

**The de Keating-Hart method of fulguration and thermo-radiotherapy / by William Seaman Bainbridge.**

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THE DE KEATING-HART  
METHOD OF FULGURATION  
AND THERMO-RADIOOTHER-  
APY.

BY

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NEW YORK.

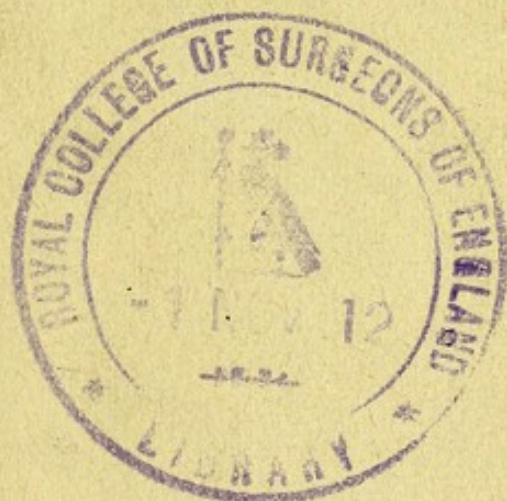
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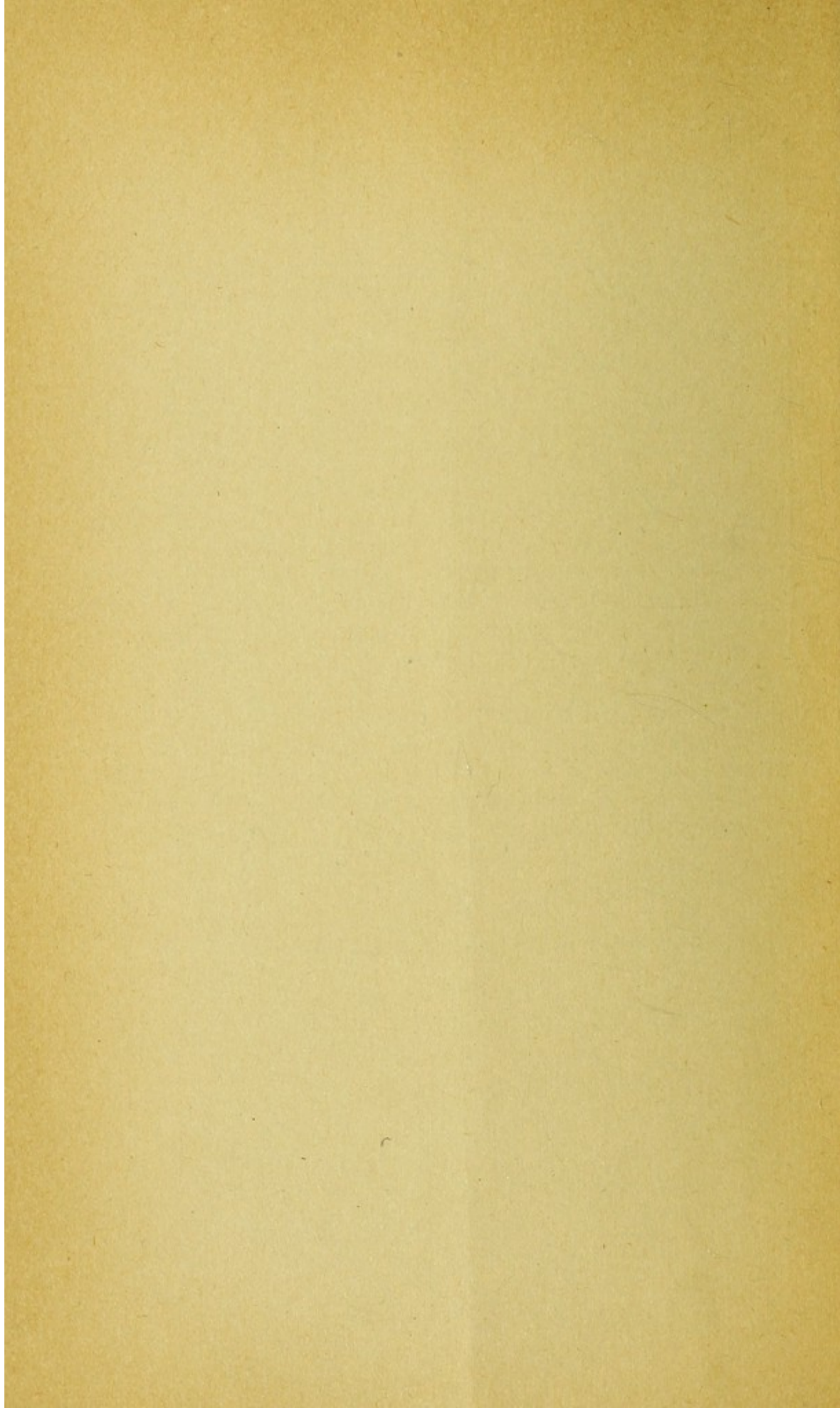
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## THE DE KEATING-HART METHOD OF FULGURATION AND THERMO-RADIO-THERAPY.

By WILLIAM SEAMAN BAINBRIDGE, Sc.D., M.D.,

NEW YORK.

ONE of the world's greatest philosophers has said: "There is a principle which is a bar against all information, and which cannot fail to keep a man in everlasting ignorance; this principle is contempt prior to examination." It is the desire of every seeker after truth to avoid this deadly principle, to examine first, and then to accept with approval, or to reject with contempt. If examination is impossible, suspended judgment is in order.

The Committee on Scientific Research of the New York Skin and Cancer Hospital has borne this principle in mind in its study of the cancer problem, being willing at all times to investigate the claims of any method for the palliation or cure of malignant neoplasms, providing, of course, that such investigation present no element of danger to the well-being of the patients concerned.

Accordingly, when, about five years ago, our attention was first directed to the treatment of cancer by the de Keating-Hart method of "fulguration,"

\*Read in part before the New England Association of Physical Therapeutics, Boston, April 12, 1912. Illustrated with lantern slides. Delivered in part, with the presentation of patients, at the Eighth Annual Clinical Lecture on Cancer, New York Skin and Cancer Hospital, April 24, 1912.

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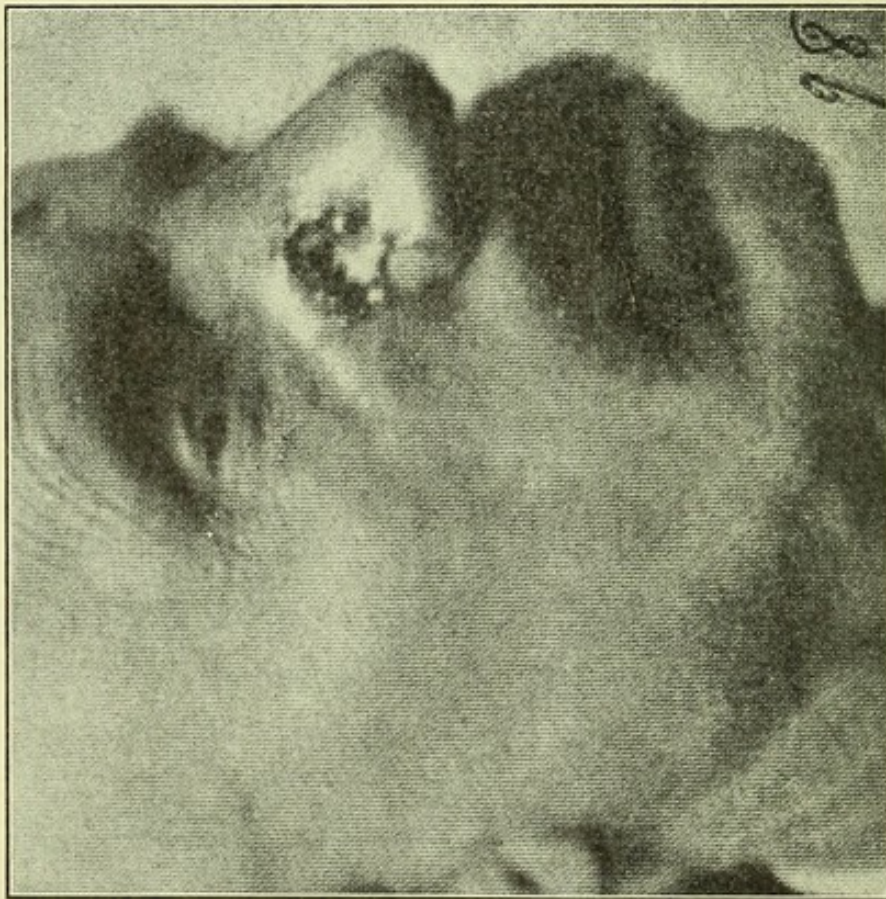


FIG. 1.

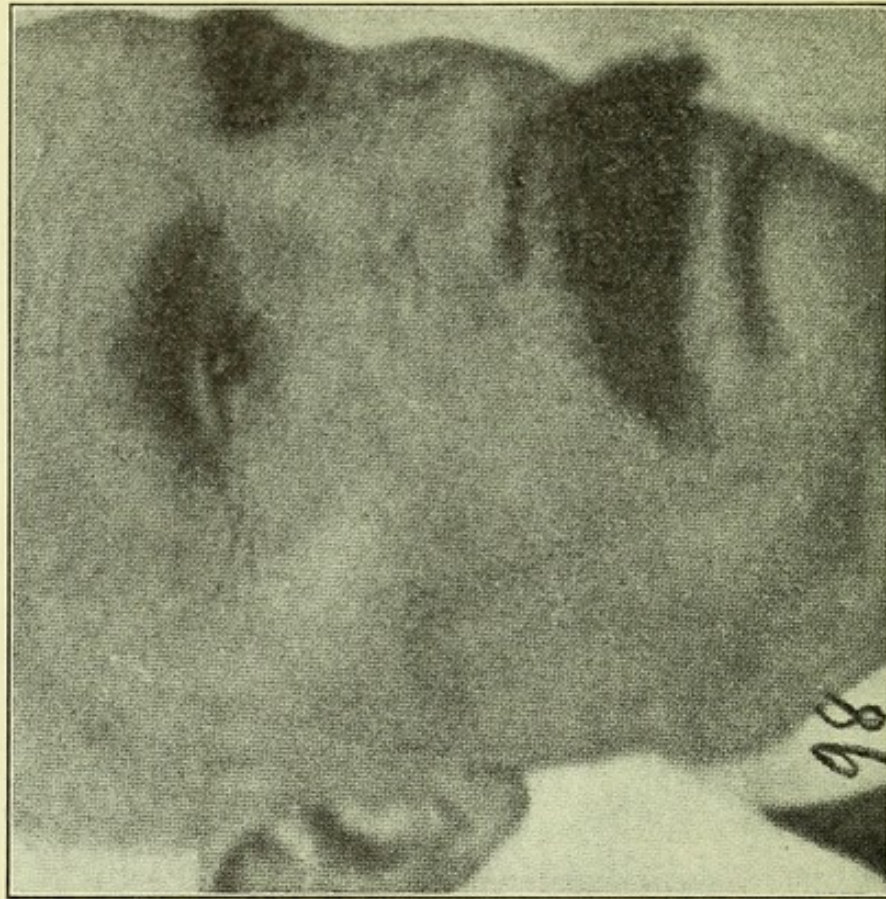


FIG. 2.

CASE I.—Epithelioma of the right side of the nose, which had invaded the subjacent bone. The first fulguration in 1907, the second in January, 1908, and the third in December, 1908. This patient having refused to submit to an anesthetic, it was impossible to treat him thoroughly at a single sitting. Cured for three years. (See Figs. 1 and 2.)



or "sideration," as it was then called, it was decided to investigate the theory upon which the method was based, as well as the technic of its application, and, if results warranted it, to give the method a scientific trial in a series of cases.

As the representative of the New York Skin and Cancer Hospital, and as a surgeon greatly interested in the cancer problem, the author, on various trips to Europe, visited de Keating-Hart, who demonstrated his apparatus and explained his method in detail. I saw him employ fulguration in numbers of cases, and examined many of the patients previous to operation, as well as upon successive visits afterward. Dr. de Keating-Hart has been kind enough to furnish us with photographs and lantern-slide pictures of a number of patients treated by him from time to time, many of whom I have examined at his clinic in Paris. A few of these photographs will serve to convince the reader, as the actual cases did me, that the method is worthy of careful trial.

In some of the cases the cure of the cancer does not offer in itself any special interest, since this might have been obtained, as de Keating-Hart has pointed out, by a number of well-known means in at least the first group. The cases are of real significance only when considered from a triple point of view, which should be borne in mind as the pictures and the case histories are studied:

(1) The strictly limited eradication of tissue around the lesions, thus saving or lessening subsequent deformity.

(2) The non-recurrence obtained for a number of years, although in certain cases the disease had not been checked by other means; or, in primary cases, the lessened likelihood of recurrence.



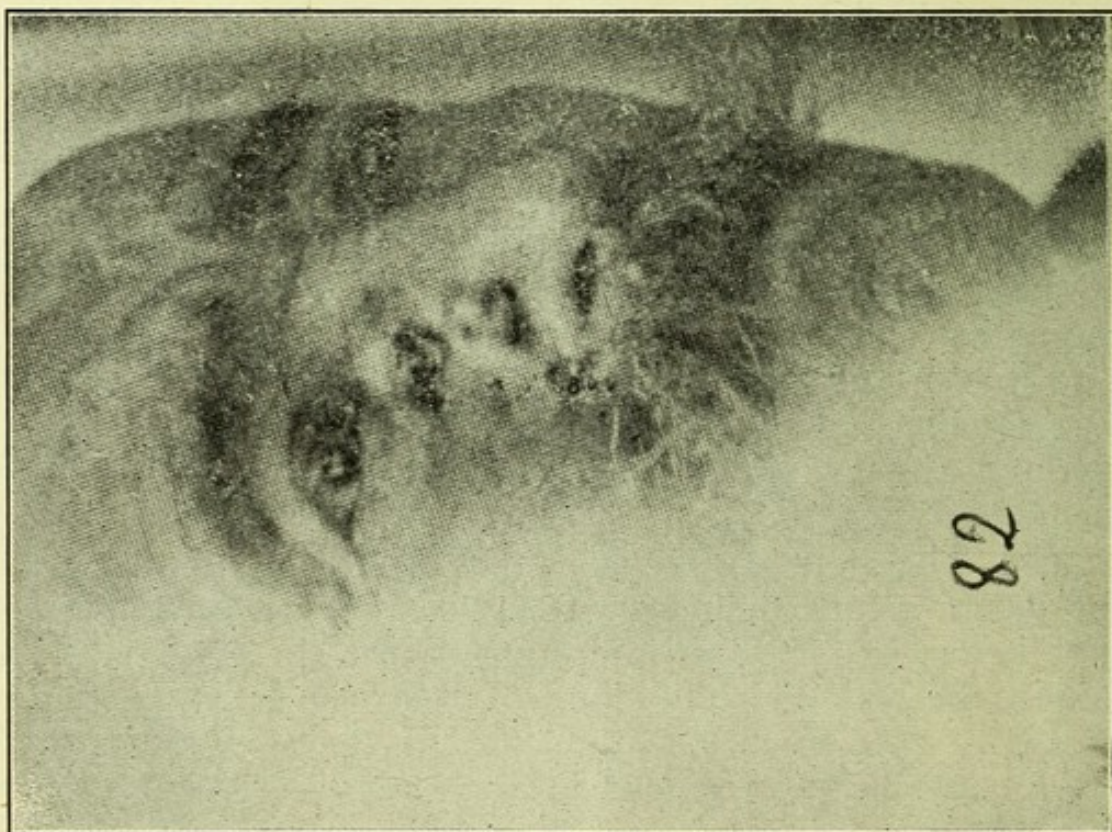


FIG. 3.

CASE II.—Epithelioma of the squamous celled type involving the inner canthus of the right eye and the nasal process of the superior maxilla. Fulguration December 31, 1907. Was seen again three years later. Cured.

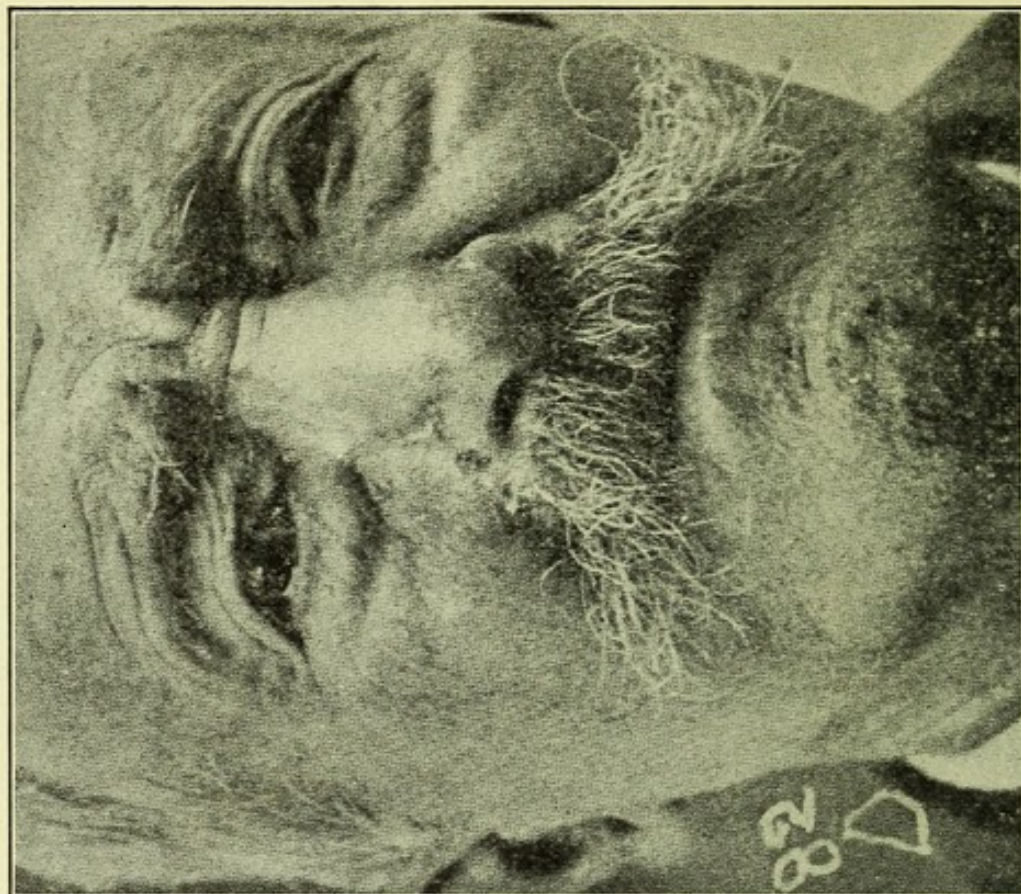


FIG. 4.



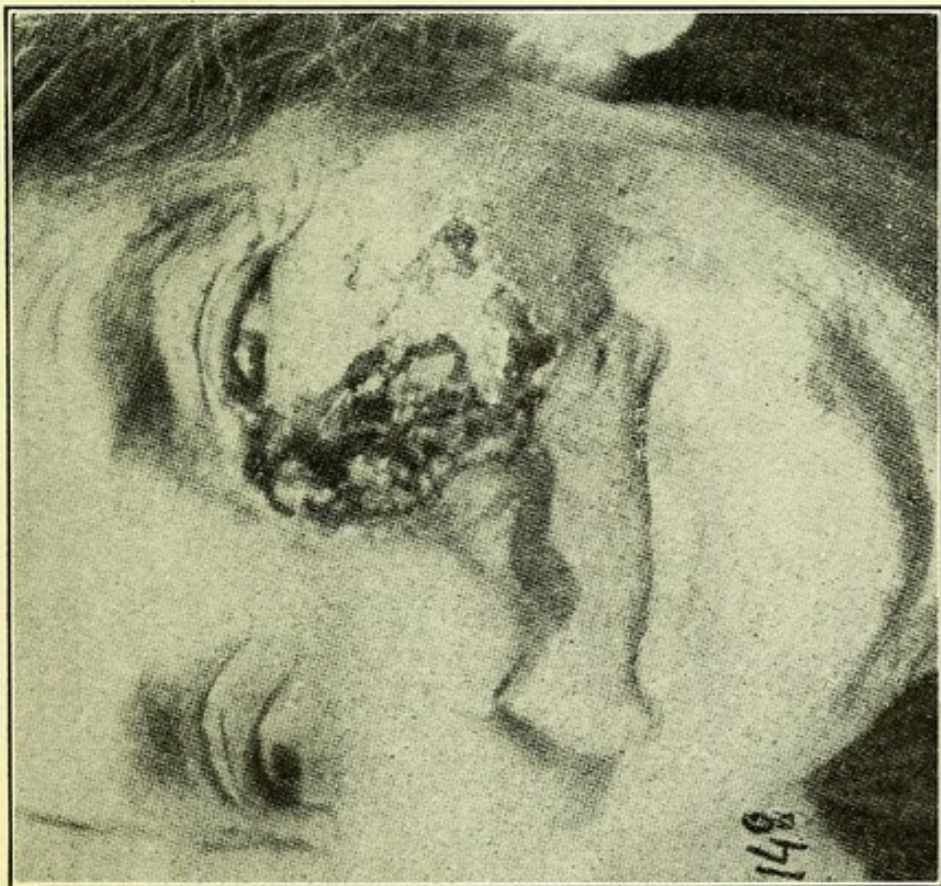


FIG. 5.

