrhage had occurred to which the patient had succumbed.

The important question to be answered in the above case is as to what share, if any, the application of electricity had in causing the secondary hemorrhage. We believe that the electric current can hardly be held at all accountable, seeing that it had not been used for eighteen hours prior to the occurrence of the secondary hemorrhage, and this is the opinion expressed by Janvrin in regard to the case. There is, however, a clear moral to be drawn from the report, and this is that stated by Janvrin: "In cases where a moderate hemorrhage has been positively diagnosed (whether from a rupture of a superficial artery or a venous plexus, or

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from a partial rupture of the sac itself), and this rupture has occurred prior to the termination of the fourth month of gestation, it is undoubtedly better surgery to perform laparotomy at once, and thus remove all possible danger of further hemorrhage, than to trust to electricity in any form." These instances, indeed, may be taken as *per se* contra-indications to resort to electricity, and we question if there are any other valid reasons why the agent should not be used.

Abundant testimony in favor of electricity in the treatment of ectopic gestation might be here inserted, but it is unnecessary to do so since American obstetricians will nearly as a unit support the following proposition: Prior to the fourth month of gestation, in the absence of symptoms pointing to rupture, electricity is the agent *par excellence* in treatment, being safe, effective, and neither at the time of application nor afterwards subjecting the woman to special risk. When laparotomy has become so safe a procedure that all women subjected to it recover, then it will be time enough to follow the course advocated among others by Tait and Martin and remove the cyst as soon as it is discovered.

The use of electricity in ectopic gestation being considered as amply justified by its fruits, it remains to speak of the preferable current and of its manner of application. Either faradism or galvanism may be used to kill the fœtus. The former is decidedly more convenient seeing that the apparatus is more portable, but it has the disadvantage of not being so pleasant to the patient in that it shocks her. It has been used successfully by Allen, Garrigues, Lusk, Reeve, Landis, and others. The interrupted galvanic current has been resorted to by Mundé, B. Emmet, McBurney, and others, but in Mundé's case it is questionable if the rapid interruptions were not responsible for the deep shock into which the woman was thrown for a number of hours. Rockwell, however, favors this current, and in all his cases he has used it in the strength of from ten to twenty milliampères. He believes that "there may be an advantage in its rapid increase by means of a rheostat. In this way the chemical and the physiological effects are greatly increased, without the disagreeable effects and even the danger that might accompany an interruption of the same strength of current. The danger to be apprehended from an injudicious application of the faradic or the interrupted galvanic current is the possibility of rupturing the over-distended tube."[1] This pos-

[1] Am. Syst. of Gyn., p. 406.

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sibility, although such has never as yet resulted, should ever be borne in mind, and therefore we question if it be not wiser to use the continuous current alone, aiming at the desired result rather through electrolysis than through actual shock or this combined with the electrolytic action. Rockwell further claims that galvanism is preferable to faradism since it is more certain in action and more penetrating, and also since it has greater influence on the process of absorption. No one, however, should be deterred from resorting to faradism in the absence of a galvanic battery, and it should be stated that in at least six cases a one-celled faradic machine was sufficient to destroy the fœtus.[1]

An important question to be still answered is as to whether electricity should be resorted to in ectopic gestation when this has advanced beyond the fourth month. Hitherto this has been about the limit of its application, and Thomas considers that at this period laparotomy, or, if the tumor be low in the pelvis, elytrotomy, is preferable to electricity, which after the fourth month leaves a fetus of considerable size to undergo absorption. It may be fairly assumed that the fœtus can be killed by electricity as well after as before the fourth month of gestation, and it will probably be uniformly granted that in cases of ectopic gestation we are fully justified in taking no account of the life of this fœtus, seeing that it is growing outside of its normal place to the imminent risk of the mother. The point to be settled then is as to the relative risk of laparotomy and from leaving such a large body as the fœtus is after the fourth month to be absorbed within the mother's abdomen. Garrigues answers this question as follows: "In order to form an idea if it would be advisable to attempt the destruction by electricity in the middle and last part of extra-uterine pregnancy, we must consider the chances for mother and child if we let pregnancy go on unchecked. The cyst may burst at any time, and, although not absolutely fatal, this accident jeopardizes in the highest degree both lives concerned. Laparotomy may be undertaken at the end of thirty-two weeks, when the child is viable, as recommended in abdominal pregnancy by Gusserow, or in the tenth lunar month as preferred by Litzmann. But how miserable the prospects of success by these operations are appears from the excellent article of the latter, in which he has collected ten operations performed while the fœtus was living. Of these ten only a single mother (Jessop's case) recovered, and

