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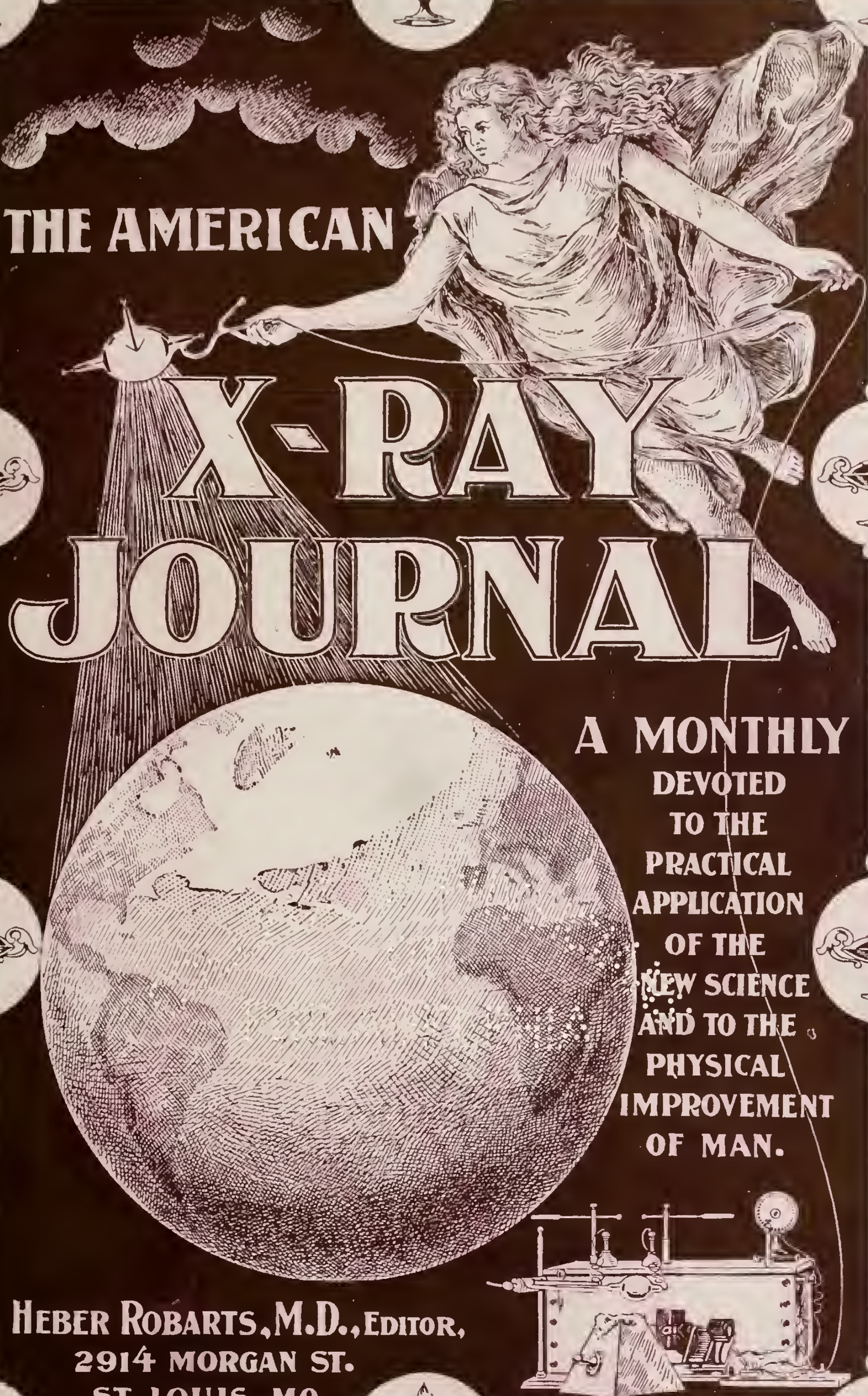

THE AMERICAN X-RAY JOURNAL

A MONTHLY DEVOTED TO THE PRACTICAL APPLICATION OF THE NEW SCIENCE AND TO THE PHYSICAL IMPROVEMENT OF MAN.

HEBER ROBARTS, M.D., EDITOR,
2914 MORGAN ST.
ST. LOUIS, MO.

THE AMERICAN

X-RAY JOURNAL.

A Monthly Journal devoted to Practical X-Ray Work and Allied Arts and Sciences.