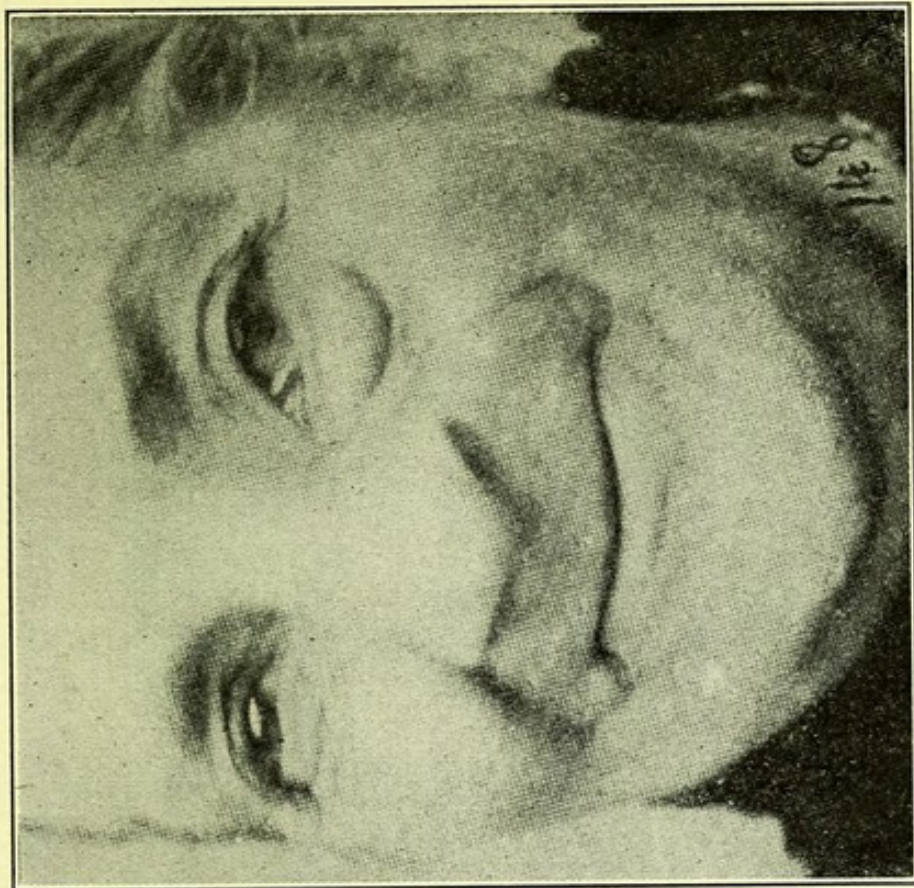


FIG. 6.

CASE III.—Epithelioma of the skin of the superior maxilla and of the bones of the nose. Treated without success by arsenical cauterization. Fulguration February 14, 1908. Seen again a year and a half later. Cured. (See Figs. 5 and 6.) I have heard since that she had a recurrence. This is possible. The case was very severe and the removal without doubt insufficient, but I cite the case especially because of the cosmetic result. [de Keating-Hart.]



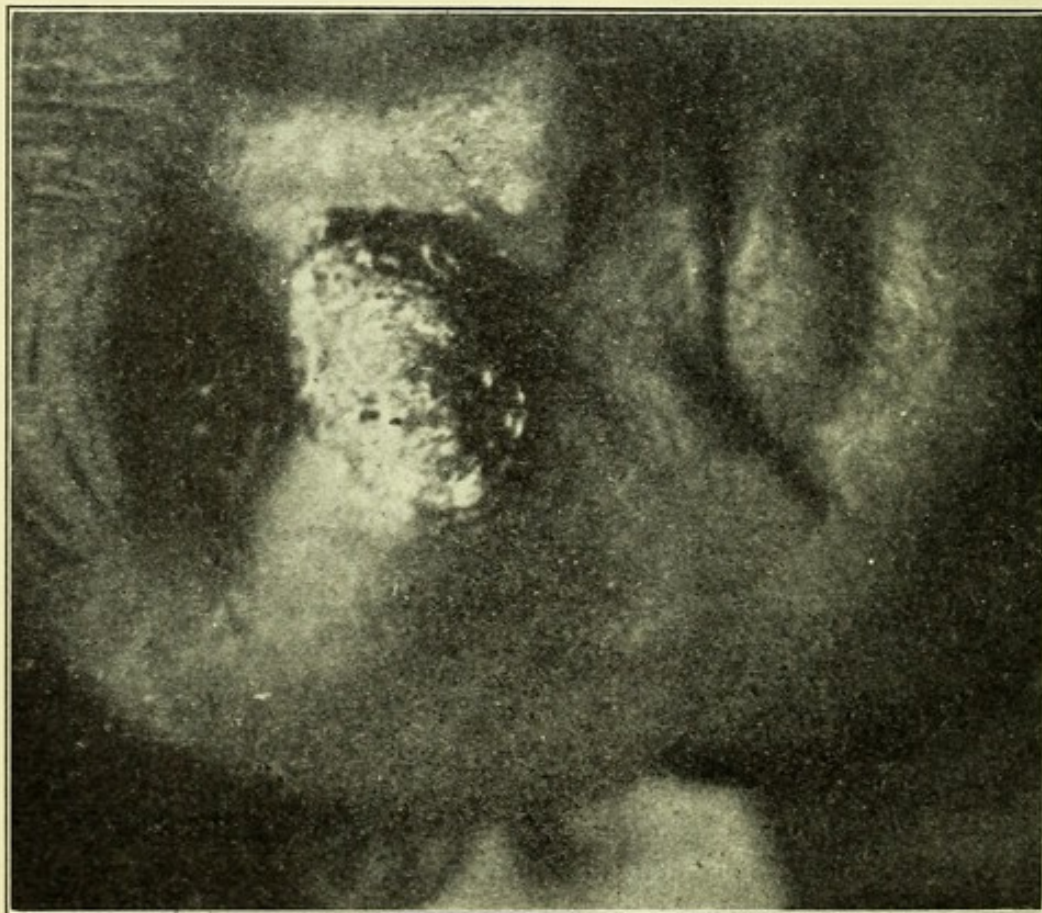


FIG. 7.

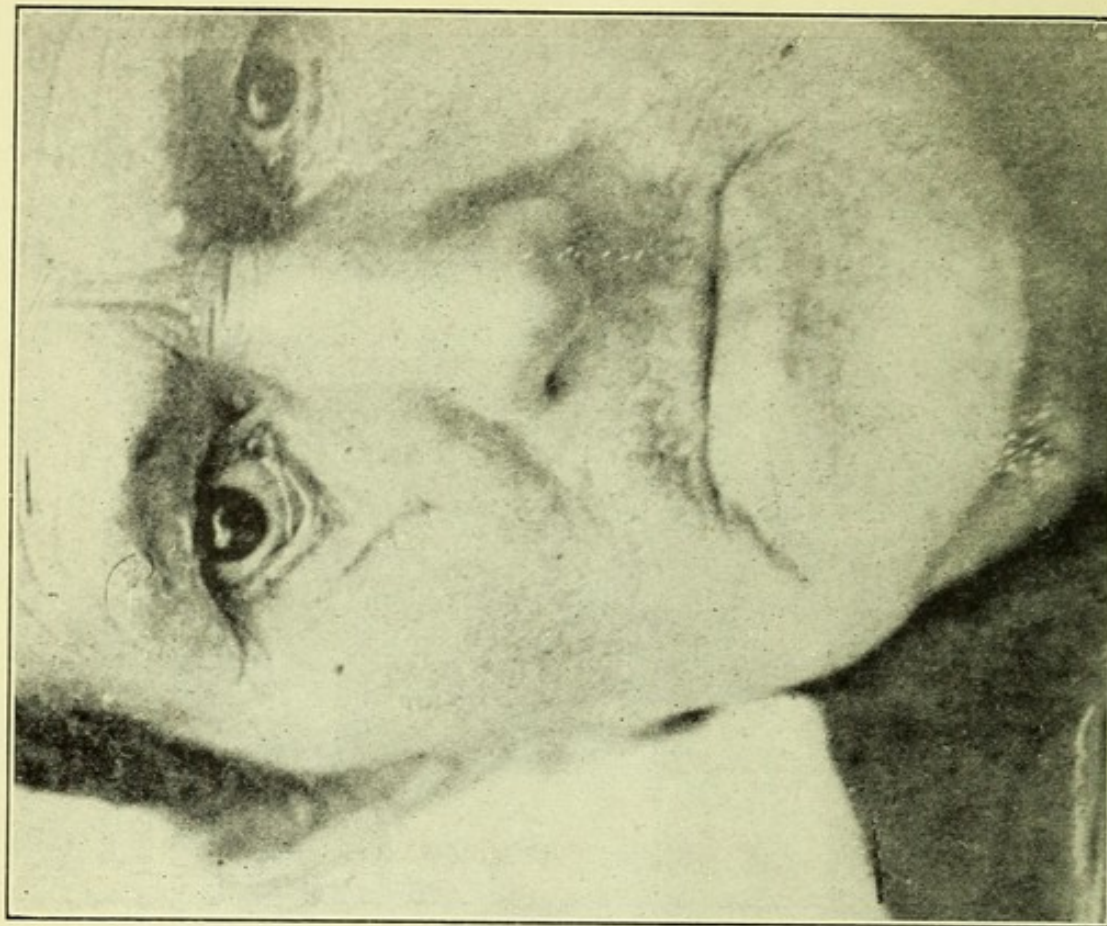


FIG. 8.

CASE IV.—Epithelioma of the face. Treated previously by surgery and *x*-rays with immediate and severe recurrence. Fulguration carried out August 29, 1907. Was followed in twenty days by a beautiful cicatrization, as shown in the figure. The patient has glands in the neck which were not fulgurated (unfortunately) which naturally have increased in size, but the local healing is still present. (See Figs. 7 and 8.)



(3) The relatively slight disfigurement produced by the method in the cases presented.

These cases are all a matter of record, and are reproduced here merely for purposes of interest and emphasis. It may be said, in justice to de Keating-Hart and his method, that these cases represent patients of sufficiently various age and disease of sufficient severity to give to them an undeniable value. Each has undergone careful histological examination, and in the published works of de Keating-Hart may be found the names of physicians and surgeons by whom the patients were treated, as well as the names of the laboratories where microscopic examinations were made.

The cases herein described or pictured have been selected for this paper by Dr. de Keating-Hart as best illustrating his methods.

*Superficial Cancers of Cutaneous Origin* (Cases I to VI).—The first group represents superficial cancers of cutaneous origin, which are interesting in that they show what excellent cosmetic results fulguration may give.

*Deep Cancers of Cutaneous Origin* (Cases VII to XI).—The next group represents deep cancers of cutaneous origin, which have acquired a greater severity from the fact of their extent and their penetration into the subjacent osseous tissue. Here the cosmetic effect is less than the therapeutic effect, but is nevertheless not entirely wanting. It is well to note that most of these cases were considered inoperable and that some had been unsuccessfully treated by other methods.

*Cancers of the Breast* (Cases XII to XV).—The following cases of cancer of the breast are presented, not only because of their severity, but because of the limited removal of diseased tissue,



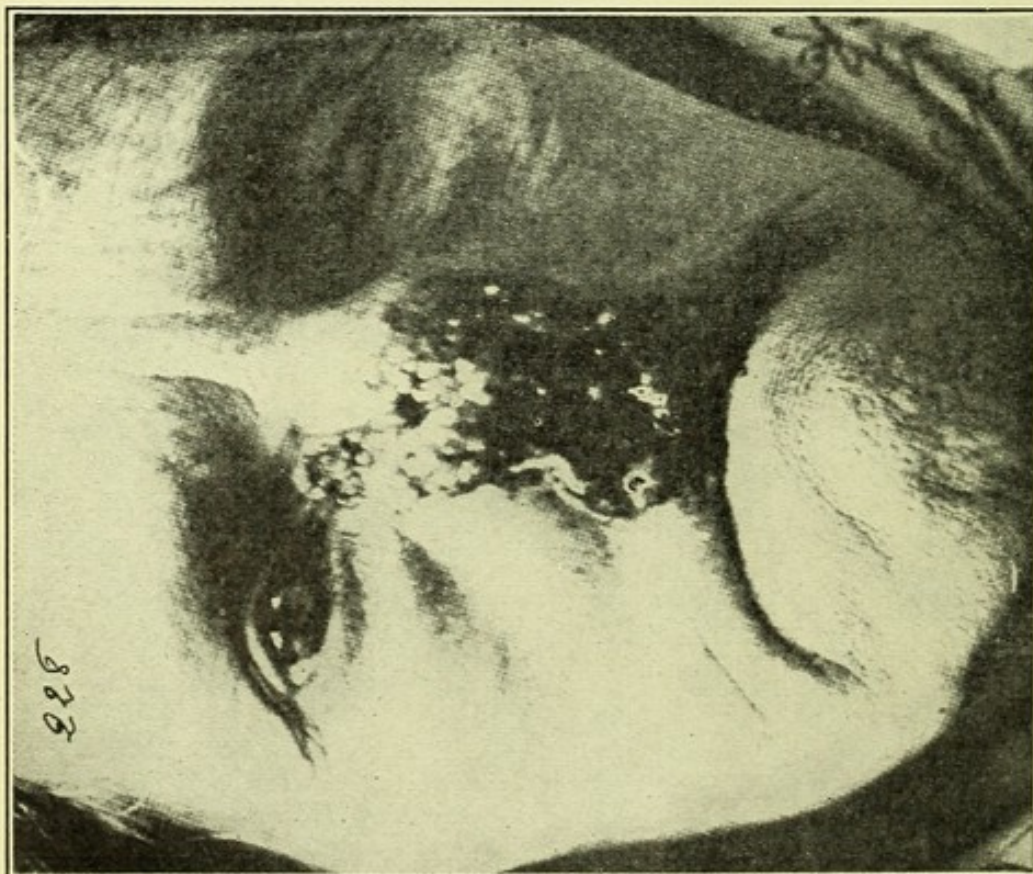


FIG. 9.

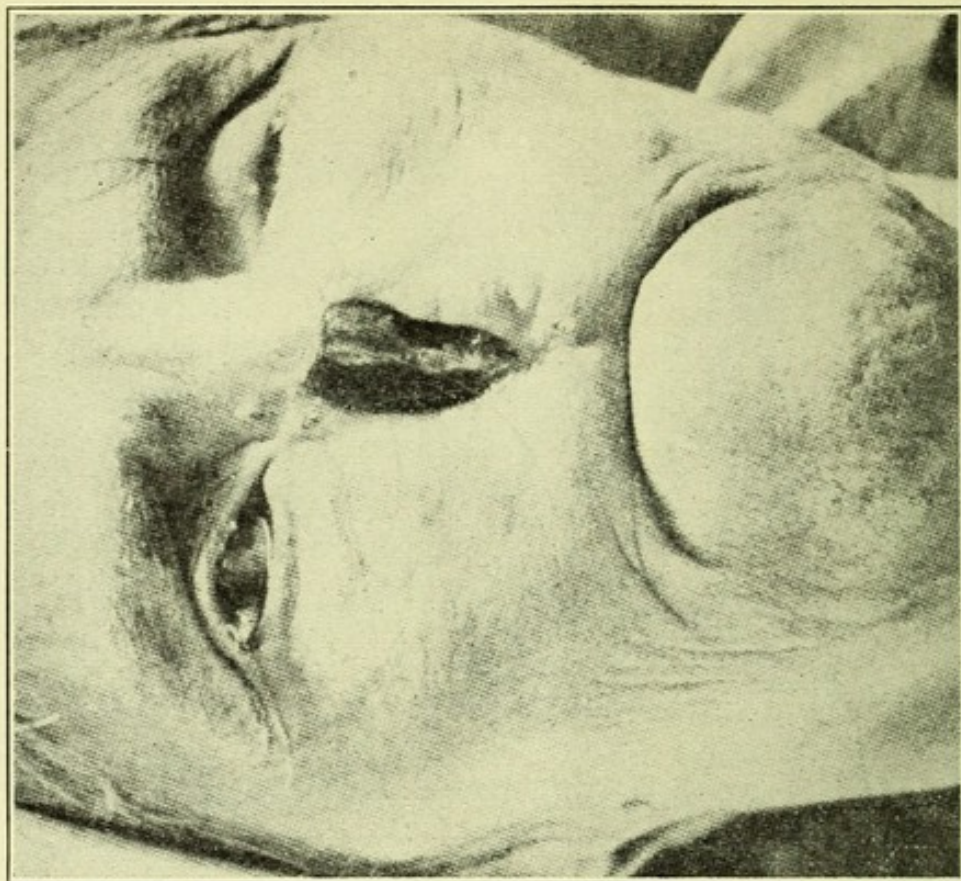


FIG. 10.

CASE V.—Flat epithelioma of the face extending to the mucous membrane of the upper lip and to the nose. Rapid growth. Fulguration June 6, 1908, preceded by very limited removal of the growth. (Lost to sight a short time after-ward.)



in spite of which permanent results were obtained. It is to be emphasized, in this connection, that this limited removal of tissue is not advocated by de Keating-Hart and others who have employed the method, except in cases where more extensive removal is not feasible.

*Cancer of the Cervical Region* (Case XVI).

*Cancers of the Mucosa* (Cases XVII to XX).

—De Keating-Hart claims to have obtained a number of permanent results in cases of cancer of the lip in which there was limited removal of the lesion, without removal of the diseased glands. These cases demonstrate the favorable results of fulguration even with incomplete removal of the disease.

*Cancer of the Rectum*, in severe cases, has given less favorable and less permanent results than has cancer in other parts of the body.

*Cancer of the Uterus* has not given good results with fulguration, according to de Keating-Hart. It is one of the localized forms of cancer where fulguration is least indicated, because of the possibility of the complete surgical removal of the disease. If the condition is inoperable fulguration may relieve and produce superficial cicatrization, but it will not cure.

*Sarcomatous Tumors* often show "splendid healing" from fulguration, according to de Keating-Hart.

As the months passed and de Keating-Hart's reports continued favorable, as did likewise those of a number of other European investigators, our interest was still further aroused in the method.

Desplat, appointed by the French Association for the Advancement of Science, to report upon "the remote results of fulguration in the treatment of cancer" (Congress at Toulouse, August, 1910), cited



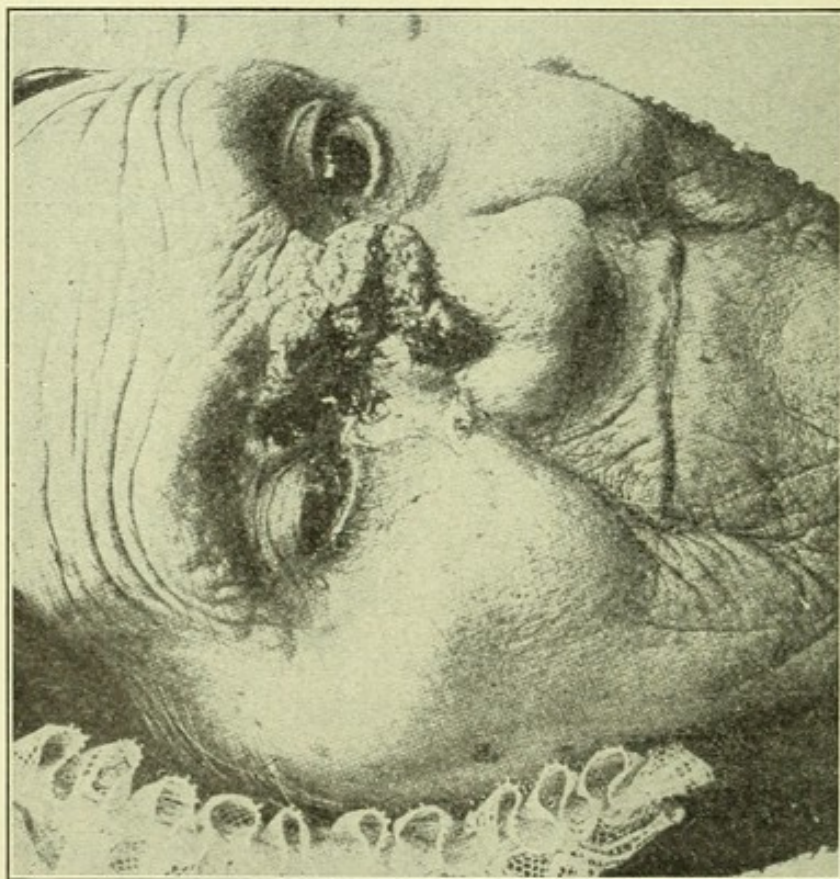


FIG. 11.