[1] See Garrigues' article, loc. cit.

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only four of the children survived, if, by a surviving child, we understand one who lives more than a few hours or days. To Litzmann's list may be added a case of Lawson Tait's and one of Neftel's of Stockholm, both ending in the loss of the mother and the recovery of the child. Thus it would seem that there is a small chance for the child and hardly any for the mother to be saved by the operation at or near term. On the other hand, Litzmann has collected thirty-three cases of laparotomy after the death of the child, of which seventeen, or more than one-half, recovered. Would it not, therefore, be not only justifiable, but wise and humane, if possible to kill the fœtus by electricity, whatever its degree of development may be? We know that there is a fair chance that it will be entirely absorbed, except the bones, or become mummified. Among many other cases I shall only quote two recently observed by Matthews Duncan in which the fœtal heart was audible. The fœtus died before it had reached the term of viability, and both patients were well at last accounts. But even if the worst should come to the worst, and the fœtal sac suppurate, causing septicæmia, there would still be a fair chance of recovery by laparotomy, and at all events, an infinitely better chance than by laparotomy performed during the lifetime of the fœtus. The chances will even be better than in those cases in which suppuration sets in after the end of gestation, for the smaller the fœtus and its envelopes the less trouble is to be anticipated."[1]

Although, so far, Garrigues stands practically alone in his advocacy of electricity at a later stage of gestation than the fourth month, it must be granted that the argument, as he puts it, is a very forcible one. The risk to the mother unquestionably increases as the fœtus approaches term, and should the sac not rupture at this time when the attempt at labor is made, the likelihood of absorption of the fœtus with safety to the mother is probably less than when the fœtus had not attained its full stage of development. The answer to this question, however, must be left to the future. Expectation after the fourth month has certainly not yielded results at all to be proud of, and seeing that the ectopic fœtus may strictly be looked upon as an ill-omened parasite, the conclusion may become general that it is proper to kill it at any stage of its development when by so doing the risk to the mother is at all lessened.

As for the manner of applying electricity to the sac, this should always

[1] Loc. cit., pages 215, 216

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be looked upon as an operation which may be followed by shock, and therefore it should be instituted only at the patient's house, or in a hospital where rest in bed is practicable. It is customary to apply the negative pole against the cyst either *per rectum* or *per vaginam*, according as it is better accessible by one or another of these channels. The ball or olivary electrode will answer very well for the internal pole, while the external, positive, electrode should be placed on the abdomen as nearly as possible over the cyst. While the fœtus may be killed at the first sèance, it is advisable to pass the current daily until diminution in the size of the cyst and cessation of the signs of pregnancy vouch for the fact that the desired aim has been attained, and further when the galvanic current is the one employed, absorption is unquestionably favored by repeated recourse to it.

A possible result from the use of electricity, to which reference should be made, is the conversion of an ectopic (interstitial) gestation into a uterine.[1] This is hardly likely to occur, however, in any other variety of ectopic gestation.

Electricity as an Oxytocic.