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2914 Morgan Street, St. Louis, Mo.

ANNOUNCEMENT.

No apology is considered necessary for undertaking the publication of the American X-Ray Journal, the "first born" of its kind, and a journal in line with human thought and the practical needs of man.

Fifteen months have passed since the Wurzburg professor first announced the discovery of the x-ray, and so great has the interest become that every item pertaining to the new science is grasped by the public press with avidity. The claims made by Professor Roentgen were received at the time with commingled incredulity and amusement, and are even at this date not properly appreciated by some professional reading people.

The medical profession have a record for amplifying, pruning, and utilizing new facts for the benefit of humanity and themselves, but in this instance there are financial, mechanical, and technical difficulties which must be surmounted by them before the x-rays can be practically applied. Again, inefficient apparatuses are everywhere used by exhibitors and forced upon the attention of doctors. It is on account of these facts that physicians do not readily adopt the new science, notwithstanding the public clamor for its use.

The ease and certainty of diagnosing some surgical affections has advanced more in the past twelve months than any previous hundred years. In the first experiments with the x-rays it was thought possible to photograph only the bones of the hands, and this only after long exposure, while examinations with the fluoroscope were considered too tedious and impracticable. But the usefulness of the x-rays has so rapidly extended that no bone of the human body has escaped successful photography, and the bones have been examined directly with the fluoroscope.

Successful work is being done also in diagnosing cases of cancer, tumors, appendicitis, gall stones, renal and urinary stones, exostosis of the cranium and blood clots, in addition to the more common cases of fracture, diseased joints, and the locating of foreign substances in any portion of the body. In the fluoroscope the heart is observed and studied in its movements, the diaphragm is outlined and seen to rise and fall with respiraton, and the visceral organs can be studied.

The application of the x-rays has been used with success in certain cases of the blind, in nervous twitching, tremulous agitations of the hands and body, and also the annoying rotatory movements of the eye-ball (nystagmus). Other avenues of inquiry have been opened for the x-ray application, notably cold abscesses within the body, degenerative germinal affections, especially consumptive abscess and the early diagnosis of this disease, and also the practical use of the x-ray in dentistry.

It is the design of this journal to give to readers and thinkers a faithful resume of all x-ray work done in any portion of the globe. The editor's personal experience with the x-rays for practical purposes, together with seventeen years of medical and surgical experience, filling many official medical positions, and traveling largely in search of medical facts, renders the task of imparting x-ray information more appropriate for those who read and think. It is the intention of the promoters of this journal to give to the world only truthful results, with full credit to the experimenter in all its relations to the new science.

This field of inquiry must have associated with it practical and useful adjuncts. The most essential which shall occupy space are medico-legal jurisprudence, the therapy of electro-medical science, preventive medicine, hygiene, dentistry, and collateral branches.

We shall favor correspondence with pro or con criticism so long as it deals with the subject matter of the journal.

No advertisements shall appear in this journal that savor of quackery, deception, or fraud.

Medical and scientific publications reflect the siftings of individual thought, and the press gives the practical side and vitalizes the facts. Their work must be equally commended and personal gratitude acknowledged.

The conduct of this journal shall not be arrogant, defiant, or bigoted, but it will have the courage of conviction to press forward the truth as we understand the truth. It will be ethical, as the throbbings of every breast should be, regardless of any written code devised by man for another's guide. There will be no personal venom, as we hold no animus against any man, but false principles will be attacked with the vigor of our ability. This is a pioneer journal of x-ray work. We are not imitators. We are casting our hopes among the needs and wants of man. We expect encouragement.

While it can not be expected nor desired that we shall escape just criticism, and it may be contumely, yet our aim shall be to improve each coming journal, encouraged as we are in the faith and usefulness of our mission.

HEBER ROBARTS, M. D., Editor.

A PREMIUM OFFER.

The subscription price of the AMERICAN X-RAY JOURNAL is $1.00 per year. While this price is low when the character of the journal is taken into consideration, we have made arrangements by which we can offer additional inducements to subscribers. We will send the JOURNAL for one year and the following named books pertaining to x-rays at the prices annexed:

"A B C of the X-Rays" (price, 75 cents) and the JOURNAL for $1.40.

"The X-Ray of Photography of the Invisible" (price, 75 cents) and the JOURNAL for $1.40.

Both of the above books and the JOURNAL for $1.80.