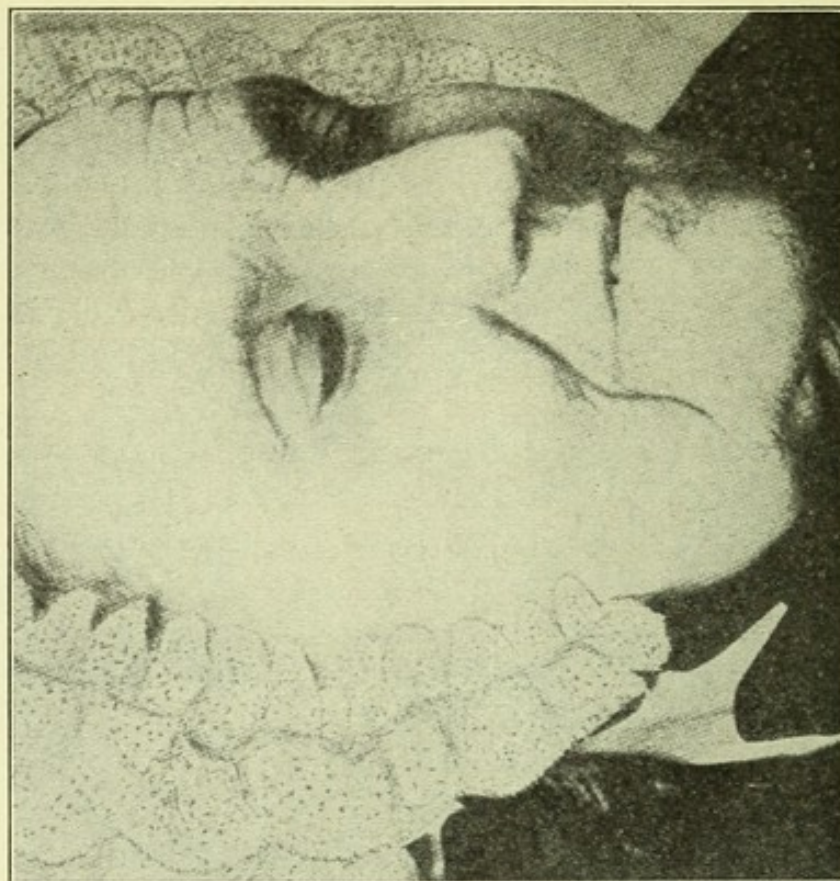


FIG. 12.

CASE VI.—Ulcerating and proliferating epithelioma at the inner angle of the right eye and on the nose. Fulguration June 3, 1907, with simple curettage. Very neat healing in twenty days, continuing perfectly well for three years. (See Figs. 11 and 12.) Lost from sight since then.



a number of interesting cases published by Dubois-Crepagne and himself. He concludes his report with the following: "After three years' experience, I conclude, as I concluded after the first year, that fulguration has enlarged considerably the field of surgery in giving it marked chance of success in those cases where it previously dared no longer intervene, and I now reply to the question which I had left under judgment for two years, that fulguration gives to the patient chances of prolonged non-recurrence superior to those chances which surgery gives when left to itself alone."

Segond, who declared himself, at the International Conference on Cancer, in Paris, in October, 1910, as being against the method, said of it, fulguration "has increased their resistance and prolonged their lives, transformed or cicatrized, in praiseworthy fashion, horrible, bleeding areas which tortured" patients whose pains nothing would calm. "Fulguration," he said, "permits surgery to intervene where intervention was no longer possible, and may offer a chance of non-recurrence to those cases which surgery alone cannot relieve."

Such statements, reinforced by our own observations, encouraged us, despite the unfavorable reports which from time to time appeared, to install a de Keating-Hart fulguration apparatus at the New York Skin and Cancer Hospital, and to extend to Dr. de Keating-Hart an invitation to visit New York and personally demonstrate the apparatus and explain the theories upon which his method of fulguration is based.

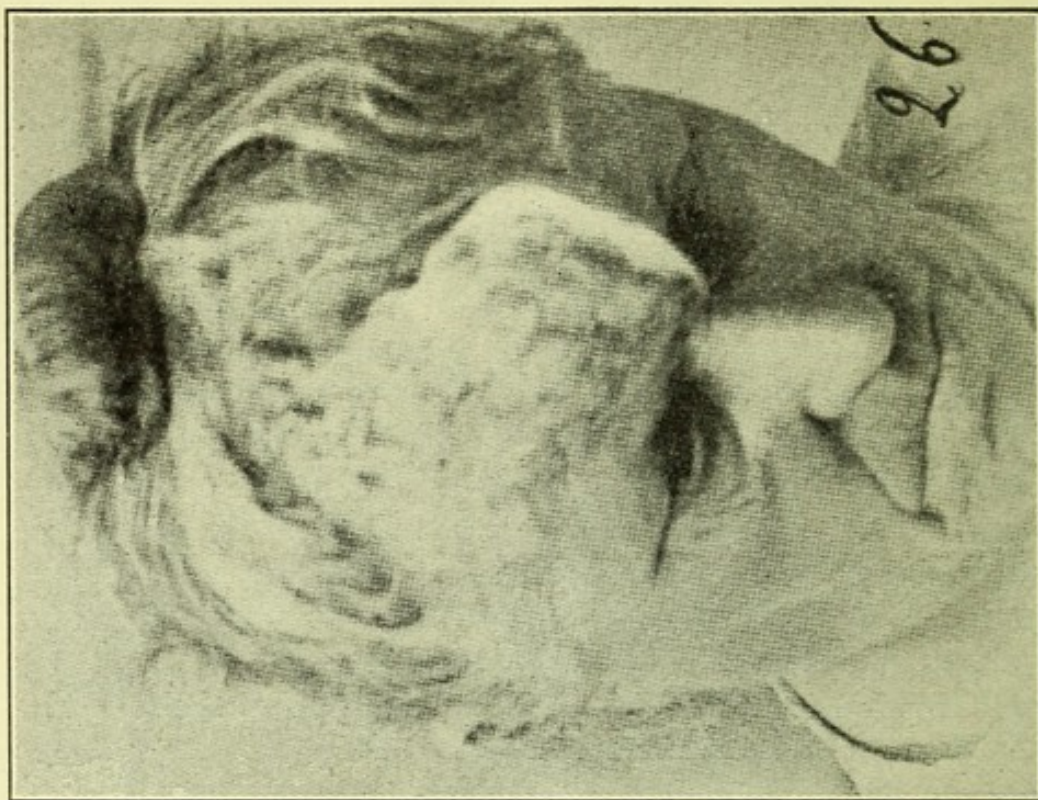
The apparatus, which had been constructed under de Keating-Hart's personal direction, was installed in the hospital in November, 1911, and in December he visited America, giving a series of demonstra-





**FIG. 13.**

CASE VII.—Large flat epithelioma of the antero-superior cranial region, with invasion of the frontal bone down to the diploë. There were two metastases in the pericranium. This case was considered inoperable by several surgeons. The first fulguration with curettage was done on January 6, 1907, in the presence of Dr. Saïas of Marseilles. Cica-trization perfect. Recurrence at the end of one year. Two repeated fulgurations in 1908 and 1909. In perfect con-dition at time of report, about three years later. (See Figs. 13, 14, and 15.)



**FIG. 14.**



tions at the New York Skin and Cancer Hospital, and delivering a number of lectures in other cities. Invitations were extended to many of the leading surgeons in this country and Canada to attend these demonstrations, and the operating room was taxed to its utmost capacity each day by members of the medical profession who seemed eager to witness the fulguration "seances," as the originator of the method is wont to call the applications of fulguration.

Many cases of cancer, in various stages of operability, were treated during the nineteen days of Dr. de Keating-Hart's visit. The surgical operations were performed by myself, with the assistance of Dr. Franz Torek, Dr. E. M. Foote, and other members of the hospital staff. Dr. de Keating-Hart was assisted in the instrumentation by Dr. Worthington S. Russell, in charge of the electrotherapeutic department of the hospital.

On behalf of the New York Skin and Cancer Hospital, of the Committee on Scientific Research, and of myself personally, a formal expression of thanks is tendered Dr. de Keating-Hart for his willingness to leave his own work and to give such untiring energy to the demonstrations at the Skin and Cancer Hospital.

It is our intention to continue to employ the method in all suitable cases, as we have been doing since his visit. Careful records of each case are kept. Notes were made of the treatment to be followed in each of the cases treated by de Keating-Hart, and his directions have been carried out in detail. At the end of a period of time sufficiently long to warrant forming a conclusion as to the merits of the procedure, a full account of our experience with fulguration will be published.



OTHER ELECTROTHERAPEUTIC MEASURES OFTEN  
CONFOUNDED WITH FULGURATION.

Before taking up the further discussion of fulguration and the theory upon which its application is based, attention will be called very briefly to some

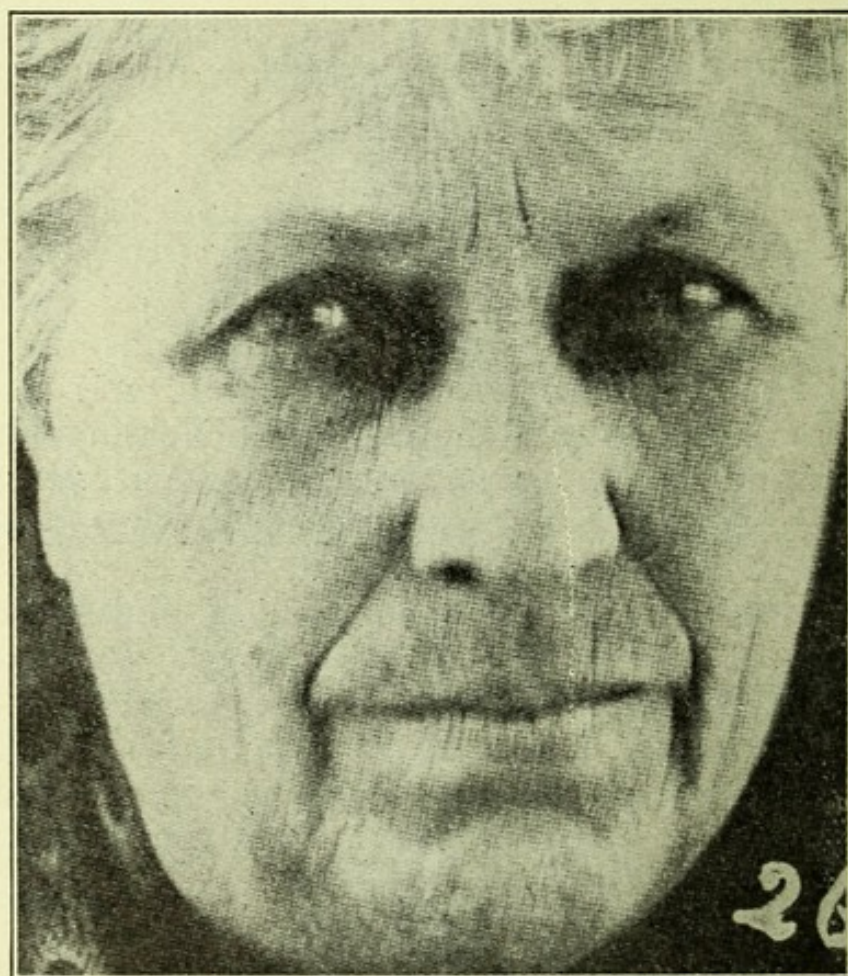


FIG. 15.

of the methods of employing high-frequency sparks which have been confounded in the minds of many with fulguration as employed by de Keating-Hart. It may be said, in passing, that this discussion is confined absolutely to fulguration as employed at the present time by de Keating-Hart, and that we



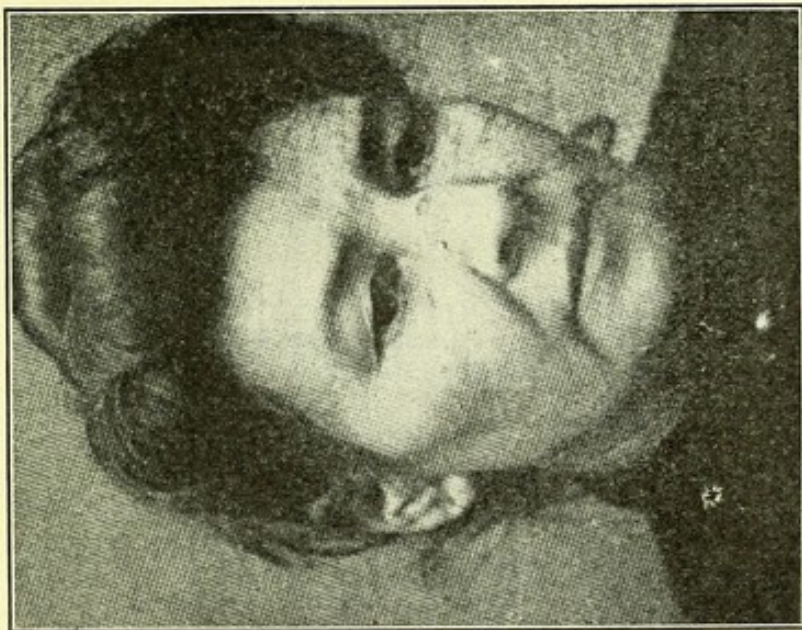


FIG. 16.

CASE VIII.—Epithelioma of the nose; rapid growth with marked involvement of the bones. Curettage and fulguration December 3, 1907. The patient had been previously treated without success by the actual cautery. Very excellent healing; well three years later.



FIG. 17.



shall in no wise enter into a discussion of the Rivière-de-Keating-Hart controversy, mentioned by so many writers on this phase of electrotherapeutics.

During the demonstration at the Skin and Cancer Hospital de Keating-Hart repeated over and over the statement that fulguration as employed by him is *not a burning method*; that it does *not destroy tissue*, normal or abnormal; that if it is applied to the extent of burning it is distinctly harmful, and is not then true fulguration; and that it acts, *not upon the cancer itself*, but upon the *soil upon which the cancer develops*.

Despite these statements it was not an uncommon thing to hear visitors tell of their experience with fulguration in the destruction of neoplasms, of "burning down" this or that kind of growth, and of using short sparks, bipolar currents, and other details diametrically opposed to the de Keating-Hart method.

It may be interesting in this connection to cite a passage from the 1911 edition of one of the leading text-books on electrotherapeutics.\* "The application of high frequency discharge," says the author of this volume, "from a metal point with a current of sufficient energy to destroy living tissue, was first described and instituted by Dr. J. A. Rivière of Paris, France. He employed the method for the destruction of epitheliomata, warts, moles, and condylomata. His student, Keating-Hart, employing the same method in connection with the operative treatment of cancer of the breast, with a view to preventing secondary recurrence by following the knife with the application of the same method designated the process as 'fulguration,' giving the orig-

\*Snow, William Benham: "Currents of High and Other Potential of High and Other Frequencies."



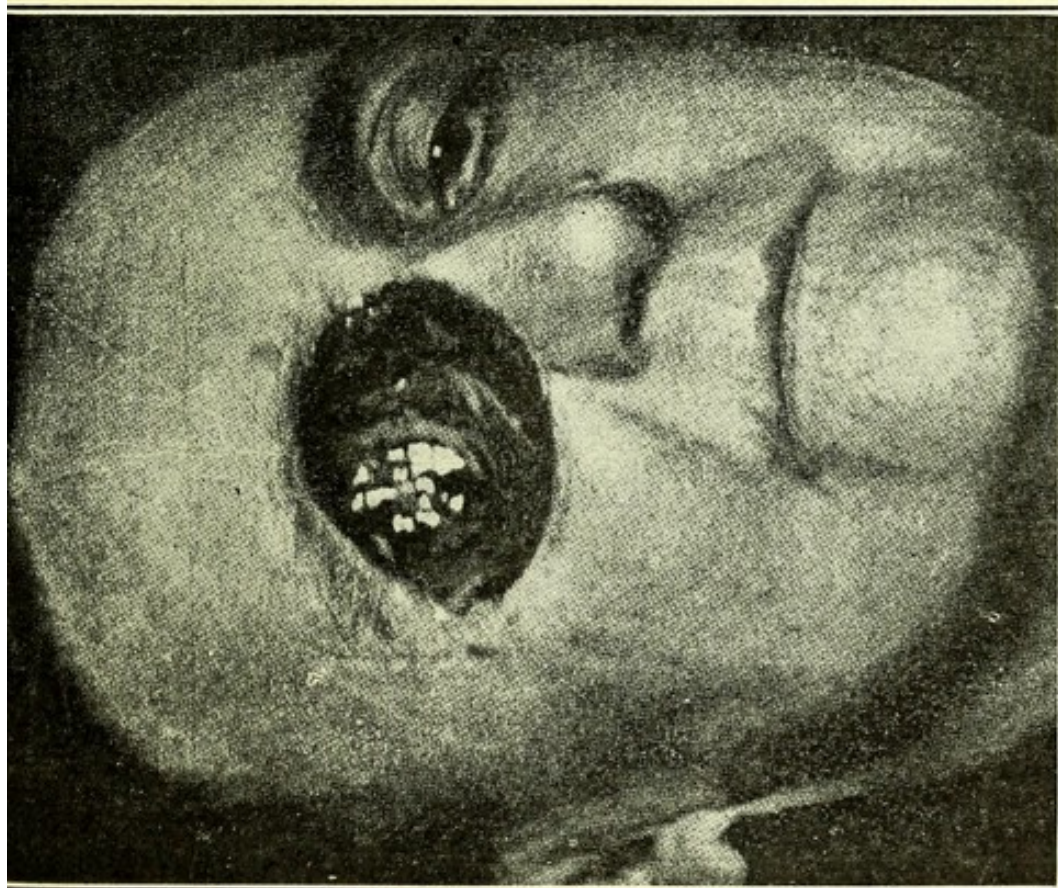


FIG. 18.

CASE IX.—Deep epithelioma of the orbital region. Considered by all surgeons consulted as absolutely inoperable. Destruction of the eye and invasion of the ethmoid bone. Fulguration in December, 1907. No recurrence for nearly three years. Perfect return of the general health, which had been undermined by the terrible pain and the use of morphine. (See Figs. 18 and 19.)