In passing to the second division of our subject, which, broadly speaking, concerns the utility of electricity as an agent for re-enforcing or awakening uterine contractions, we are justified in taking for granted the acceptance of the statement that electricity is able to cause contractions of the uterus, either indirectly through the effect of the current on the nerve centres which innervate the organ, or else directly through stimulation of its muscular substance. On this point there seems to be no scope for difference of opinion. The question to be settled, tersely stated, is this, Has electricity any advantages over the routine methods at our disposal in those conditions in which stimulation is called for? If it has not then it is scarcely worth the obstetrician's while to burden himself with an additional instrument; if it has, then, in view of the fact that in certain emergencies even the most reliable means may fail, any number of additional ones should be welcomed.

It would be a thankless task to burden these pages with a record of the diverse opinions which have been expressed in regard to the utility of electricity as a means of stimulating the uterus to contraction or of

[1] Mundé: Appendix to Cazeaux and Tarnier.

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restoring tone to it when its energies are flagging. We will consider the subject rather from its clinical than its theoretical side, in connection with the two conditions in which electricity may *à priori* claim to be indicated, and particularly in comparison with those measures which are matters of accepted routine.

The two conditions in which we are called on to re-enforce or awaken uterine contractions are: Uterine inertia, the induction of premature labor.

Uterine Inertia.—This condition, broadly speaking, may be present during either of the three stages of labor, or may follow at a variable interval on the completion of the third stage. We will briefly consider the cause of the inertia during these separate periods, and thus endeavor to deduce the indication, if it exist, for resort to electricity.

During the first stage of labor, under the usual normal conditions, that is to say, given a parturient canal of sufficient size, a fœtus presenting favorably, and the absence of pathological alterations in the soft parts, a prime cause of ineffective uterine contractions is exhaustion of the parturient. What is needed here then is rest for the uterus rather than stimulation. In this stage, therefore, resort to electricity will as rarely be called for as, in the opinion of leading obstetricians, are other oxytocics, such as massage and ergot. In this stage, while the labor is otherwise progressing normally, time and patience will be of greater advantage to both the mother and the child than resort to any uterine stimulant. In the second stage of labor the conditions are somewhat different. Dilatation of the cervix once completed, it may be considered of positive advantage to end the labor as soon as possible without resort to means which are meddlesome or fraught with danger to either the mother or the child. Here then stimulation of the uterus and of the abdominal muscles, while of direct assistance to the parturient, is not at all open to the charge of interfering with the natural forces, but on the contrary, may be looked upon as a desideratum. At this juncture then we may properly consider the value of electricity in comparison with other means of assisting the mother. Resort to ergot is common enough still during the second stage, notwithstanding the fact that prominent obstetricians reject the drug prior to the completion of the third stage of labor. Unquestionably ergot will re-enforce the contractions, and will not always by any means be attended by those tetanic contractions which imperil the

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life of the child, or, after its birth, may interfere with the due completion of the third stage of labor. In view, however, of these possible consequences, it seems wiser to reject ergot in the second stage. Massage and compression of the uterus are further means, and, in general, effective ones, of re-enforcing the contractions during the stage of expulsion. The method by massage and compression, however, is tedious, and the compression, if persisted in, becomes annoying to the patient. Electricity, on the other hand, is not open to the objections which attend the use of ergot. None of those who have used it, as far as we have been able to discover, have found that the agent tetanizes the uterus, and so far from the patient complaining of the applications, she will often crave them, for exceptionally it seems as though they took the edge off the pains. This latter point is one on which Baird[1] lays considerable stress, although we have personally not noted this sedative effect, nor does it seem to have especially impressed other observers. This gentleman states that "whenever the pains are of sufficient severity to cause considerable distress, I make *them a pretext* for the use of the faradic current, at the same time promising the patient *some* relief from her sufferings, but without explaining to her or her friends all the benefit which I expect her to derive from its use. In making the application to relieve pain, I pay no regard to the stage of the labor. Too much care cannot be exercised here in making the application to the abdomen not to use too small an electrode," else, the current being localized, painful contractions of the abdominal muscles are at once produced. "At first a current barely strong enough to be perceptible to the patient is generally sufficient, and it can be gradually increased if necessary. I then keep the circuit closed until sedation is obtained." It seems likely, then, that in addition to re-enforcing the expulsory pains through resort to electricity, we may spare the patient suffering, an advantage which no other oxytocic means at our disposal possesses.