"Roentgen Rays and Phenomena of the Ariode and Cathode" (price, $1.50) and the JOURNAL for $2.00.

These three books are richly illustrated, beautifully printed on coated paper, and handsomely bound in cloth.

THE great number of questions coming to us through the mail seeking information in regard to the x-ray have become too voluminous and too important for individual reply. We have concluded, therefore, to make a catechismal text of these inquiries, and annex to each a brief answer or definition. Calculating from what we have now, and the probable result from general extended requests for further questions as a basis for judgment, we feel confident of being able to continue an instructive and interesting page for readers in each number of the JOURNAL. These questions and answers will ultimately comprehend all information ascertained about the x-ray science. There will be an abridgement of all new facts up to the time of going to press with each number of the JOURNAL, so that the readers will have an easy and valuable reference page. Invitation is, therefore, extended to those who desire to send questions pertaining to electricity, radiant matter, discharge tubes, fluorescence, surgical and medical use of the x-ray, and all other allied phenomena. Questions do not have to be restricted to the x-ray, but may extend into any of the phases of science and art into which the JOURNAL enters. Should writers at any time send questions which they desire withheld from publication, "personal" should be written upon the letter for individual answer. No names will be printed unless requested.

THE shock of a Tesla current taken through the body is less than that given by a small medical coil. The current can be passed through the body and then through an incandescent lamp, illuminating the latter and producing no material shock to the person. The Tesla current has a very high frequency, up in the millions or thousands of millions, while the others are in the hundreds. It is not advisable to try this experiment unless previously guarded against accident by an armature and an additional commutator put on to an electric motor. The liability to accident is always present, and especially made so, when the street current is used, by the crossing of a high-tension current on the street.

THE physicians of Missouri, Illinois, Arkansas, and Texas are to be congratulated that St. Louis offers them in the St. Louis Physicians Supply Company a house where they can get their drugs, instruments, tablets, fluid extracts, and surgical sundries. This house tries to fill all the wants of the physician. The president of the company is a physician, and knows the needs of the medical fraternity, and the secretary, who is also manager, is an experienced druggist, and superintends the manufacture of their specialties. Read their advertisement on the second page of cover, and send for their catalogue.

WE would be ungrateful indeed not to express our appreciation of Mr. Strauss, the photographer, and his assistants for their invaluable kindness and most excellent service in the execution of our x-ray pictures.

In this connection an injustice would be done should we fail to proclaim our continued reliance upon James Heber Robarts, a lad of 14 years, who has mastered the x-ray art with wonderful facility and used it for our constant guide and dependence.

THE manner of using Tesla's high frequency current as a remedial agent has been thus far very crude and unsatisfactory. With a suitable commutator and resistance it is destined to occupy a very prominent place therapeutically with physicians.

THE fortieth annual meeting of the Missouri State Medical Association will be held the in Century Theater in this city on May 18th, 19th, and 20th. The Illinois State Medical Society will convene in regular session at the same time in East St. Louis. There will be joint sessions of these associations in both cities. Elaborate preparations are being arranged by the committees for the entertainment of physicians and their wives, and it is expected that these meetings will surpass, socially and intellectually, any ever before held in either state.

WE have much to be thankful for along the path of life's duty, but the greatest debt of obligation, and the thing for which we should be most thankful at this time is for the journalistic appearance of the AMERICAN X-RAY JOURNAL. The work was superintended by Mr. O. F. Oberbeck, whose knowledge of publications extends into the minutest details. We are not only indebted to him for assistance and courtesies, but also for the perfect typographical arrangement of this JOURNAL.

THE University of Strasburg contained in 1883 three men, each unknown to the other, and each of whom has since achieved international fame. The trio consisted of Paderewski, then musical instructor at the University; Prof. Roentgen, professor of physics, and Nicola Tesla.

For the beautiful half-tone of Professor Roentgen, printed in this issue of the JOURNAL, we are indebted to Edward P. Thompson, M. E., E. E., author of "Roentgen Rays and Phenomena of the Anode and Cathode." Professor Roentgen was born in Holland in 1845.

WE feel it our duty to express our appreciation of the uniform courtesy shown us by the Sanders Engraving Company, of this city, in the preparation of this first number of the JOURNAL. The excellent half-tones made by them are models of art, and reflect credit on the JOURNAL and themselves.

THE large circulation of this journal naturally offers increased advantages to physicians who offer their practice and property for sale. Stamps should accompany inquiries on these subjects.