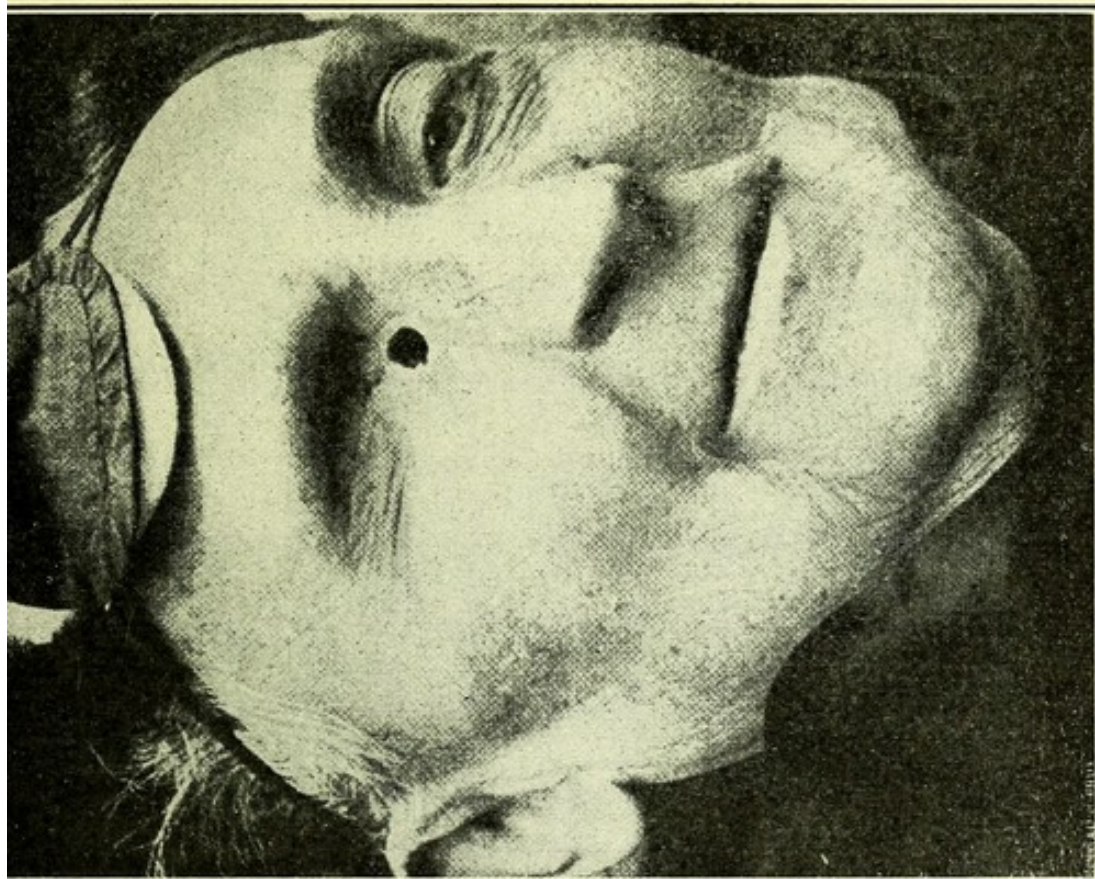


FIG. 19.



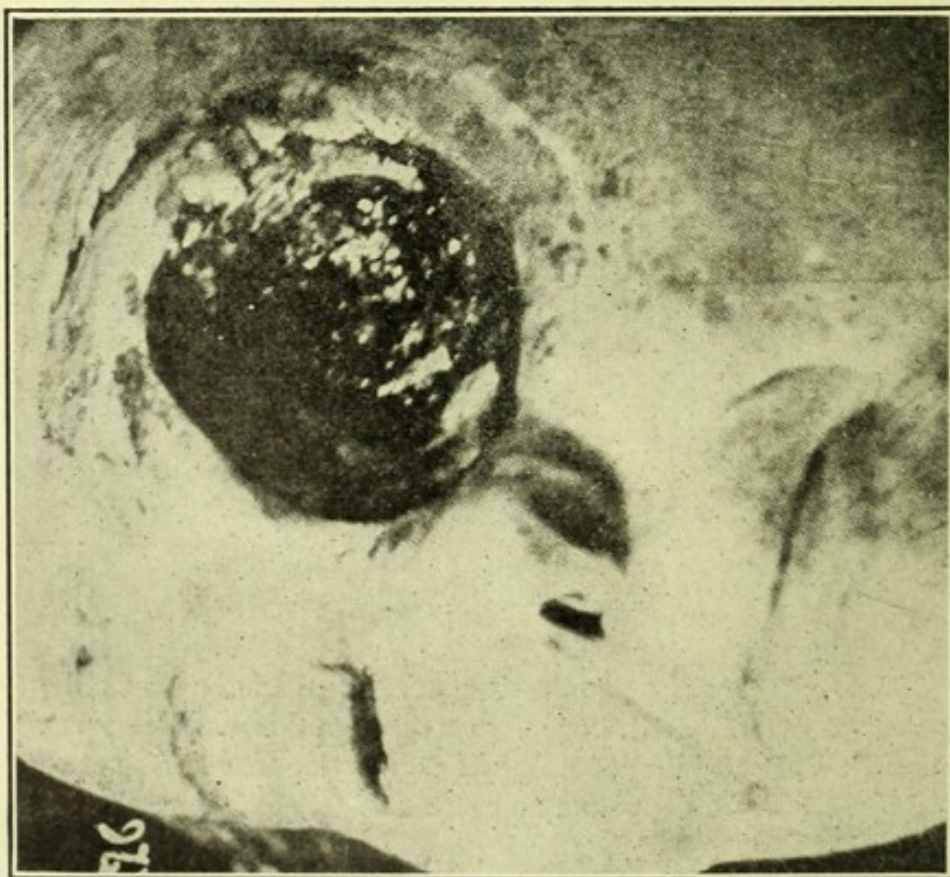


FIG. 20.

CASE X.—Epithelioma with invasion and destruction of the left eye, the malar bone, and a portion of the superior maxilla. Fulguration June 29, 1908. Cured for three and one-half years. A fistula communicating with the nose still persists. (See Figs. 20 and 21.)

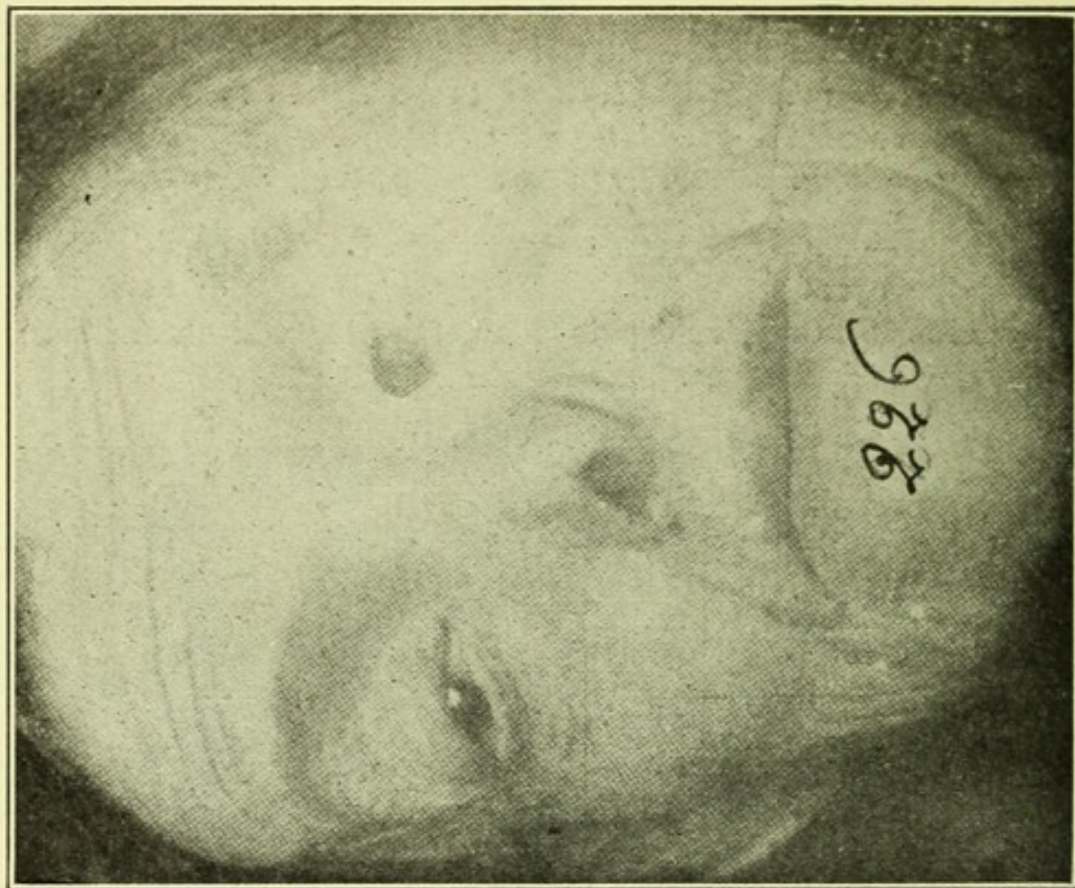


FIG. 21.



inal investigator no credit for the originality of the method. His association as a surgeon led to the adoption of the latter name which is the designation of the effect and not the method; the method being a hot effleuve discharge and the effect one which simulates burning."

"The process of effleuvation," he continues, "may be applied for a cauterant effect or as a desiccating agent as described by Clark; the discharges in the one case destroying the tissue by actual chemical decomposition of heat, and the other process by applying the current with sufficient strength to produce a drying out of the tissues with the induction of coagulation-necrosis. When the thermic application is made in the tissues, above 73° C., coagulation-necrosis is induced."

After witnessing a number of de Keating-Hart's demonstrations at the New York Skin and Cancer Hospital, the author above quoted said, in an article in the *Journal of Advanced Therapeutics* for January, 1912, "The principle employed by him (de Keating-Hart) is to remove entirely the cancerous growth, and then to apply to the surfaces and tissues from which the cancer has been removed long, high potential resonator sparks, in quality very similar to the sparks from a static machine. This administration gives no burning or destruction of tissues, but an effect of over-stimulation which, according to the theory of de Keating-Hart, depletes or exhausts the tissue to such a degree that the reparative process is considerably deferred, the effect from the application of the electrical sparks lowering the vitality of the normal cells, and destroying by depletion the diseased cells that may have been left in the tissues."

Another distinguished writer on electrothera-





FIG. 22.



FIG. 23.

CASE XI.—Orbital epithelioma. Invasion of the left eye, the superior maxilla, and the bones of the nose. The patient was sent by Prof. Lapersonne to Prof. J. L. Faure, who operated before using fulguration on February 4, 1909. Cured for nearly three years. Patient was presented by Dr. J. L. Faure before the Surgical Society. (See Figs.



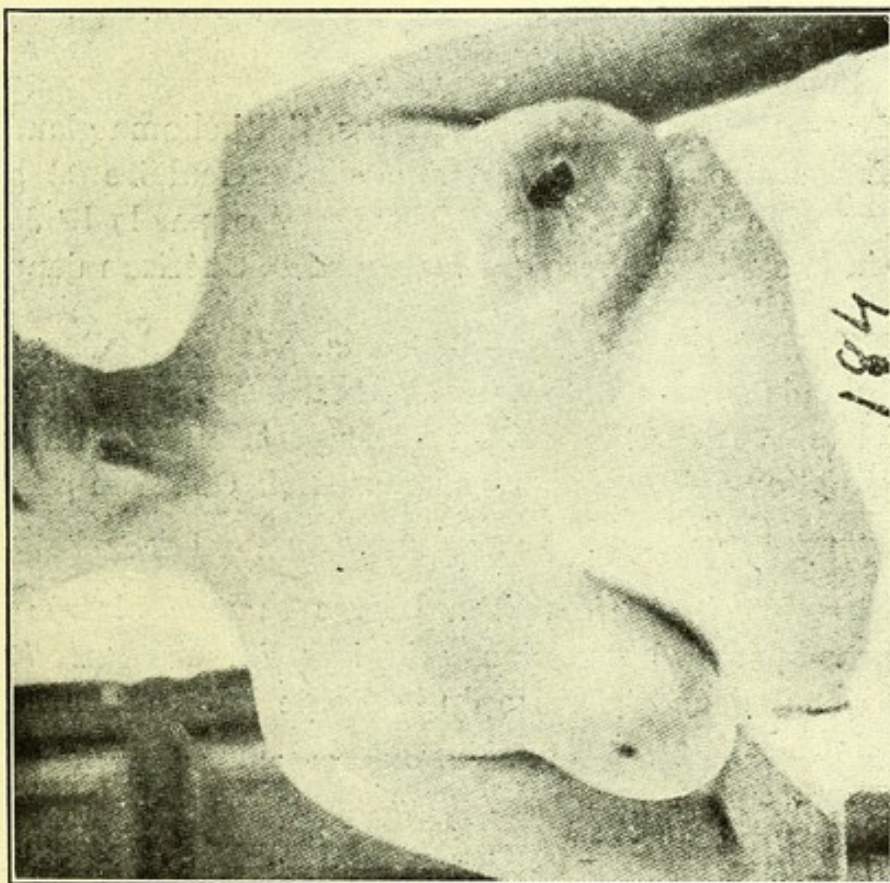
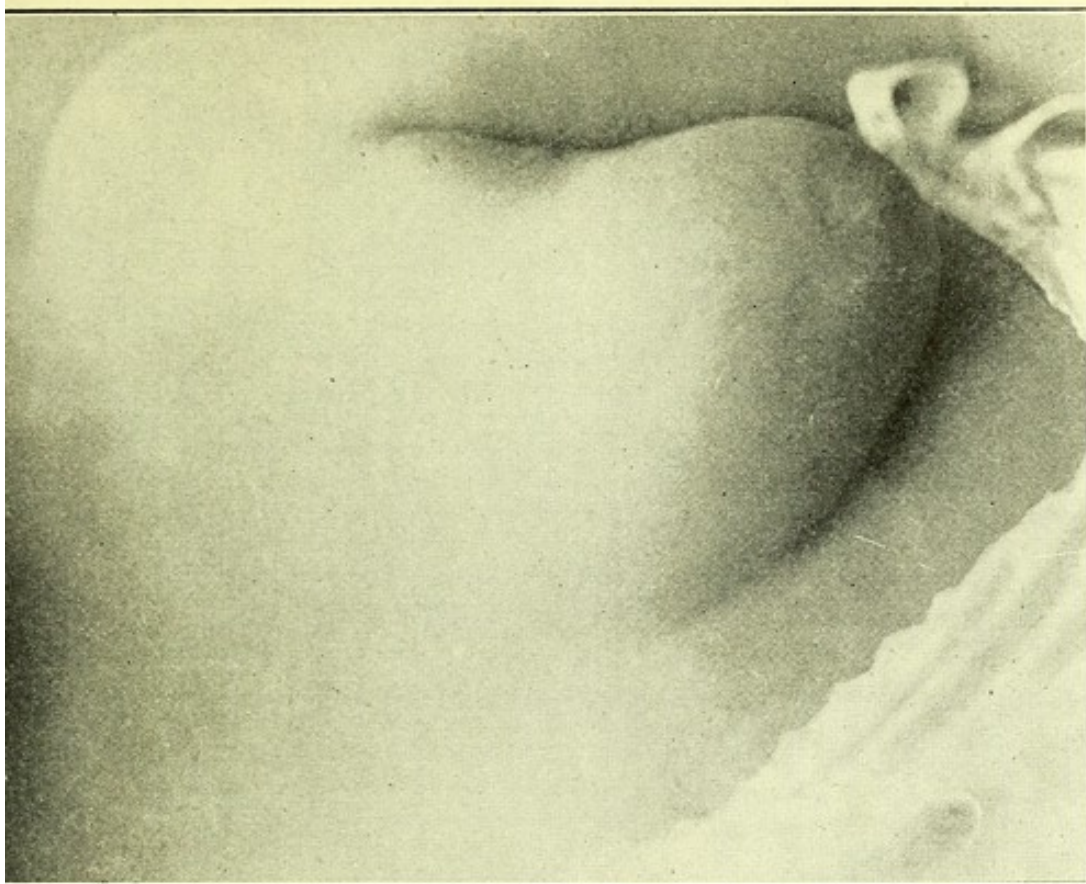


FIG. 24.

CASE XII.—Epithelioma of the nipple of rapid growth. Examination showed an indurated mass of the size of a walnut. Fulguration May 12, 1908, with excision passing exactly around the lesion, thus forming a cone shaped area in the breast. Still cured after three and one-half years. (See Figs. 24 and 25.)

FIG. 25.





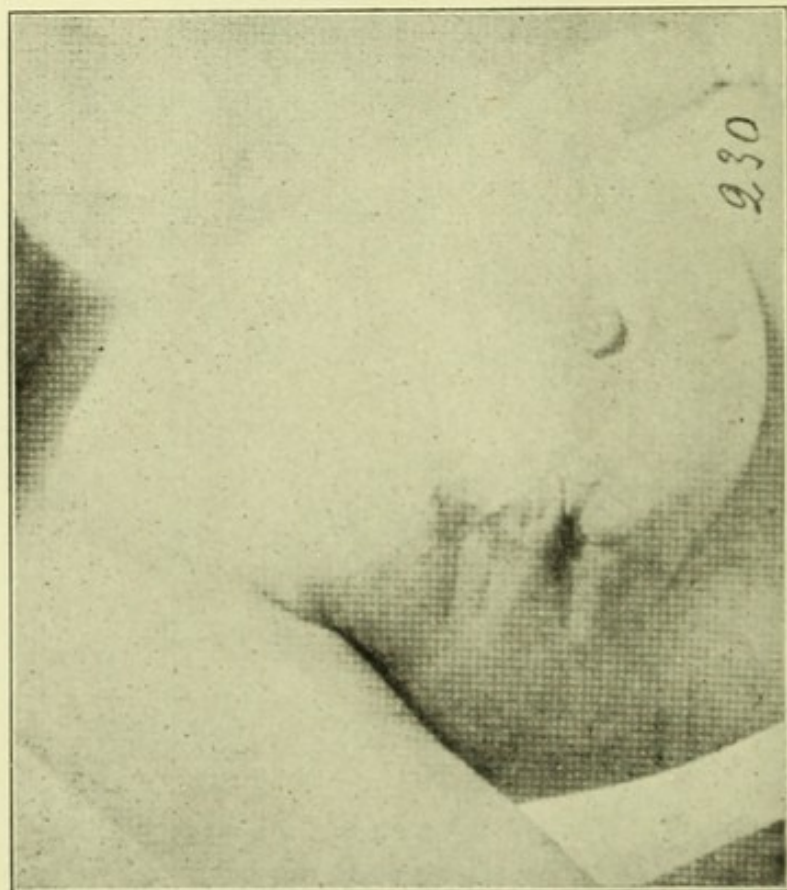


FIG. 26.



FIG. 27.

CASE XIII.—Epithelioma of the right breast, occupying the superior external quadrant. Rapid growth of the tumor to the size of a pear. No glands were felt. Fulguration July 9, 1908. Removal of the lesion only and conservation of the greater part of the breast. No recurrence after two years. Disappeared from observation. (See Figs. 26 and 27.)



peutics,\* in 1910, said of the method under discussion: "This method consists in the application of long and powerful sparks for the destruction of morbid tissue. The apparatus may be any of the resonators giving high-frequency currents, and may be either monopolar or bipolar, the latter being preferable."

From the above it will be seen how easily the fulguration of de Keating-Hart may be confused with the "destructive fulguration" to which various writers allude.

The term "fulguration" (lightning) was suggested by Pozzi, and soon supplanted the term "sideration" (a sort of stunning of cancer cells), which de Keating-Hart at first applied to his method under a mistaken conception of the action of the spark upon the neoplasm.

The fulguration of de Keating-Hart, the "destructive fulguration" obtained with short sparks, desiccation, electrocauterization, electrocoagulation (Doyen), "diathermy" (Nagelschmidt), all signify the application of currents of high frequency. The current, however, may be unipolar or bipolar, and the spark may be long or short, or suppressed, and herein is the difference between the de Keating-Hart fulguration and the various methods of electrothermic penetration.

In fulguration the unipolar current, with long, high-frequency, high-tension sparks, is employed. In the other methods named, the bipolar current is generally employed, though in some the unipolar current may be used. In the former the amperage is comparatively low and the voltage high, while in the latter the reverse is usually the case.

\*Tousey, Sinclair: "Medical Electricity and Röntgen Rays."



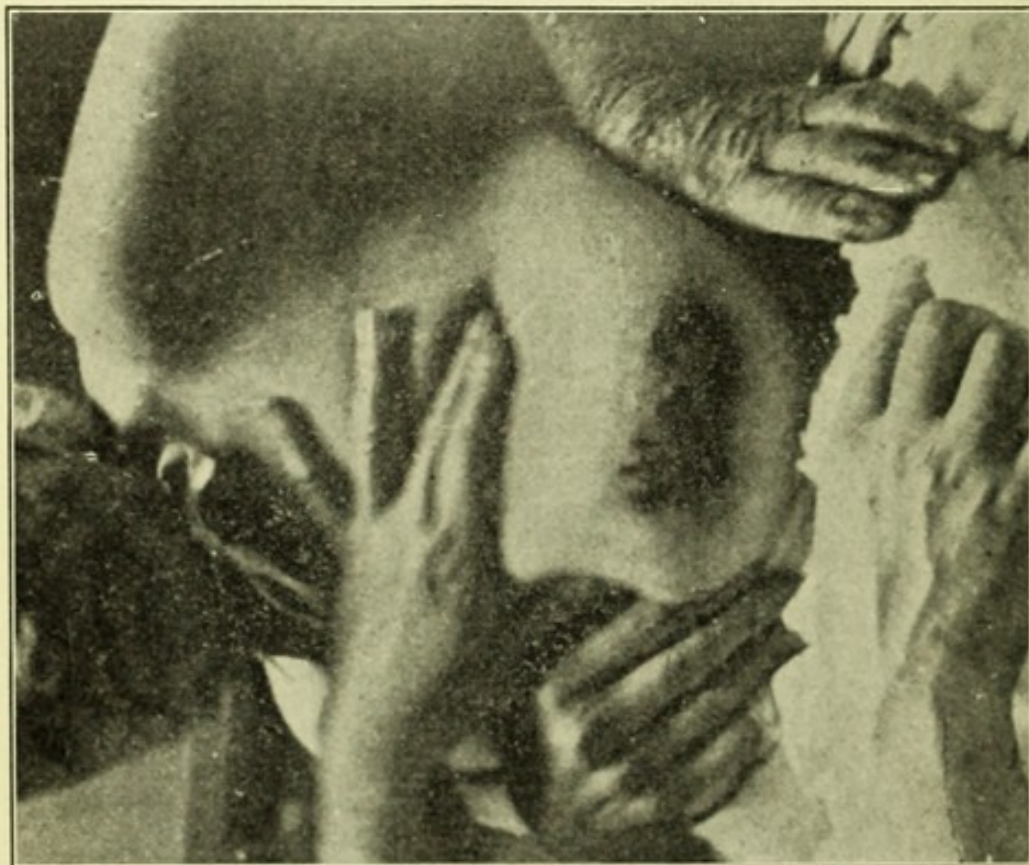


FIG. 28.