During the third stage of labor it is questionable if electricity properly finds a place. When the uterus is given time, as it should be, to rest and recover tone after its efforts, under normal conditions judicious expression is all that is needed to complete the stage, and so long as there are no indications, the chief of which is hemorrhage, for active

[1] Loc. cit., b. 479, 480.

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spurring of the organ, it is a sound rule to leave it alone, that the placenta may have the opportunity to separate normally. In the event of inertia and hemorrhage during this third stage, the faradic current will very likely evoke contractions, but the preferable indication then is to proceed to the manual removal of the afterbirth, a step which of itself will often cause uterine contractions. If it should not, the placenta having been removed, we are in the presence of inertia after the completion of the third stage, that is to say, post-partum hemorrhage is either a fact or is imminent, and in this complication electricity must take high rank as an adjuvant in treatment. It cannot, however, be depended upon alone to the exclusion of other recognized methods, for the fact must be emphasized that, although occasionally the uterus responds instantaneously, as it were, to the faradic stimulus, in other instances the action is too slow to meet the emergency, and in others still it may fail altogether. Often again, where the uterus contracts under the influence of faradism, it relaxes at once when the circuit is broken. The agent, hence, is one not to be depended on in this emergency, except in conjunction with other well-known means.

To summarize then the facts in regard to the value of electricity during labor, as they present themselves to us from a careful study of the contributions to the subject: The agent may be considered a valuable aid to the parturient during the second stage, in that by means of it we are able to assist the expulsory forces, and there is reason further to believe that a certain amount of sedation is exerted; during the first and the third stages of labor there are means at our disposal for assisting the parturient which better fulfill the indications, that is to say, rest during the first stage, expression during the second stage; after completion of the third stage, in the presence of more or less inertia, electricity may be looked upon as a decided adjuvant to the routine methods at our disposal, but it cannot be depended upon alone to avert an impending or to check an existing hemorrhage.

It is but just to state that in reaching these conclusions we have endeavored to draw a happy mean between those observers who are enthusiastic in regard to the value of electricity in labor and those who can see no good in it. The diversity of opinion is very striking among practical obstetricians. Thus, to refer only to the views advanced of later years, Playfair, in discussing Kilner's paper on the induced current dur-

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ing parturition,[1] said that he had tested the current and it had proved a failure, possibly because he lacked the special skill, and that if special skill were needed, it could not be generally used. He had found its effects in diminishing pain slight, and not to be compared with other means at our disposal. He considered it useless as an oxytocic. On the other hand, Murray, of New York, has treated over fifty cases of uterine inertia by means of the faradic current and with uniformly good results; Tripier and Apostoli are strong advocates of faradization; Robert Barnes states[2] that by means of electricity the uterus can be made to contract, when it resists the influence of what may be called "the diastaltic remedies," although he cannot rely on the agent in that its effects are not always permanent, an objection which is applicable with peculiar force to its utility in case of post-partum hemorrhage; Lusk says that "probably the faradic current is a most efficient agent in securing contractions of the uterus," but then it is rarely on hand when needed; finally Baird, who has used electricity in obstetrics to a greater extent than any one in this country, claims that the agent "stands unrivalled as an oxytocic." In his hands it has subserved the following purposes: 1. To modify the pains of labor; 2. To favor a more rapid dilatation of the os; 3. To promote more vigorous uterine contractions; 4. To add tone and strength to all the muscles engaged, and increase their power of doing work; 5. To abridge the time occupied by the labor; 6. To prevent shock, exhaustion, and post-partum hemorrhage; 7. To insure contractions of the uterus in cases of instrumental delivery; 8. To arrest hemorrhage and accelerate labor in cases of placenta prævia; 9. To prevent an undue expenditure of nervous force, in all cases of debility from whatever cause, thus leaving the patient in a condition to secure a speedy and favorable convalescence.[3]