DR. WILLIAM J. MORTON, of New York, has recently radiographed the entire adult in one picture.

BRIEFLY NOTED.

The chief symptoms of death-approach are shallow and irregular breathing; rattling in the throat; a peculiar far-off expression of the face; dulled sensibility; restlessness and subsultus tendinum; muttering and incoherent speech; a morbid appetite; unnatural ecstasy; failure of radial pulse; coldness of the extremities and vaso-motor paresis, as evidenced by cold sweating, etc.—*The Nursing Women.*

ACUTE APPENDICITIS (WITHOUT TUMOR).

By A. G. GERSTER, M. D., Professor of Surgery New York Polyclinic, Etc.

SIMPLE APPENDICITIS (NO TUMOR).—Anatomy teaches that in the supine body the attachment of the vermiform appendix can be found directly underneath a point located two inches from the anterior superior spine of the ilium, on a line connecting this bony prominence with the navel. Whenever acute and persistent pain appears in this region, accompanied by fever and retching, the pain being markedly increased by palpation of this area, trouble of the appendix can be confidently diagnosticated. In women bimanual palpation ought to exclude the presence of an inflammatory process of the displaced uterine appendages. Though the local and general symptoms may be very alarming, tumor can rarely, if ever, be detected in the early stages of the affection. Meteorism is also absent.

In view of the impossibility of foretelling whether, in a given case, spontaneous evacuation of the contents of the appendix or perforation is to take place, and in the latter case whether a superficial or a deep-seated abscess is to develop; and, considering the fact that laparotomy followed by excision of the appendix has yielded uniformly good results if done before the access of perforation, it is safe to follow McBurney's advice, which recommends laparotomy and removal of the appendix whenever severe symptoms persist and increase for more than forty-eight hours.

The steps of the operation are these: A longitudinal incision, four or five inches long, parallel with and just outside of the outer margin of the right rectus muscle. Having opened the peritonæum, the appendix is found, which will be rendered easy by first ascertaining the location of the caput coli. The mesentery of the appendix is included in a double ligature of stout catgut and divided. Then the root of the appendix is secured by two ligatures, between which the viscus is cut off. The mucous lining of the stump is either seared with the thermo-cautery, or, after careful disinfection, is touched with a few drops of perchloride-of-iron solution and dried off. Then the stump is dropped back and the external wound is closed.

Case.—Miss F. L., aged 20, has had altogether sixteen or eighteen attacks of appendicitis in two years. Characteristic local pain, irregular fever with temperatures reaching 104° F. No tumor: uterine appendages normal.

April 20, 1890.—Laparotomy. The free appendix is found very much thickened, its distal half distended and bent upon itself, containing a quantity of fetid serum. It was removed. Uninterruped recovery.

JUVENILE OFFENDERS.

Lord Chief Justice Coleridge, of England, in charging the Grand Jury at Bedford, England, recently, took occasion to remark on some of the methods by which society manufactures crime. One of these, he insisted, was the unreasonably severe punishments which are too commonly allotted to small offenses against propriety. If such excessive punishments should be awarded to the petty pilferer, there is no kind of severity which the law can, with relative adequacy, administer for the greater and more serious crimes. Commenting on a case in which two little boys had been sentenced to three months' hard labor for stealing apples, after a previous conviction, he said that it was monstrous to make these boys felons for life for having done what some of the best men in the world had done, and for which they certainly deserved to have their ears boxed, but not to be sent to prison with hard labor.—*London Medical Times.*

The rod in the family or at school, properly administered in the old-fashioned way, notwithstanding the growing disinclination for and prejudice against, is far more efficacious as a moral and social correction than judicial sentences of children for petty offences. We concur with the English Chief Justice in his views—many a boy is ruined at home by that neglect of judicious parental correction which might have saved a wayward child from becoming at last a criminal.—*Medico-Legal Journal.*

We question very much if the Lord Chief Justice intended corporal punishment when he referred to the boys, "and for which they certainly deserved to have their ears boxed." The idea he wished to convey was that the parent or guardian should show to the children a contempt for any one who would be guilty of such petty larceny. By this no anger would intermingle with the chastisement, which is always an associate of boxing, striking, and rodding children. It is the element of disapproval, associated with reason and and respect, which rules the child in the guardian's absence. Fear of the supernatural may create obedience, but fear of corporal punishment does not enter into a single factor of the good qualities of a child. If it is obedient for fear of punishment, it is controlled through the animal and baser elements of nature. Such persons will never benignly influence mankind. They are cowards either by inheritance or servitude. A child generally realizes that about the only difference between a man and a boy is their size. Any punishment inflicted upon him after the age of such realization, which occurs very early in life, is instinctively taken as a superior "bully force" used against a weaker.