CASE XIV.—Conservative intervention. Cicatrization of cancerous breast after limited removal. Cancer following Page's disease. The left mammary gland deeply invaded. Enlargement of glands in the axilla. In view of the great age of the patient, seventy-six years, and her feebleness, decided to remove only the diseased part of the breast. Operation performed in the service of Prof. Tuffier of Paris. Still cured after three and one-half years. (See Figs. 28 and 29.)

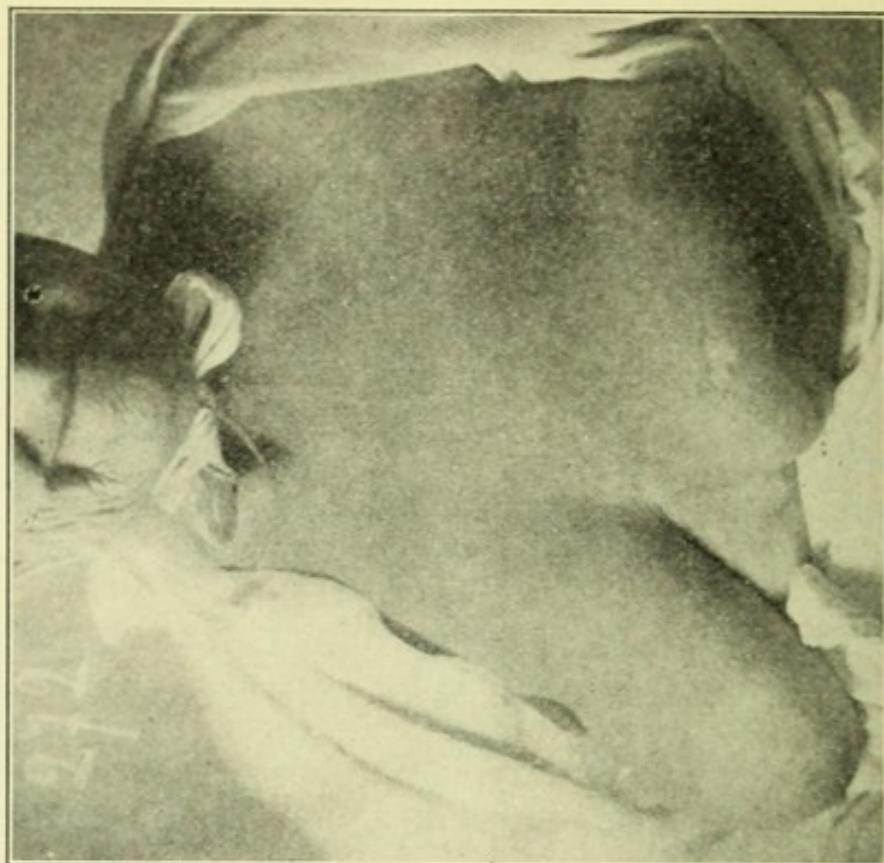


FIG. 29.



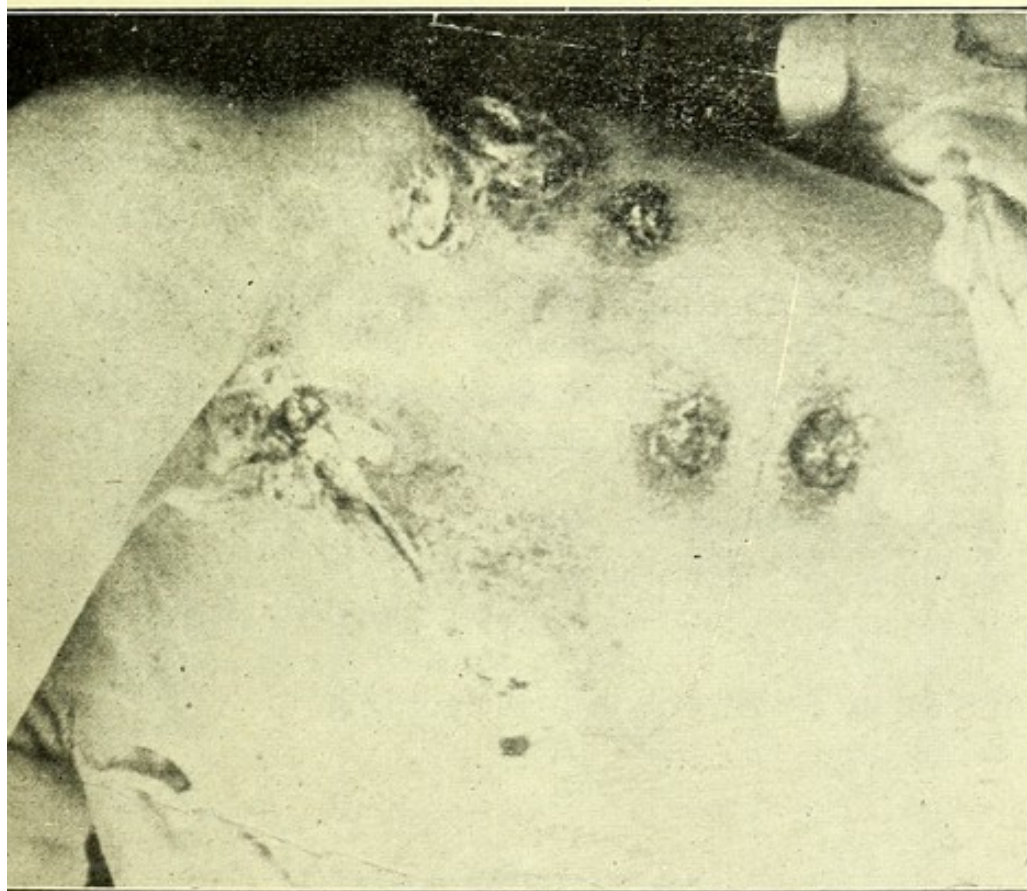


FIG. 30.

CASE XV—Epithelioma of the left breast. Operated twice, with recurrence on the ribs, in the axilla, and in the skin of the flank and shoulder. Patient had received radium treatment which ameliorated her condition somewhat. At the time of fulguration there was cachexia, swollen arm and intense pain. Fulguration in March, 1906, and in February, 1907. Incomplete excision of the nodules and if the axillary mass by Prof. Maurras of the Colonial Infantry. Remained in perfect health for more than three years. I do not know if this will continue, as one must expect a recurrence, since there was still some diseased tissue left in place which it was impossible to remove, but it is extraordinary to have been able to obtain such a result in such a case [de Keating-Hart]. (See Figs. 30 and 31.)

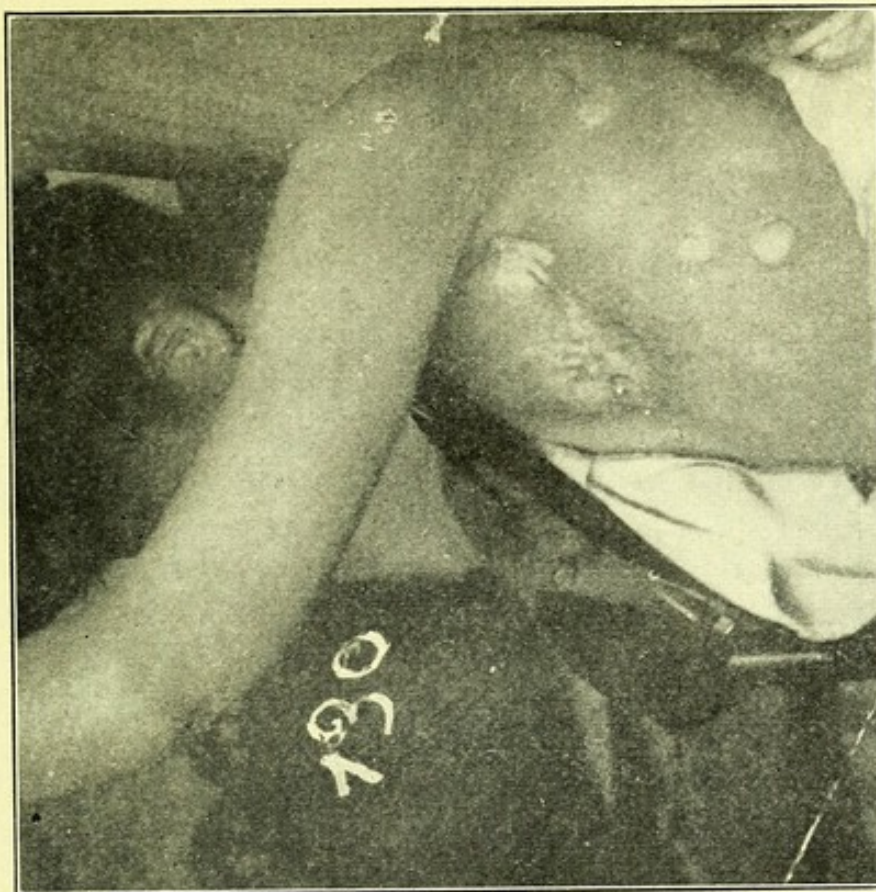


FIG. 31.



Desiccation, "diathermy," electrocoagulation, etc., are all methods of *electrothermic destruction of tissue*, the strength of the spark and the extent to which its application is carried, giving the respective designations to the different methods. Fulguration, on the other hand, is in no sense a destroyer of tissue, but a *modifier of trophic nerve centers*. It is understood, of course, that these are de Keating-Hart's opinions.

It is not necessary for the purpose of this communication to go into further details concerning the various methods named. It may be said, however, that apparatus for employing these have been installed in the New York Skin and Cancer Hospital, and the relative merits of the different methods will be thoroughly tested in suitable cases, the results being reported in due time.

*Instrumentation and Technique.*—The production of fulguration sparks may be accomplished by means of very differently adjusted apparatus. Static electricity and the city current may be utilized, according to the case. The following list comprises the equipment to which de Keating-Hart gives preference:

(1) Electric source: city current, dynamos, or accumulators, etc.

(2) A table holding the rheostats, amperemeters, etc.

(3) A transformer coil with rapid interrupter, or transformer in the closed magnetic circuit (alternating current).

(4) A condenser furnished with a spark gap.

(5) Oudin's resonator.

(6) A bellows furnished, according to the case, with a foot-pedal, or with a tube of carbonic acid, or an electric bellows with disinfected air.



(7) Special electrodes of de Keating-Hart. (Fig. 45.)

(8) An operating table of wood or metal.\*

A few details to be emphasized:

(1) The source of the current must be powerful.

(2) The amperage at the primary may vary enormously (from two to eight or ten amperes, according to the voltage of the current, and the manner in which it is utilized by the internal construction of the coil, etc.).

(3) The strength of the coil cannot be measured in terms of the length of the spark, as formerly, because of important modifications which have been introduced in the internal adjustment of the new apparatus. In the old models one was able to estimate a minimum of forty to forty-five centimeters of spark as the limit of the secondary. But the ensemble of the apparatus ought to be able to produce at the extremity of the solenoid, of the resonator, crackling white sparks of a minimum length of from seven to eight centimeters.

(4) The electrode, the special instrument for delivering the spark to the patient, is in the form of a sound. It is made of a smooth, metallic mandrel, or obturator, working snugly within an insulated tube of hard rubber. (Fig. 45.)

(5) The bellows produces during the operation a constant circulation within the hard rubber tube of a current of carbon dioxid, or, preferably, of air, the purpose of which is twofold: 1, to prevent

\*The Bainbridge table (Fig. 46) was used for many of the fulguration operations during de Keating-Hart's visit. It is especially advantageous for this purpose, the metal of the table serving as the conductor. It is only necessary to expose a small area of the patient's naked body to the uncovered metal top of the table.



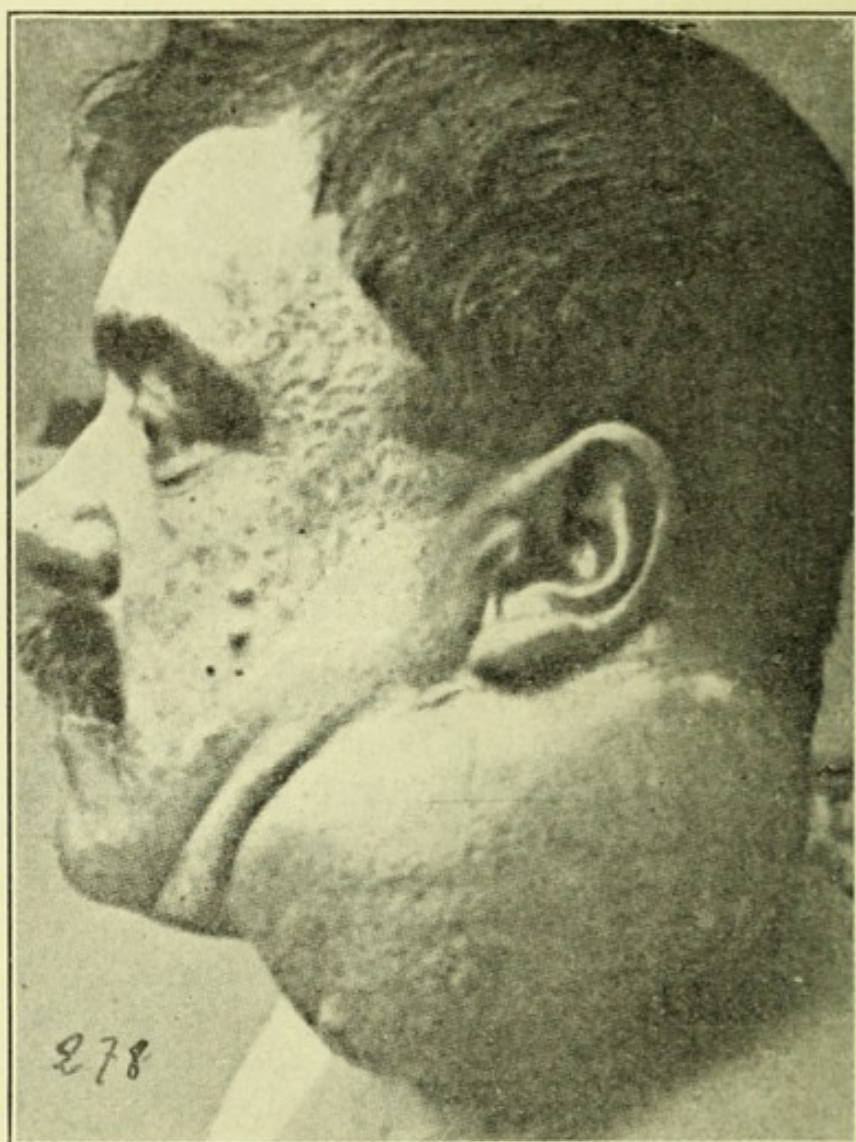


FIG. 32.

*Cancer of the Cervical Region.*—CASE XVI.—This was a case of epithelioma of the left cervical region, the origin of which is uncertain, since it was not seen by de Keating-Hart until the patient had had two recurrences, and when it was impossible to determine the primary focus of the disease. The tumor was large, of rapid growth, fixed to the deep structures of the neck in the carotid region, and declared by several surgeons to be inoperable. Extensive operation. The location, appearance, and consistency of the tumor pointed to a diagnosis of sarcoma, but micro-



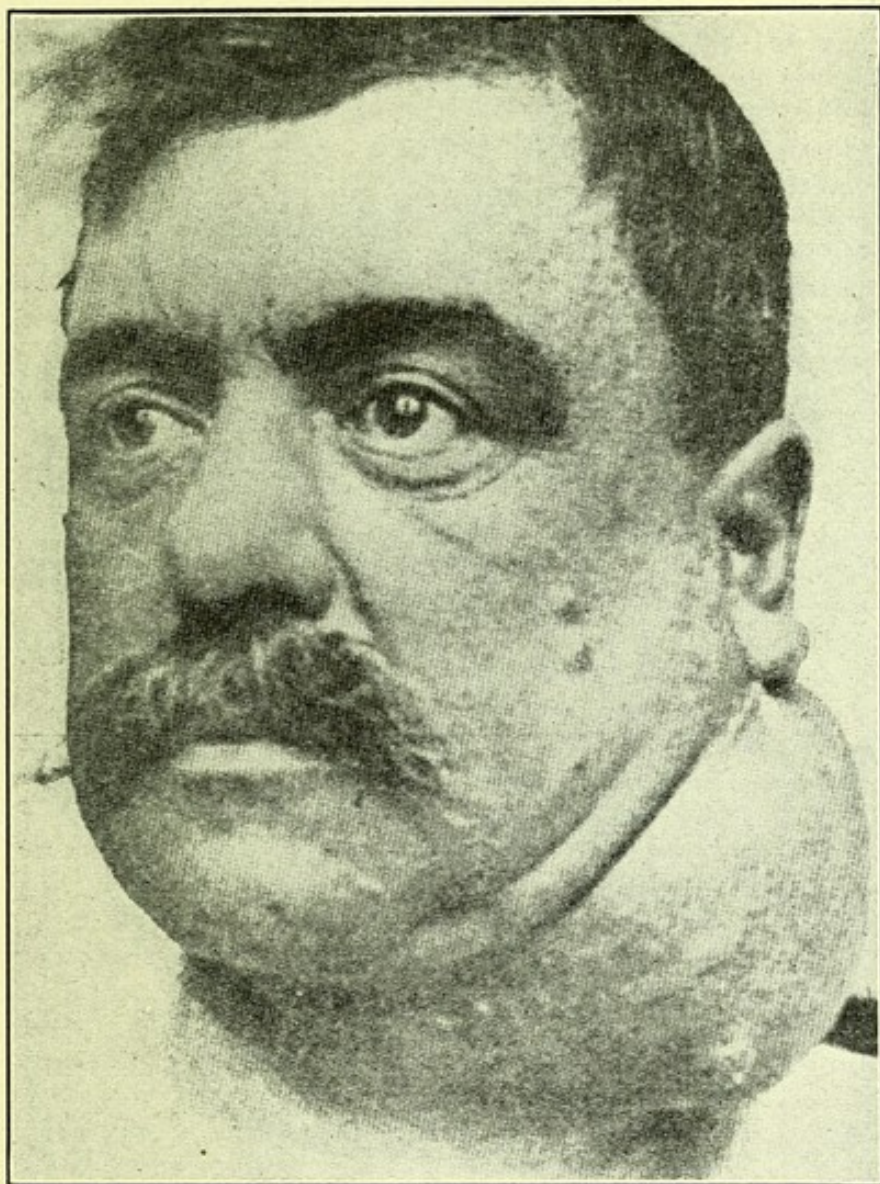


FIG. 33.

scopical examination showed that the clinical diagnosis was incorrect, the tumor proving to be an epithelioma. Fulguration November 2, 1908, after removal of the entire macroscopic mass. During the fulguration of the surgical site it was found that a small metastasis situated in the posterior cervical region was left behind, but it was considered inadvisable to prolong the operation, since the patient was already in a condition of shock. This mass was fulgurated some months later. Perfect result. Complete cicatrization in a few weeks. Seemingly cured after three years. (See Figs. 32, 33, and 34.)



a rise in temperature of the column of air within the electrode where the sparks are produced; 2, to remove the coagulable liquids which may obstruct

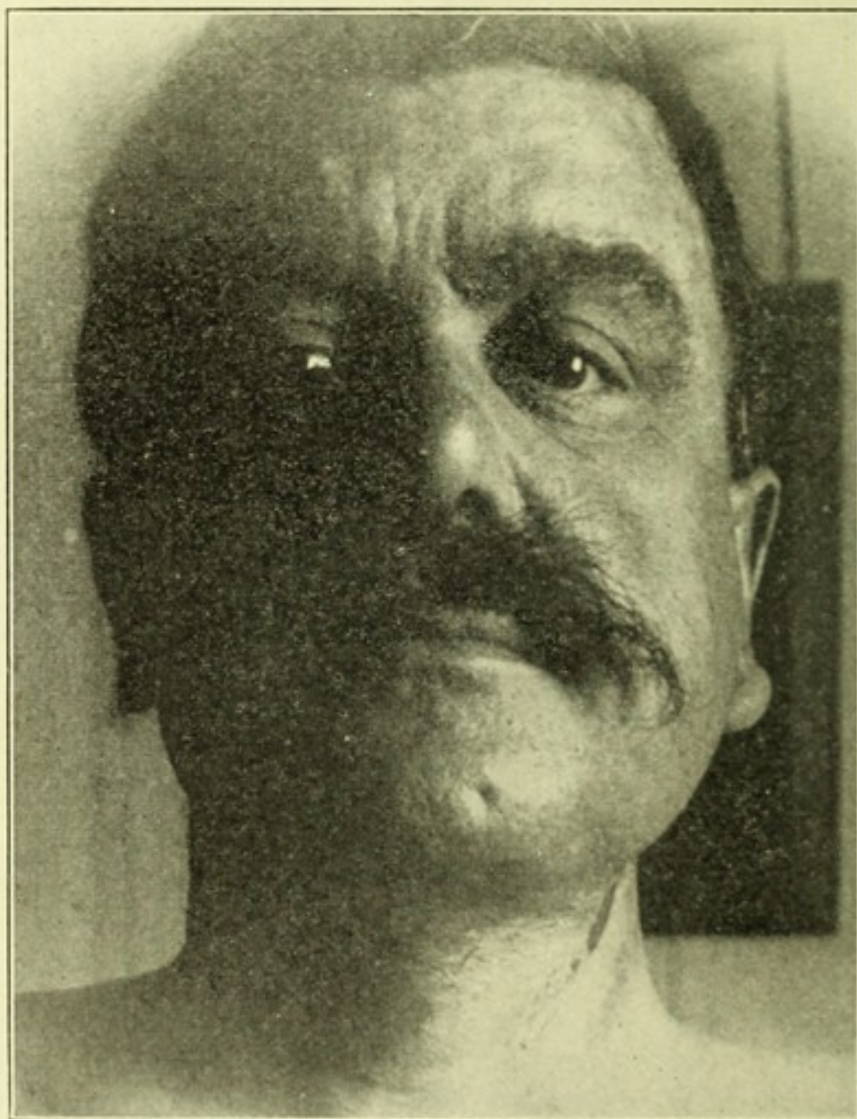


FIG. 34.

the free end of the sound at points of contact of the latter with the operative field.