In regard to the variety of electricity which may prove of service in the condition which we have referred to, there can be question simply of faradism, since, as we have stated, this is the only variety which the obstetrician can be expected to have with him in the immediate emergencies of labor. Fortunately, this is the very current which is most likely to fulfill the indication, and if it should fail, there is no ground for think-

[1] Transactions London Obstetrical Society, 1884.
[2] System of Obstetric Medicine and Surgery, p. 595.
[3] Baird, loc. cit., p. 744.

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ing that galvanism would answer. The methods of application we have already spoken of, decidedly the most convenient being to give the patient one electrode, hold the other in one hand, and complete the circuit by means of the other, grasping or massaging the uterus through the abdomen.

The Induction of Premature Labor.—In our systematic treatises on obstetrics electricity is hardly recognized as an agent deserving of serious consideration among the means to be resorted to for the purpose of inducing labor. Lusk, for instance, classes it among the methods which are not entitled to anything more than mention as having been suggested; Schröder ranks it with the agents which have only a historical value; Playfair says that it is a means too uncertain to be relied upon, and that it is irksome both to the patient and the practitioner; Barnes, after testing it in three cases, while he succeeded in inducing labor, found the method tedious and sometimes distressing to the patient. Notwithstanding these views, a number of instances have of late years been reported, which seem to speak quite strongly in favor of this method of inducing labor. Bayer,[1] from his experience in eight cases, claims that electricity is the best, safest, and most certain means of inducing labor; and Baird records a number of instances where the agent was of unquestionable value, although he used it in connection with local dilating measures. The most recent writer on this subject is Brühl, who reports[2] in detail seven cases in which the value of electricity was carefully tested. He used, as also Bayer, the constant current, and these cases may be taken as typical of what may be expected from resort to galvanism. His conclusions are, and the record justifies them, that, while the method does not carry with it special risk to the mother or the fœtus, its effects are uncertain, and if the applications be persisted in, the uterus may be rendered so irritable as not to respond readily to other means of inducing labor in case it becomes requisite to resort to them. In not one of the instances he reports was galvanism alone effective; in three it failed altogether; in four contractions were evoked and the cervix partly dilated, but these contractions had to be re-enforced by other means. It is to be noted, further, that galvanization was repeated from two to twenty-four times, and that from five to twenty-eight days was required, even in connection with other means, to attain the desired end. The length of time

[1] Ztschrft. f. Geb. u. Gyn. XI. I.

[2] Archiv f. Gyn. XXX. I.

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and the number of applications requisite were about the same in the cases reported by Bayer. We may fairly, hence, conclude that galvanism is hardly entitled to consideration among the means for inducing labor, since not uncommonly, where interference of this nature is called for, the welfare of the patient is opposed to the waiting which this current necessitates. In regard to faradism, when used alone, the same general conclusion is warrantable. Owing to its acknowledged greater power of inducing muscular contractions, the time requisite for starting labor by means of it is likely to be considerably shorter than that demanded by galvanism. But the point to be emphasized is that although contractions of the uterus may be evoked, they are very likely to die away as soon as the stimulus is withdrawn, and to maintain them some adjuvant means must be utilized. This is precisely what Baird did in the instances he has recorded. He faradized the uterus, and at the same time dilated the cervix by his finger and Barnes's bags, and was thus enabled in seven cases to induce labor in less than ten minutes. It is at once apparent that the combination of these two means has advantages over any recognized method used alone, and herein would seem to lie the reason why electricity, in the faradic form, may be classed among the means suitable for inducing premature labor. It is assuredly entitled to further tests, for although the ultimate result may only be its estimation as an adjuvant, as such there is ample scope for it in an emergency where, on speedy result, the welfare of the mother and of the fœtus not infrequently depends.

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