In connection with the above the following may be read with interest. The clipping was taken from the *Berbice Gazette* of May 23, 1896, a paper printed in New Amsterdam, Berbice, British Guiana:

POLICE COURTS OF NEW AMSTERDAM.

Before Mr. J. E. Hewick, S. J. P.

SENT TO THE REFORMATORY.—Manoel Gomes Pimento was charged with having, on the 15th inst., stolen $2.88, the property of Mary Marks at Asylum street, New Amsterdam, under circumstances already described in this paper. Defendant pleaded guilty, and he was ordered to be sent to the Reformatory for three years.

RIDING ON A CART.—Thomas Hooper was charged by T. C. Barron with having, on the 8th inst., ridden on his donkey cart while plying for hire in New Amsterdam. Defendant pleaded guilty, and he was fined $1 and costs, or seven days' imprisonment with hard labor.

ABSENCE FROM SERVICE.—Robert Lambert was charged by Anemandoo with having, on April 21st, absented himself without lawful cause from his work as a fisherman. Fined $1.68 and costs, or seven days' imprisonment with hard labor.

GLASS is opaque and diamonds transparent to the x-rays.

THE USE OF THE X-RAYS AND FLUOROSCOPE IN SURGERY.

By Arthur Ayer Law, M. D., Minneapolis, Minn.

Thomas A. Edison took advantage of the hint given by Professor Roentgen in his description of the phenomena noticed when plateno barium cyanide paper was subjected to the influence of the x-rays, and experimented along the same line, finally devising the fluoroscope, with its tungstate of calcium screen, and in so doing gave to the world one of the most important adjuncts to the x-rays themselves.

Much has been written about the photographic application of the x-rays in taking the skiagraph, but the subject of the use of the fluoroscope has not received the attention its importance deserves, for in the practical application of the x-rays, either as a means of surgical diagnosis or as an aid in operating, the fluoroscope is of infinitely greater service than the skiagraph. With this device we have a speedy and certain means of locating foreign bodies (providing they are opaque to the rays) in practically any region of the human economy, admitting, of course, that your apparatus is sufficiently powerful to excite the tube to the degree necessary to enable the rays to penetrate the body. Instead of being limited to but one view, as in the skiagraph, we may examine our patient from any position, determine with absolute certainty the exact position of the foreign body—be it bullet, needle, metal, or glass—and its relation to the adjacent bones, enabling us to much more intelligently operate for its removal. Obscure fractures and dislocations are easily determined, even though the edema of the soft tissues is so great as to preclude the possibility of an exact diagnosis by other methods. Exostosis or congenital malformations can be detected at once, and their removal or correction be facilitated.

Admitting the importance of the fluoroscope as a means of diagnosis, as an aid in operating it is well nigh indispensable, for by covering the instrument with a sterilized towel we can use it to watch the steps of an operation in removing foreign bodies or to verify their absence: indeed, if the foreign body can not be readily found, and we are well aware how elusive needles or bullets can be, we can follow our instruments as they penetrate the flesh and determine their proximity to the body sought. As a means of medical diagnosis the fluoroscope has as yet been of little aid, its use being confined almost exclusively to the surgical aspect of medicine.

Dependent upon their location, some of the denser tumors cast darker shadows than the surrounding tissues. Tubercular or syphilitic osteitis is revealed, showing either the rarified areas incident to the disease, or the blurred and irregular outline of the bones, a lack of the usual clear-cut, well-defined shadows. In the location of bullets or foreign bodies in the thorax, trachea, esophagus, or indeed in any part of the gastric-intestinal tract or abdomen, the fluoroscope is of infinite service, as also in the detection of fractures of the ribs.

Dr. Heber Robarts, of St. Louis, has suggested an ingenious device attached to the handle of the fluoroscope, where by pressure on a button under the thumb the current is cut off, enabling you to study the soft structures, and when the desired illumination is obtained cut off the current and repeat at will.