(6) This gaseous circulation first strikes the upper end of the sound and escapes at the tip. An elec-



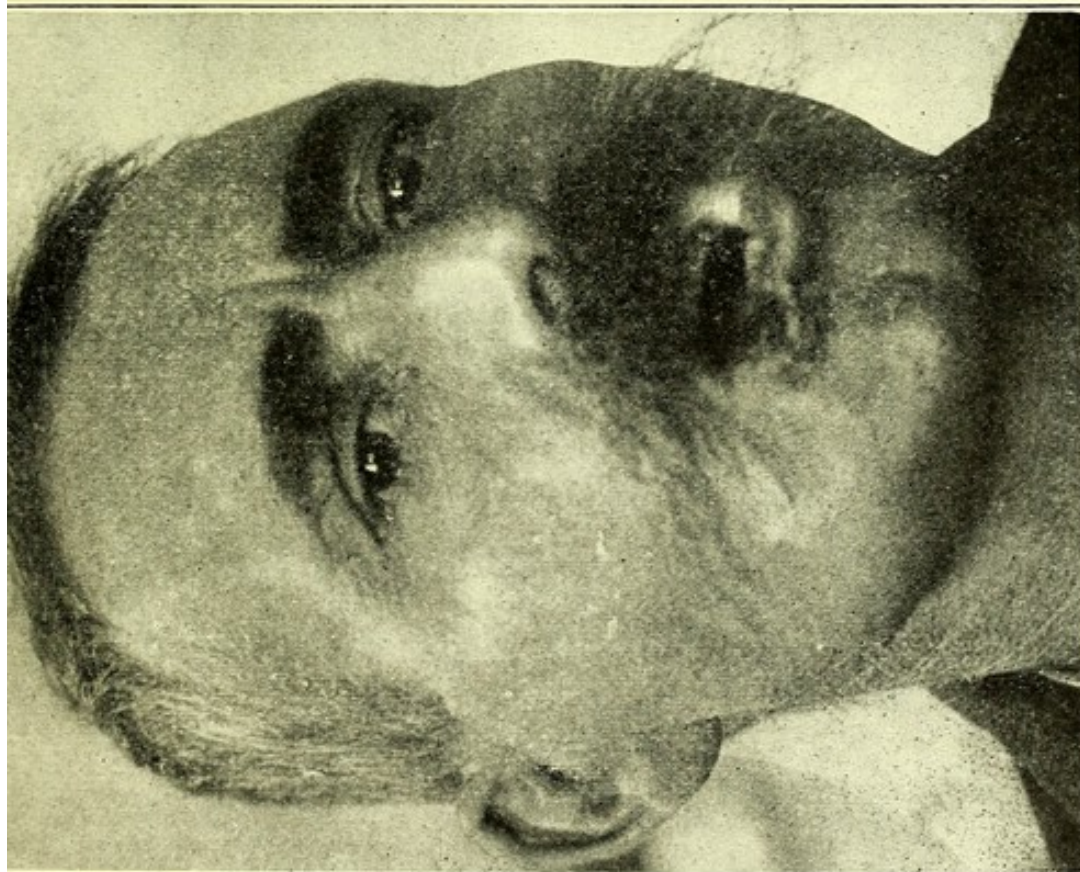


FIG. 35.

CASE XVII.—Flat epithelioma of the angle of the mouth and lower lip, of recent beginning and rapid growth. Fulguration September 18, 1907. Removal limited to the macroscopic lesion alone, without removal of a margin of healthy tissue or of the glands, which were not perceptible to the touch. Cured for more than four years.

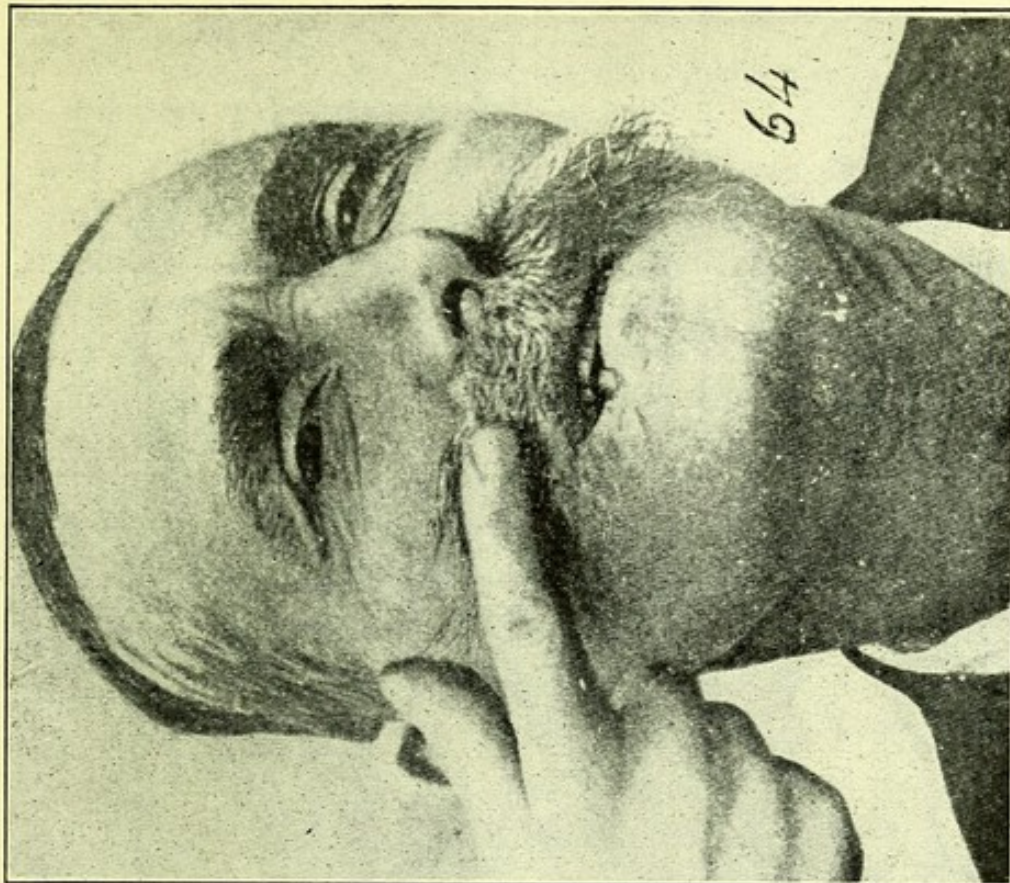


FIG. 36.



tric contact is then established between the electric source and the metallic mandrel. The mandrel is then withdrawn from ten to twelve centimeters outside of its hard rubber casing, in such way that the point of the conductor is situated at an equal distance from the tip of the insulated sound. Conse-

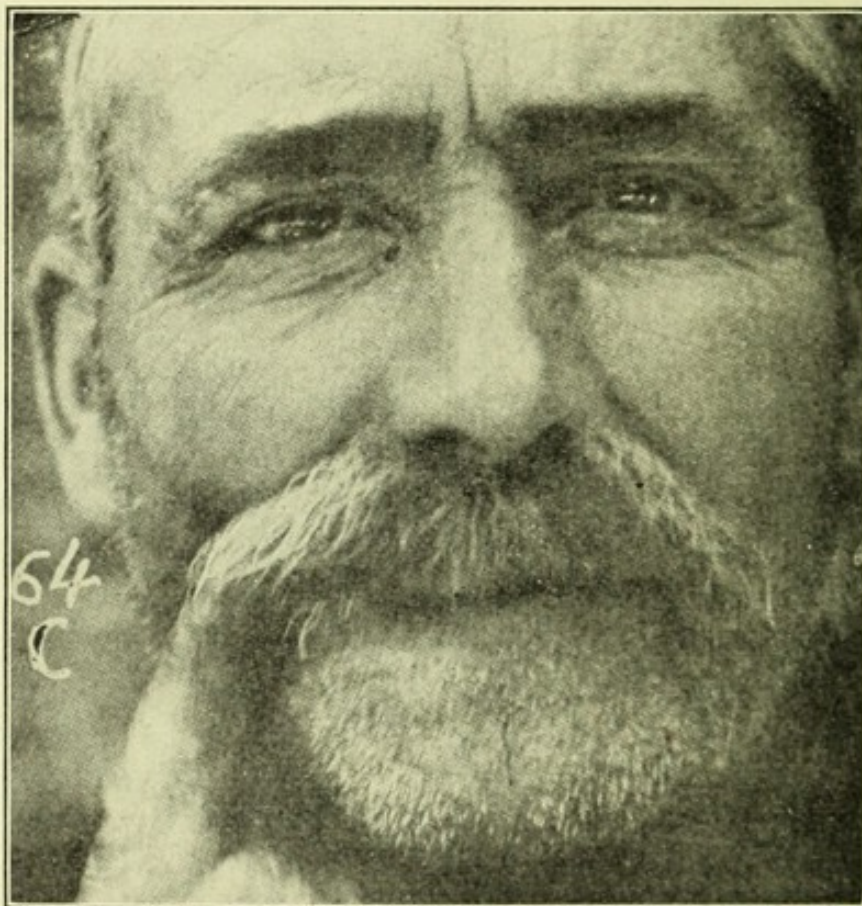


FIG. 37.

quently, in order to reach the fulgurated zone, the spark must pass through the non-conducting aerial column in the sound, which will permit the fulgurator to deliver sparks to those points only which it is intended to reach. For a large flat surface such an instrument may not be necessary. In



all hollow places, or in all empty organs, a spark which is not thus surrounded by insulation spends itself upon the edges or upon certain points and cannot penetrate in its entire length to the bottom of the place in question.

(7) Even with this instrument perfected, as it is, one is not free from all error of technique, unless it be utilized according to certain principles and with precaution. The first precaution to take is the surveillance of the proper function of the apparatus. If the interior wall of the hard rubber tube is still moist after being sterilized, it may change completely the properties of the spark, and especially its length, by prolonging the metal conductor through a conducting liquid as far as the inferior extremity of the instrument. Likewise, it may happen that in spite of the bellows, or, at least through its insufficiency, a coagulum may fill up the interior of the electrode, altering the force and the quantity of the current.

It would take too long to discuss here all the incidents which may take place in the course of fulguration, and, by changing the entire conditions, vitiate the results. From the foregoing it may be readily inferred that precision of technique is quite as essential in the application of the electrical current as it is in the preceding surgical operation.

*Surgical Technique.*—The first step of fulguration is purely surgical. This depends entirely upon the exigencies of the case, and need not be given detailed consideration here. Fulguration is essentially a method of treatment for *operable* cancers. The more complete the removal of diseased tissue, the more certain, according to de Keating-Hart, is the freedom from recurrence. The possibility of complete cure and absolute prevention of recurrence





FIG. 38.

CASE XVIII.—Epithelioma of the lower lip of the size of a small walnut, situated at the angle of the mouth. Enlargement of the submaxillary glands on the right side. Fulguration April 10, 1909. Removal of the tumor, incision of skin to right submaxillary region, ablation of the enlarged glands, and the degenerated submaxillary gland. "Spark- ing" of the entire wound. Cured for more than three years. (See Figs. 38 and 39.)

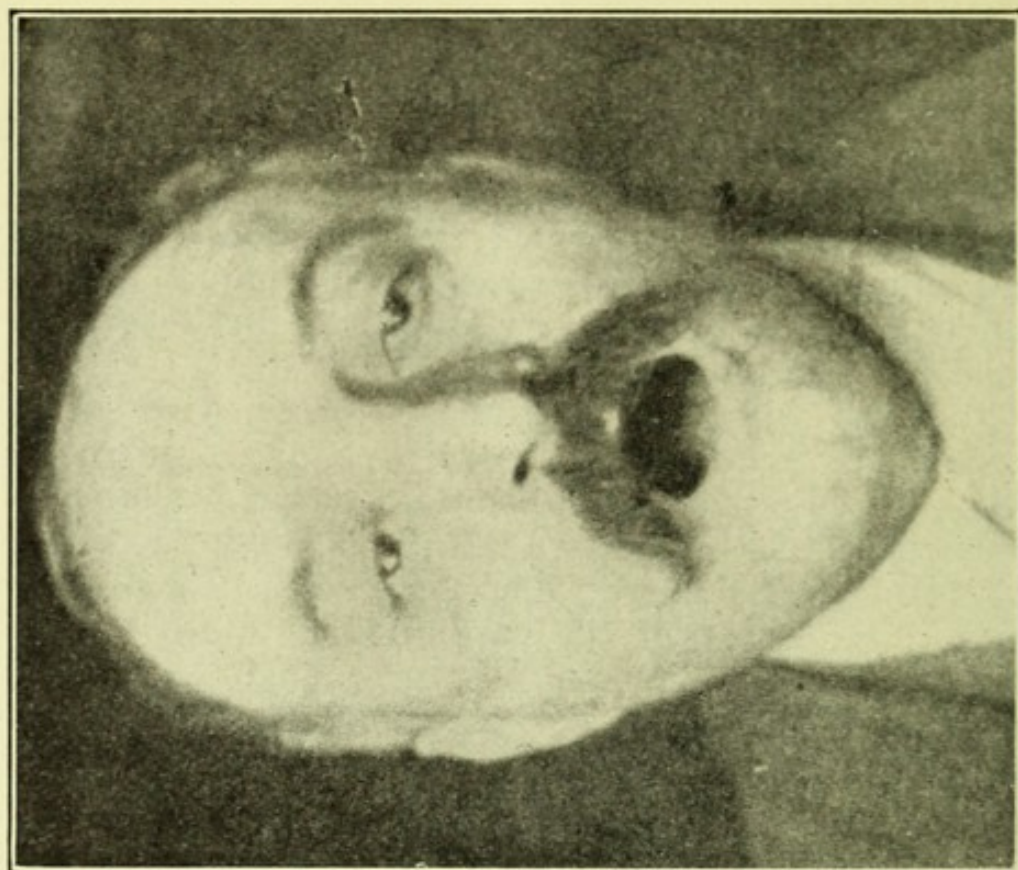


FIG. 39.





FIG. 40.

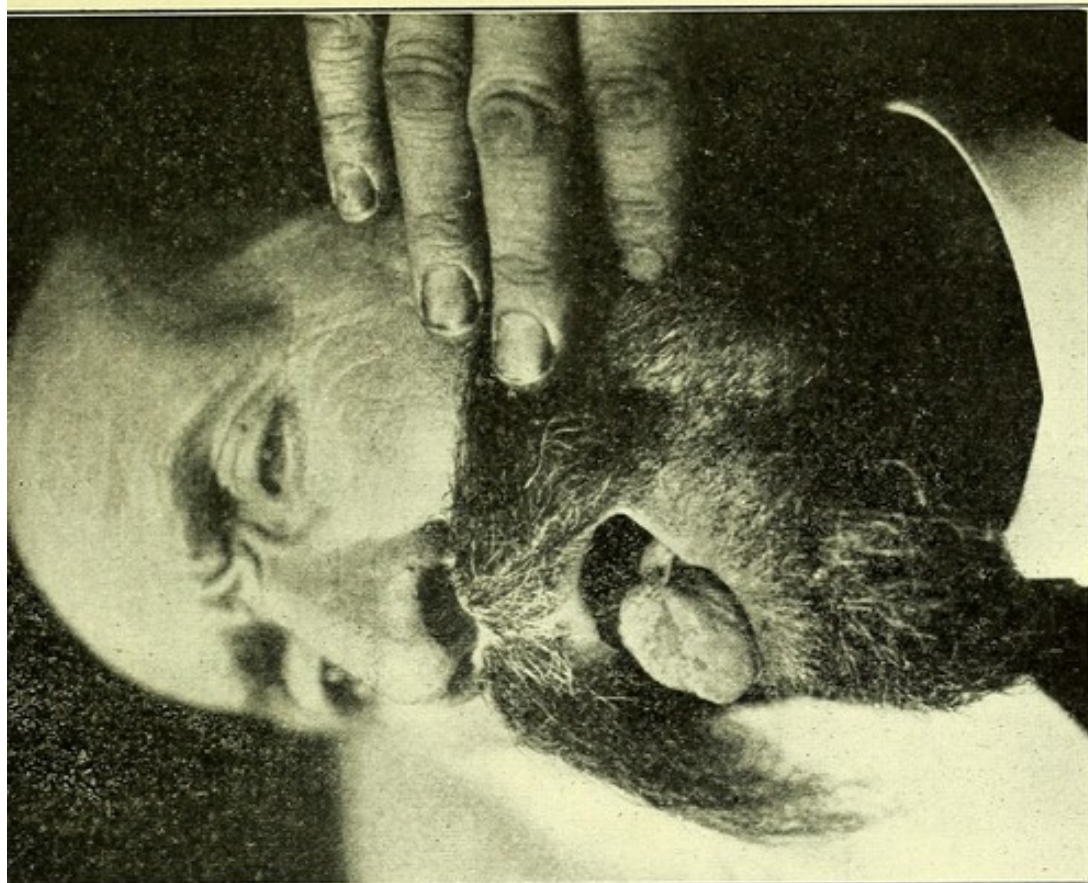


FIG. 41.

CASE XIX.—Cancer of the left half of the tongue, with leucoplakia and bilateral cervical adenopathy. Removal in two sittings of the cervical and buccal lesions. The small glands on the right side were left in place (unfortunately). Fulguration March 21, 1909. Cured for nearly three years. (See Figs. 40 and 41.)





FIG. 42.



FIG. 43.

CASE XX.—Very large cancer of the cheek on the left side, developed primarily on the mucosa of the mouth from a spot of leukoplakia. The tumor invaded successively the superior maxilla, which it destroyed, and the skin of the cheek from the malar region to the ear and as far as the angle of the mouth. A part of the inferior maxilla was also involved. The tumor was treated for some time at Lyons with a high-frequency current, without operation. The tumor grew larger and larger. The patient was seen by Prof. Jaboulay in Lyons. Fulguration April 9, 1909, with the surgical assistance of Dr. Juge. Ablation of the macroscopic masses by means of the curette, the scissors, and the knife. The greater part of the left superior maxilla was seen to be completely cancerous. A sharp primary sparking was then done and repeated some days later upon some new nodules which had appeared at certain points of the wound. Has remained in perfect condition, without recurrence, for more than three years. (See Figs. 42, 43, and 44.)



is commensurate with the extent to which eradication may be carried. Where only partial removal of diseased tissue is possible the method of fulguration is palliative rather than curative. In these cases de Keating-Hart advocates another method—thermo-radiotherapy—which will be considered later.

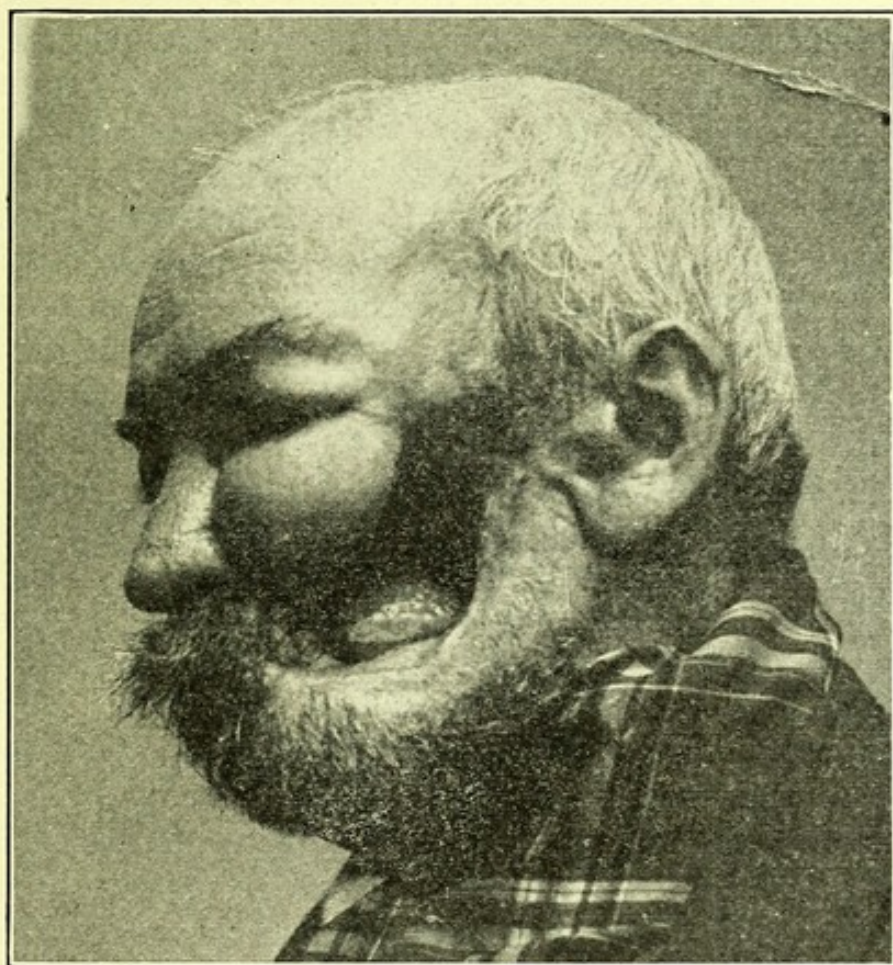


Fig. 44—Actual condition (cicatrized). The tongue is seen at the bottom of the opening.

*Electrical Technique.*—The electrical technique is simple in its description and delicate in its application. The general rule laid down by de Keating-Hart is as follows: Spark for a long time, using powerful sparks of high frequency and high



tension, applying them to the area from which every macroscopic trace of cancer has been removed. It is, then, *under* the cancer, and not *upon* it, that the electrical discharge is applied.

The spark should be white, producing the sensation of a violent shock, its mean length to be from ten to twelve centimeters. An important detail is to utilize the spark at its maximum length. The electrode should be kept in constant motion, and should be regularly passed over the surface being treated. The reason for this is twofold: (1) In order to avoid carbonization of the points at which the spark strikes the tissues; (2) in order to equalize the dosage, save at suspected points where one must work energetically.

The dosage, or the duration of the application of the spark upon a given point, it is impossible to establish in other than an empirical manner. It is not difficult to comprehend the reason for this, when one realizes that no two apparatus are exactly alike, and that in the same apparatus there may be great variations in the primary current, the distance of the sparkgap, and the conductivity of the air which surrounds it, all of which bear an influence, as does likewise the insulation of the patient. Under such conditions the electrical properties of the spark are subject to enormous variation. As a general rule, however, one may advise "ten minutes of fulguration for an area of ten square centimeters." This is near enough for ordinary purposes, in the majority of cases, and with the usual apparatus.

Another guide in the matter of duration is the change in the color of the tissues being fulgurated. All tissues take on a slightly darker tinge, not from destruction, but from the deposit of small blood clots produced at the surface through contact



with the spark. This change of color varies with the tissue involved. While the muscles take on the tinge of smoked meat the bones become slightly yellow. In reality these appearances are apt to be deceptive, depending upon the manner in which the sparking is carried out, and upon the thickness of the sanguinolent fluid through which it passes. As a rule, bones should not be fulgurated as long as the muscles, or the vessels as long as the tendons.

The two main points to be emphasized are: (1) Sufficient removal of diseased tissue; (2) powerful sparking of the underlying tissues.

The method should not be condemned unless these two essential features are practised. De Keating-Hart calls attention to the fact that most of the German authors, with the notable exception of

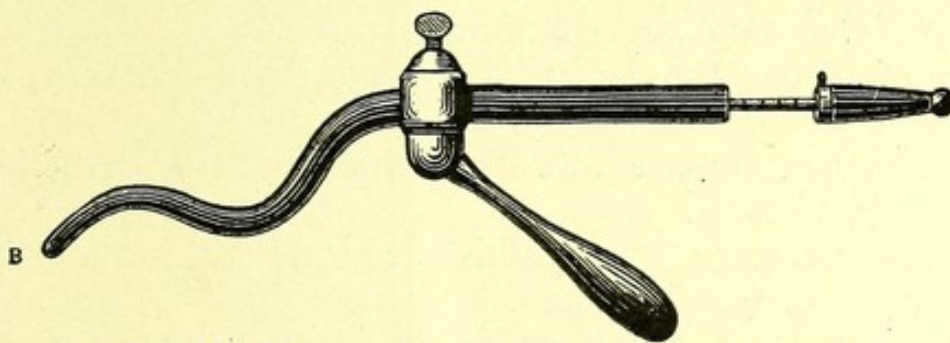


Fig. 45.—De Keating-Hart's Fulguration Electrode.

Czerny, have published only failures. This is accounted for by him by the fact that almost everywhere in Germany he has seen very defective electrodes employed. The apparatus in these instances permits of the use of a spark only about three centimeters long. Furthermore, this spark fails to affect the parts concerned when one is working at the bottom of a cavity.

Bad instrumentation and bad technique, combined with insufficient surgical intervention, are the chief



causes of failure. In addition to these, an improper understanding of the indications for fulguration may lead to failure. Some tumors, because of their location (as in the intestine, uterus, brain, lung), escape the action of the spark. In such cases fulguration alone is not indicated, but a combination of fulguration and "thermo-radiotherapy," another method suggested by de Keating-Hart, of which we will speak presently.

*Theoretical Basis of Fulguration.*—During the visit of de Keating-Hart to this country full notes were taken of his lectures and demonstrations, in order that our test of his method might be in absolute accord with his views. In addition to this, he was asked to formulate for us a full exposition of the theory upon which he bases his claims concerning fulguration. What is said on the subject, therefore, is an abstract of his own statements. We wish to emphasize the fact that we are neither accepting nor rejecting his views, but that, as stated in the beginning, we are merely *examining* the evidence by clinical tests.

The premise upon which the de Keating-Hart fulguration method has been developed is that the *unipolar long spark of high frequency and high tension acts not upon the neoplasm, but upon the soil on which the neoplasm has developed.*

Three groups of facts are relied upon to establish the premise:

(1) That sparking, even when used with inadequate surgical operation, gives undeniable results, insufficient doubtless, but already very definite.

(2) That the tumor is in no way modified in its appearance or in its vitality, from which one may reasonably conclude that it is not the tumor itself, but the condition of its nutrition—that is to say, the



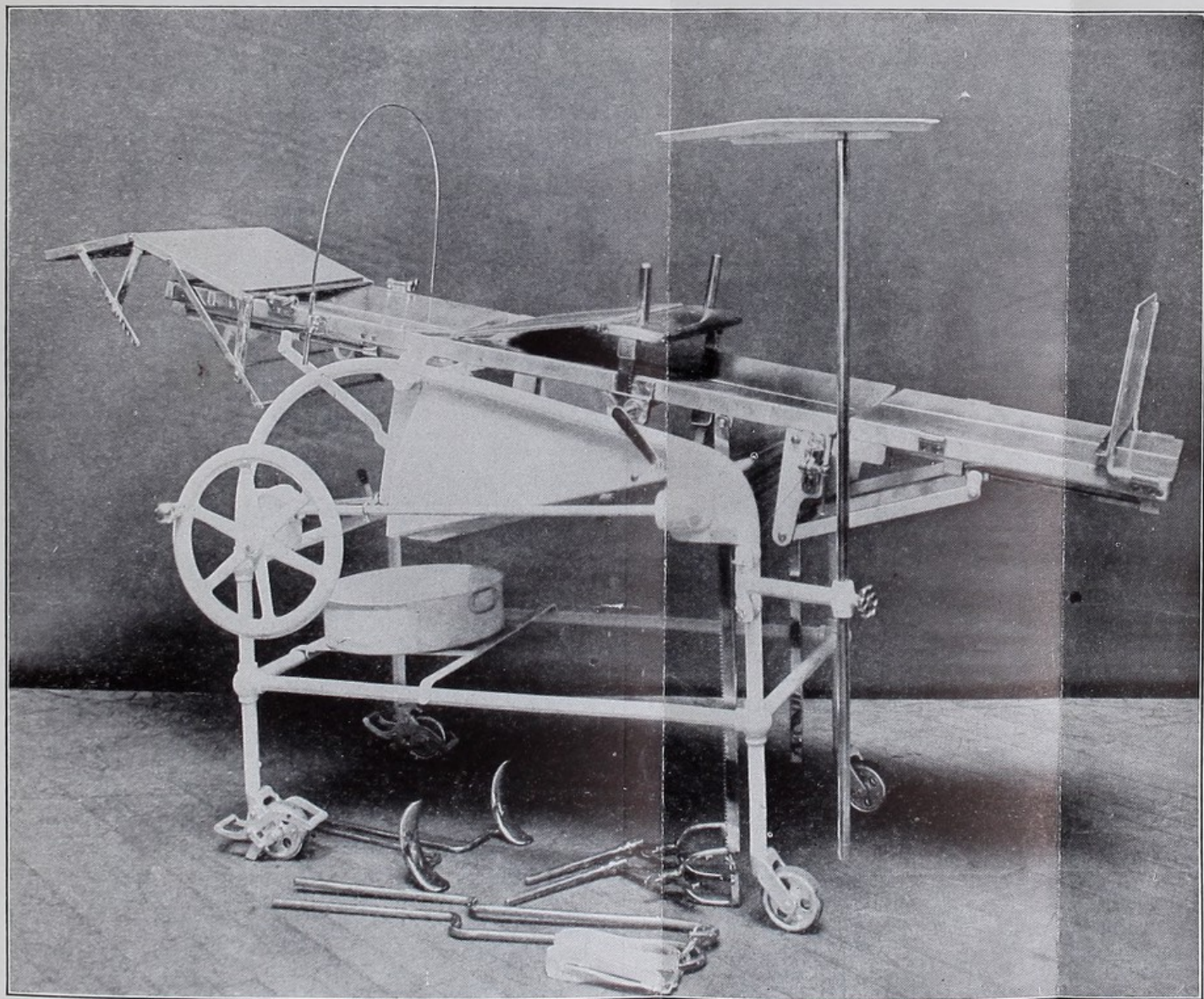


Fig. 46.—Bainbridge's operating table, the metal top of which serves as the direct connection with the electrical apparatus







environment in which it develops—that is transformed.

(3) That laboratory experiments and clinical observations furnish plausible explanations of the foregoing.

#### THE ACTION OF THE CURRENT WITHOUT EXCISION —“SIDERATION.”

In his earlier attempts de Keating-Hart based his work upon a principle which he afterward found false, viz., he sought to produce, by means of the electric discharge, not an immediate and direct destruction of the tumor, as many thought, but what he called its “*sideration*,” by which he meant a sort of stunning of the cancer cell, in consequence of which the cell became partially devitalized and retrograded little by little, so that from a condition of anarchy there was a return to a condition of organized and orderly control.

By way of parenthesis, it may be emphasized here, that by “cancer cell” de Keating-Hart does not suggest a parasitic or microbic origin of cancer. He does not accept this theory of the etiology of the disease, but considers it rather the expression of the hypernutrition of abnormal cells. The object of his treatment, therefore, is to bring about a lessening of the nutrition of these abnormal, or cancer cells, and their death in consequence of this lowered nutrition.

His early results seemed to prove the correctness of this theory. The first case which he treated in this manner was one of cancer of the breast, “*en cuirasse*,” in which division of the nerves had caused anesthesia of the cutaneous surface, permitting the application of violent sparkings many times a week to the affected area without anesthetizing the



patient, and without giving rise to intolerable pain. Under this treatment the general condition improved very quickly. The tumor was adherent to the thorax, but was nevertheless quite superficial. It retrograded under one's eyes.

De Keating-Hart has since published a series of observations of the same kind, in which, despite the persistence of cancerous nodules in fulguration wounds, he obtained, after the application of his method, excellent and durable retrogressions, more or less complete, notwithstanding that previously the lesions were developing with rapidity, and that surgical intervention had aggravated rather than diminished them.

From these experiences he was convinced that the current, even when employed alone, or accompanied by inadequate surgical intervention, gives rise to remarkable results in cancer. He concluded, therefore, that the current is the active element in his method, but he could not at first determine upon what tissues the current acted, whether upon the unhealthy tissue, by destroying it, or upon the healthy tissue adjacent to the abnormal tissue, modifying the former. In time he reached the conclusion that the current caused the "sideration" of the abnormal tissue cells.

*The Modification, by Sparking, of the Area Underlying the Tumor.*—A previously determined fact helped to shake his faith in the hypothesis of the direct "sideration" of the cancer cell. He had seen cutaneous neoplastic nodules retrograde around a fulgurated region without themselves being touched by the discharge. A very simple experiment overthrew his first theory. He found that mice cancers, when fulgurated, removed, and reimplanted in healthy mice, developed afresh under conditions



identical with those of grafts that had not been exposed to the spark. The neoplastic cell, not destroyed directly by the electric discharge, was in no way attacked in its vitality by the discharge.

It was necessary then to completely reject the "sideration" hypothesis, or that the high-tension current caused any notable modification of the neoplasm, whether physiological or histological. The evolution of the cancer, however, being indisputably diminished by the current, in his experience, he concluded that it could only be that the soil sustaining the lesion had been rendered less fit for its growth.

His observations, then, led de Keating-Hart to the theory that sparking modified the local trophism in such way that the tumor, being badly nourished, tended to retrograde. He announced this view at the Congress of Physiotherapy at Paris, in 1909, and afterward at the Congress for the Advancement of Science, at Lille, in the same year.

The observations and experiments which verified, in his opinion, the hypothesis thus modified, may best be given in de Keating-Hart's own words. We quote, therefore, directly from his statements, as published, and as forwarded to the author in a personal communication since the former's return to Paris:

*"Facts and Experiments which Confirm the Hypothesis of an Action on the Subjacent Healthy Tissue.*—The employment of the high frequency short spark (from one to four centimeters), that is to say, at a relatively low tension, produces the effect of cellular stimulation; it provokes a rapid cicatrization of wounds, and its remarkable action of the closure of torpid ulcers is too well known to require any insistence upon it.\*

\*Zimmern: "La Valeur Thérapeutique de la Fulguration," Paris, 1909.



"On the other hand, the high-tension spark properly so-called, of a minimum length of seven centimeters, applied for a time sufficiently long in proportion to the surface fulgurated, *so far from activating cicatrization, retards it and transforms a given area into a torpid wound.* The wound fills up, but the surrounding healthy tissue contracts. The surface becomes hardly at all covered with epithelium. There is, in other words, a natural autoplasty, not cicatrization, and if the surrounding skin is but slightly elastic, the closing of the wound, far from being hastened, becomes extremely slow. By analogy, then, and considering the difficulty of the reformation of healthy epidermis after fulguration, I had to admit that the same trophic phenomenon that prevented such reformation retarded or suppressed the propagation (repullulation) of cancer *in situ*. New and very interesting experiments, previously unknown to me, have come to support, by histological examinations, my somewhat unsupported hypothesis. I refer to the researches of Professor Ghilarducci of Rome.

"On June 30, 1909, Ghilarducci presented to the Royal Academy of Medicine of Rome a communication in which he made known his researches on the 'biological and curative action of fulguration.' He says: 'the curative value of fulguration in malignant tumors is still the subject of much discussion. The method of Keating-Hart has both ardent partisans and strong opponents. I have treated by fulguration eleven almost inoperable cases; namely, three epitheliomas of the breast, two of the neck, one of the nose and the antrum of Highmore, one of the concha of the ear extending to the mastoid process, two carcinomas of the cervix uteri, and one carcinoma of the nasal septum. . . . The



patients belonged to the services of Professors Allesandri, Ferreri, and Ferreti. The immediate results *have been good in those cases in which surgical excision could be practised in such a way as to comprise the macroscopic limits of the tumor*. I cannot express an opinion of the definite results, my experience being yet too recent.'

"But having observed the constancy of all the trophic reactions of the current published up to that time, and rightly admitting that all trophism is normally regulated by the nervous centers, he (Ghilarducci) has sought the causes of these phenomena in the modifications of the nerves and of the spinal cord consequent on fulguration. With this point in view he has made a series of experiments on rabbits. Exposing the animal's sciatic nerve, he subjected it to the current for from a second to half a minute. Then from day to day he examined macroscopically the histological results of these fulgurations. His work *in extenso* gives his observations in detail, which are too long to be recounted here. I shall content myself with a résumé of the principal conclusions, as follows:

"(1) The action of the current varies as the intensity and duration of the fulguration.

"(2) *It manifests itself at a considerable distance from the point fulgurated*. In his experiments, Ghilarducci has discovered in the *sacral and cervical segments of the cord even when not itself fulgurated, lesions corresponding to those that he had produced on the sciatic nerve subjected to the current, and that without modification of the intermediary nerve trunks or of the spinal ganglions*, as though the nerves transmitted the electric shock to the medullary cells without themselves suffering any consequences therefrom.



"(3) Finally, *the distant medullary lesions may vary from a simple chromatolytic reaction to a cellular necrosis*, according to the intensity and the duration of the application of the current to the sciatic.

"We know what profound troubles of nutrition may be brought about by the destruction of certain medullary segments, witness the retardation of growth that the limb of a child undergoes after an attack of anterior poliomyelitis. Is it not easily admissible that the modifications transmitted to the spinal cord by all the nerve terminals of a wound subjected to fulguration, should determine in it reactions that manifest themselves by a certain cellular destruction followed by a more or less complete repair? And would not that explain and justify, to use Ghilarducci's words, 'the analgesias and trophic troubles clinically displayed?'

"To sum up, I believe that I have shown that the reaction of the high-tension current employed in a *fulguration dose* in no way resembles that of other physical agents.\*

"The retardation it causes to the epithelial covering of wounds, the retrogression that it provokes even in cancer nodules situated around the fulgurated zones, and, finally, the distant histological ac-

\*"It is especially differentiated from 'diathermia' studied in Austria and Germany by von Berndt, Zeyneck, Preeps, and Nagelschmidt, and lately introduced into France under the name of 'electrocoagulation.' This is indeed only a thermic means of destruction, not a modifier of trophic centers. I do not discuss, but merely call attention to this method, so interesting from other viewpoints, which up to now has not given any result that has been seriously studied in cancer; and the work of the authors themselves of the method (Berndt, Nagelschmidt) have proved that the cancer cells *not destroyed by diathermia acquired on the contrary a heightened vitality.*"



tions that it determines in the medullary centers corresponding to these zones, all suggest a seductive, even if yet incomplete, explanation of its success in the treatment of cancer. The ignorance in which we find ourselves regarding the exact pathogeny of these neoplasms, does not permit us to demand more from any theory. Certain experiments, however, now proceeding, will soon, I hope, permit me to support it with sufficiently forcible proofs. But the difficulty in the matter of dosage explains how it is that results can be so different with different experiments and cases."

#### THERMO-RADIOTHERAPY

Reference has been made to cases in which fulguration alone is not indicated, and in which a combination of fulguration with "thermo-radiotherapy" has been employed to seeming advantage by de Keating-Hart. The method consists, briefly, in the sensitization of the tissues by fulguration, or other means, and their irradiation by means of  $x$ -rays, the skin surface through which the  $x$ -rays must pass being previously or simultaneously cooled in order to prevent  $x$ -ray dermatitis.

The procedure and the theory upon which it is based was given to the profession for the first time during the demonstrations at the New York Skin and Cancer Hospital in December. It is now being published for the first time. The method is too new to permit a definite statement with reference to its effects, or to predict its future. According to its originator, some very astonishing and quite un-hoped-for results can be reported, a few examples of which are herewith presented.



A number of cases were treated by this method under de Keating-Hart's direction, during his recent visit, and the treatment has been continued in these and other cases since that time.

The following cases are fair examples of the results obtainable with this method. The histories and photographs were furnished us by de Keating-Hart.

CASE I.—This is intended to show the inhibitive action which cold exerts against the effects of the rays. A man who was suffering from an epithelioma of the face extending to the cranium and to the brain had been subjected to the  $x$ -rays, and a few days after the application he had suffered from a radiodermatitis, despite the care taken by the specialist to avoid such an accident. The patient, refusing to submit to further applications of radiotherapy, presented himself to de Keating-Hart. Upon the promise of the latter not to burn him the patient agreed to allow a treatment. The  $x$ -ray was applied to the skin every eight days for several weeks, during which time the skin showed no untoward symptoms. Before each treatment the skin surface to be traversed by the  $x$ -rays was chilled, either by means of bellows, evaporating a little water imbibed in a piece of gauze placed upon the region, or by means of a small sack of crushed ice. It is added that the patient had a very much congested and warm face, which explained his susceptibility to the  $x$ -rays.

The other cases have reference to particularly rapid results with the  $x$ -rays upon cancers previously warmed.

CASE II.—This case was that of a woman afflicted with an inoperable cancer of the uterus which had fixed this organ in the pelvis and formed a large glandular metastasis in the left groin. The compression caused by these glands had produced considerable edema of the left leg and foot. The patient suffered horribly despite the six or seven daily injections of morphine. Thermo-radiotherapy was applied in two sittings within four days. At the first sitting it was applied by means of a thermopenetrative electrode introduced into the vagina, the other pole being placed upon the left lateral wall of the abdomen a little below



the spleen. At the second sitting the temperature of the pelvic region was increased by means of a hot vaginal douche with water at 50 degrees centigrade for twenty



FIG. 47.

minutes. Both calorifications were accompanied by radiotherapy through the chilled skin of the abdomen. (As usual, the dosage given was 4H. ten Benoist.) The result was very remarkable and rapid. From the first application the pains diminished, and after the second the



disappeared. The swelling of the leg subsided so that morphine was no longer necessary. The internal tumor diminished by one-half in eight days and the inguinal glands had grown smaller. At the same time some very remarkable cytolytic phenomena of intoxication appeared, viz., profuse diuresis (4 to 5 liters in twenty-four hours), fever from  $39^{\circ}$  to  $40.5^{\circ}$  C., and during the eight days symptoms of depression alternating with nervous excitability, etc. Then everything went well again, and several weeks later, without other treatment, the pain had not reappeared, and the local condition remained about the same. This patient is still under treatment.

CASE III.—The third case is somewhat similar to the preceding. This was an extensive cancer of the vagina fixed to the rectum and involving the adjacent structures. The uterus was apparently invaded. The surgeon, Dr. Rouland, who referred her to de Keating-Hart, considered the case inoperable, or at least that no good results could be expected from operation. Three applications of thermo-radiotherapy were made, extending over three weeks. This sufficed to reduce the tumor to the size of a peach stone—a small indurated mass situated upon the posterior vaginal wall, completely free from the rectum. In this case very warm water was used to heat the parts and radiotherapy in the dosage of 4 H applied through the pelvic route.

CASE IV.—This case is that of a woman (Figs. 47 and 48) afflicted with chondrosarcoma which had recurred twice in the palm of the hand. The lesion was deep and the flexor tendon was invaded, as shown in the photograph. The surgeons who had seen the case proposed amputation of the forearm, but the patient refused, presenting herself to Dr. de Keating-Hart for treatment. He began by extirpating the greater part of the tumor with a knife, then fulgurating this area. Deep down, however, there remained some masses in contact with the bones and tendons. Some days later he plunged a high-frequency needle into these masses and simultaneously allowed the  $x$ -rays to play upon them. In a few sittings the induration had disappeared and four weeks later the hand was healed, as shown in the second photograph. The function of the hand is almost normal, and the pains, which had kept the patient awake, disappeared after the first exposure.



*Theory.*—Again we quote directly from the communication of de Keating-Hart:

“Every luminous radiation passing through a liv-



FIG. 48.

ing organism, determines in it biochemical reactions, the intensity of which varies with the quantity and duration of the exposure from a mere over-



excitement of normal transformation to the destruction of cell-life. Such is the law regulating the relations of living beings to light, whatever the length of the luminous vibrations.

"It must not be overlooked, however, that a knowledge of the quality, number and duration of irradiations does not necessarily imply a knowledge of the length and intensity of biochemical reactions.

"The explanation of the unequal effects produced by radiations of the same strength must be sought in the morphological differences and the biological state of the cells themselves at the moment.

"Every radiotherapist, however expert he may be, and even with the use of the same instrumentation under the same general conditions, sees very different results according to the individual. It is well known that certain pathological tissues are much more sensitive than others to Röntgen rays.

"In 1907, Bergonie and Tribondeau (of Bordeaux) threw some light on these hitherto empiric notions. Their researches were made to determine the amount of cell destruction in the organic depths with radiations which were innocuous to surrounding or more superficial tissues. From their work these authors have arrived at certain conclusions which, if not sufficient to explain all the known facts, permit one to understand at least many important phenomena.

"The following three laws are worth remembering: The activity of rays is proportional: *First*, to the reproductive activity of the cells; *second*, to the duration and constancy of their karyokinetic movements; *third*, to the higher differentiation of cell morphology and function.

"From these data we may readily conclude that the effect of  $x$ -rays on pathological cells is not spe-



cific. It is thus easily understood how neoplasms are destroyed by  $x$ -rays that pass through the more fixed normal cells. For the same reason certain tumors of rapid growth are more radiosensitive than tumors characterized by less constant and intensive karyokinesis.

"Of a similar nature are the conclusions drawn by Dominici and Cheron from radium effects. These experimenters not only observed a greater radium-fragility in the case of epitheliomata than in that of sarcomata, but they noted also the same difference between embryonic sarcomata and fibrochondrosarcomata, the cells and functions of which are more specially differentiated.

"In the same way also Schwartz observed that moistened and sprouting seeds are more radiosensitive than those which are previously dried. In this we have an obvious confirmation of Bergonie's findings.

"On the other hand, these laws do not by themselves explain the great skin-sensitiveness from which certain patients suffer during every exposure to  $x$ -rays, no matter how short the sitting may be.

"Furthermore, these laws do not explain the resistance offered to the Röntgen rays by certain tumors which were in the very beginning of treatment markedly radiosensitive. This is still more remarkable when we remember that cutaneous tissue becomes weaker at every successive radiotherapeutic sitting.

"Another contradictory fact was observed by Gerhartz: that the genital organs of frogs (organs, however, made up of karyokinetic cells) were not found to be sensitive to the  $x$ -rays. This would appear to be contrary to Bergonie's rule and to the



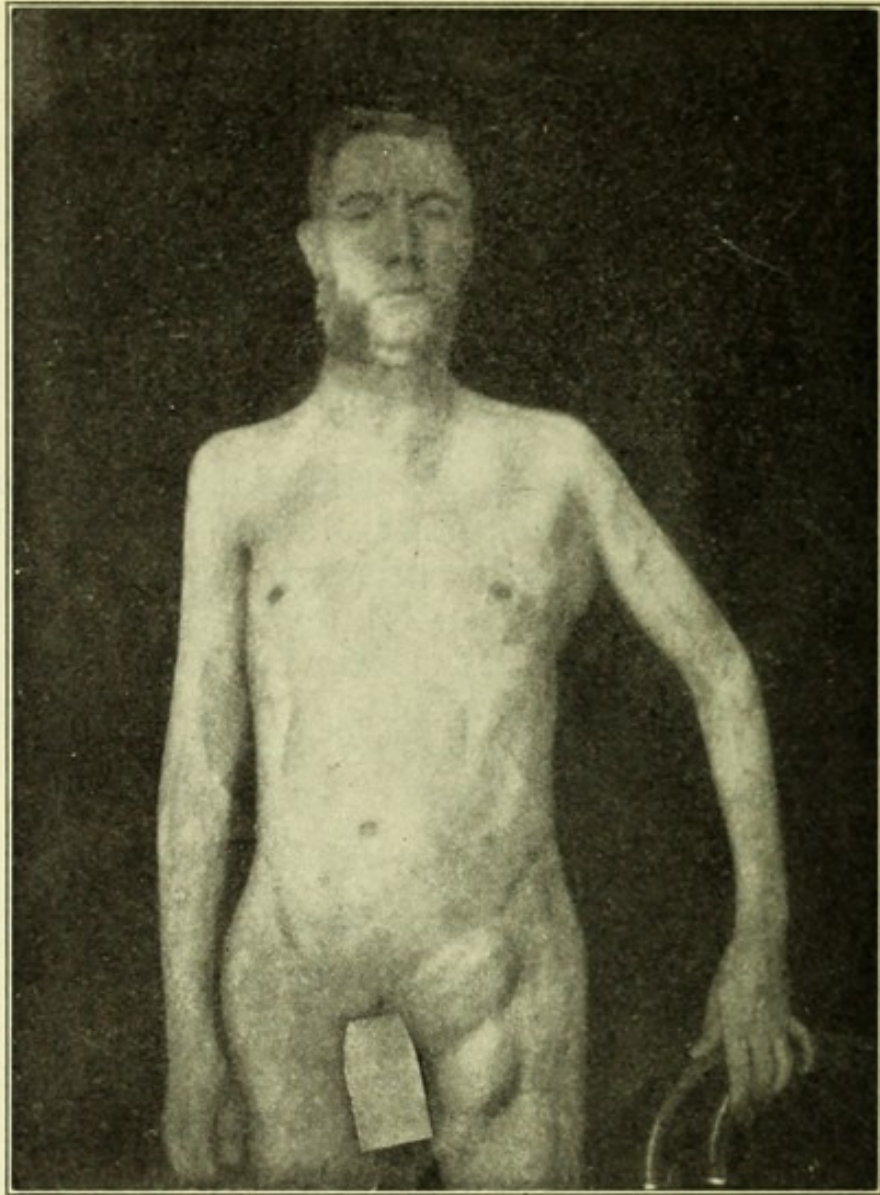


FIG. 49.

CASE V.—The fifth case (Figs. 49 and 50) is that of a man who was suffering from Hodgkin's disease, with generalized lymphosarcoma and leukemia. He showed numerous large tumors, the most important of which were situated in the cervical, axillary, and inguinal regions, tumors of rapid growth developing almost simultaneously everywhere. The spleen, while not enormous, was perceptibly increased in size. For three years this patient had undergone various kinds of treatment, among which were  $x$ -rays and two surgical operations. Electric treatment gave him marked relief at first, a number of the neoplasms rapidly softening under the action of radiotherapy. Then, as often happens, the tumors, instead of continuing to disappear, seemed to receive a new stimulus to growth, so that the specialist in charge finally advised cessation of the treatment. When the tumors had acquired an enormous size the patient was admitted, in June, 1911, to the service of Prof. Delbet, at the Neckar Hospital. Prof. Delbet operated upon two large masses situated in the neck and in the groin. The patient, terrified by these repeated operations,





FIG. 50.

left the hospital and entered Dr. de Keating-Hart's Hospital.

The areas operated upon already showed new recurrences, and the non-operated tumors, shown in the first picture, grew very rapidly. They were of a hard, nodular consistency, and a histological examination at the Neckar Hospital confirmed their malignant nature.

The patient was treated every day, or every other day, for three weeks by injecting into one of the tumors artificial normal serum at a temperature of about 50 degrees C., nearly equal in quantity to the size of the tumor before the injection. Immediately after each injection an x-ray treatment (4 H, 10 Benoist) was given. One sitting for the small tumors and two for the large ones was sufficient to soften them in a few days.

This patient, who had been condemned to a very rapid death eight months previously, is in an almost florid state of health, and has taken up his work again. There are still a few disseminated tumors not yet softened, but the great majority and the largest of them have disappeared, as one may see from the last picture.



conclusion drawn from Schwartz's experiments on seeds.

"Paul Becquerel, upon exposing dried spores of yeast, found that these spores are very quickly sterilized at normal temperature and but very slowly when frozen.

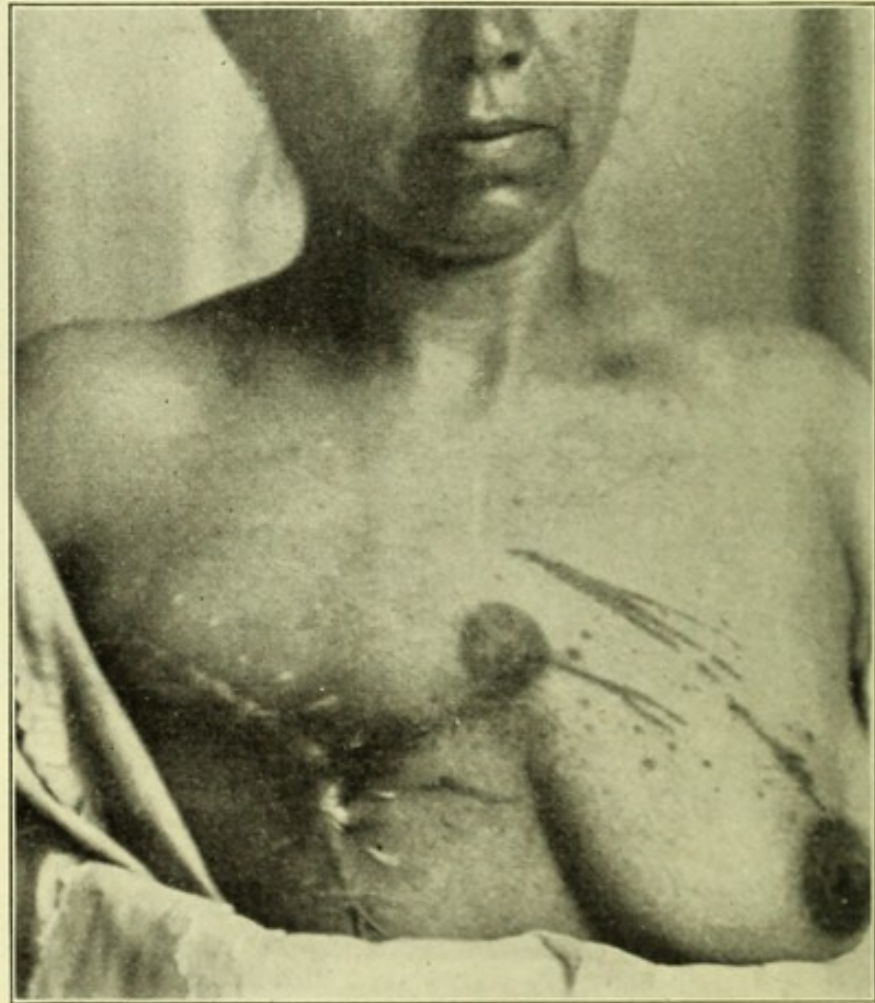


FIG. 51.

"When we consider that the experiments of Gerhartz were made during the winter on frogs, animals whose temperature is variable, we can only conclude that, as in Becquerel's experiments, cold



seems to be opposed to the destructive action of rays on living cells.

"Histopathology, clinical researches, and personal experience have confirmed the statement that I made at the Dijon Congress, namely, *other conditions being equal, the radiosensitiveness of tissues depends upon their temperature*. In other words, the higher the temperature of tissues (between the normal vital limits) the greater the destructive power of radiation upon them. An excellent illustration of this is shown in the picture (Fig. 51).

"The patient, being treated for cancer of the right breast, presents needle marks upon the left breast. The needles were plunged into the skin and served with thermopenetration. During respiration the needles were thrown out upon the skin two or three times without any apparent mark. X-rays, applied immediately after, revealed these various displacements through the radiodermatitis produced in the burned areas."

All these clinical and experimental facts, however interesting they may be, must be confirmed by therapeutics. The researches of de Keating-Hart on the radiosensitiveness of cells were made with therapeusis in view. Röntgen-therapy, in his opinion, would be the best kind of treatment for cancer if it would sufficiently work on deep tissues without destroying the healthy overlying tissues. If it is possible to render abnormal cells radiofragile and healthy organs radioresistant, the best possible results can be obtained. Such are the principles of his method of thermo-radiotherapy, which consists in *cooling the skin and heating the diseased tissues during or before the application of x-rays*.

*Technique*—Thermo-radiotherapy is applied in three different ways, as follows:



(1) In the case of tumors with abundant blood supply, such as sarcomata, physiological hot serum is injected at  $50^{\circ}$  C., and in such a quantity as to raise the internal temperature of the neoplasm to about  $41^{\circ}$  or  $42^{\circ}$  C.

(2) In case of cancers developed in the natural cavities (rectum, vagina, stomach), irrigations as warm as possible are used during a time varying with the needs of the individual case.

(3) In tumors of woody consistency, that can be heated neither by injection nor irrigation, high-frequency currents are employed either by passing the current through needles thrust into the skin, or through an electrode placed on the skin surface.

The last-named method of applying currents is not new. It has been employed by several persons, but with serious inconvenience because, by rendering the skin more radiosensitive than the deep-seated tumors, they have produced radiodermatitis, making the subsequent application of the current impossible.

A natural consequence of the law controlling the relation of temperature to radiosensitiveness led de Keating-Hart to obviate the difficulty just mentioned by *cooling* the organs which he would protect. This is accomplished by several means, two of which may be mentioned.

First, the surface to be protected by cooling is covered with cracked ice wrapped in cotton.

Second, a special apparatus may be employed which cools by blowing the dampened surface with a bellows.

Whenever possible,  $x$ -rays should be applied during the heating of the cancer, especially when the neoplasm is small and superficial. If the mass is deeply situated, as in uterine cancer, it may retain its



warmth long enough for the irradiation to follow immediately after the warming process.

The irradiation must be subjected to the usual rules of radiotherapy. The longer and more frequent the exposure, without destroying the normal surrounding tissues, the more rapid are the local results. The results may sometimes be too rapid, which fact calls for great care, inasmuch as the cytolysis of the tumor may be the cause of serious autointoxication. This is particularly true of epithelial tumors.

*Conclusions.*—From a study of the data cited, and from the experience described, de Keating-Hart arrived at the following conclusions with reference to thermo-radiotherapy:

(1) That the  $x$ -rays have a more intense action upon warmed cells than upon cold cells.

(2) That the application of this principle under the name of thermo-radiotherapy in the treatment of cancer, by previously cooling the surface of the normal tissues to be traversed by the  $x$ -rays, produces more rapid destruction of the cancerous tissue with a weaker dose.

(3) That this treatment is applicable to the majority of cancers, but the autointoxication brought about by the cytolysis renders it advantageous to remove as much as possible of the cancer and to fulgurate the field of operation in operable cases.

(4) That in inoperable cases, and with patients who refuse all operative interference, thermo-radiotherapy alone may be employed, care being taken to prevent too rapid cytolysis and consequent autointoxication.

(5) That cases in which the cancer has been completely removed and fulgurated show the same sensitiveness to  $x$ -rays as do warmed cancers.



Thermo-radiotherapy, alone or in conjunction with fulguration, according to the requirements of the individual case, is being tested at the New York Skin and Cancer Hospital. We are not ready yet to even express an opinion concerning its merits, further than to say that we would not be testing it if it did not hold out a modicum of hope of at least ameliorating suffering.

In due time the cases treated by means of thermo-radiotherapy, along with those treated by fulguration, will be reported in detail.

34 GRAMERCY PARK.