I am aware that the theoretical consideration of a subject has much less weight than its practical presentation; therefore, to illustrate the surgical adaptability of the fluoroscope, I quote the following cases:

Case 16. Mr. F., Grand Forks, North Dakota. Referred to me by Dr. Walter Courtney, of Brainard. Mr. F. was sent to him with a diagnosis of rheumatism. Dr. C. suspected a bullet in the knee joint, as the man had been shot in the thigh in the early fall. Fluoroscope revealed small bullet in the knee joint. Skiagraph taken and sent along with the patient back to his surgeon.

Case 18. Mr. B., in September, 1896, shot himself in left foot, necessitating amputation of great toe; foot torn. Dis-

Case 16. Bullet in knee joint.

charging sinus persisted for some time. Fluoroscope revealed five large shot and fracture of second and third metatarsal bones. Two of the shot removed.

Case 19. Mr. S., brakeman, shot in left elbow; wound probed, but no bullet found; believed to be imbedded in forearm. Fluoroscope revealed no bullet: struck acromion process and glanced: while plowing a furrow in tissues, it was not imbedded.

Case 20. Miss X., colored. Referred by Dr. Frank R. Wright. Received a charge of buckshot in right arm; four in triceps muscle, one two inches above wrist, one wedged between ulna and radius at wrist, and one in hand. Fluoroscope revealed them. Skiagraphed and returned to her surgeon.

Case 27. Mr. K., Utica, South Dakota. Referred by Dr. Dunsmoor. Tumor in lower third of femur. Fluoroscope revealed bone shading off into tumor: skiagraphed the same. Diagnosis, osteo sarcomo. Dr. Dunsmoor amputated at hip joint. Microscopic section verified diagnosis.

Case 34. W. H., aged 12. Referred by Dr. Fitzgerald. Fluoroscope revealed old backward dislocation of radius and ulna, fracture of olecranon and joint cap-

Case 20. Buckshot in wrist and hand.

sule filled with adhesions. Dr. F. operated, cleaning out fosse and reducing dislocation.

Case 37. Mr. M., brakeman. Referred by Dr. Frank Burton. Right hand pinched in making coupling. Cellulitis and swelling so great as to prevent diagnosis of the condition of the bones. Fluoroscope revealed fracture of third metacarpal bone at the middle of shaft and partial crush of head of bone.

Case 42. M. S., aged 7, Valley City, North Dakota. Referred by Dr. Gerish. Hand puffed badly; last two fingers flexed

Case 42. Needle in palm of hand.

and numb. Two weeks previous child ran a needle into palm of her hand and broke it off. Fluoroscope revealed it at once. With instruments under fluoroscope I incised, introduced forceps, and removed needle. Flexion and anesthesia of fingers cured.

Case 43. E. M. B., child of 16 months, Rice Lake, Wis. Referred by Dr. Chas. Wheaton. Five days previous swallowed a safety-pin open. Fluoroscope revealed pin in ascending colon; open, but pointed the right way. I refused to operate, holding that if it had gone so far it would probably go further, an assertion which was verified by pin passing next day.

Case 44. G. C. D., bridge builder. Referred by Dr. Dunsmoor. While drilling a steel girder a small chip of steel flew off clamp and buried itself in the heavy muscles of the calf of his leg. A doctor in Wisconsin enlarged the wound at entrance, but failed to find foreign body. Fluoroscope revealed it at once. Under fluoroscope I introduced forceps into the wound, opened them, watched them grasp piece of steel and removed the same.

Case 46. Mrs. R. Referred by Dr. Dunsmoor. Fluoroscope revealed sarcoma of right shoulder so extensive as to make operation inadvisable.

Case 49. Miss S. Referred by Dr. Dunsmoor. Domestic with needle in hand, which is puffed and tender. Revealed at once under fluoroscope, and removed by small incision and introduction of forceps.

The above cases illustrate the ease with which diagnosis can be made and surgical operations aided by the assistance of the fluoroscope. The operations in cases 42, 44, and 49 were made with the room perfectly dark, simply using the fluoroscope as a guide.

I have had several cases with a medico-legal aspect, cases where patients proposed to bring suit either against corporations or individuals. With these my fluoroscopic examination gives me knowledge as to whether it is advisable to take skiagraphs or not, as the latter are already playing an important part when introduced as testimony, for they can not be controverted.

While great proficiency with the fluoroscope is a question of some experience, yet almost all cases can be as readily diagnosed by the novice. Its use is so extremely simple that it should find its legitimate place in the armamentarium of the modern surgeon.

LIFE INSURANCE OF WOMEN.

Only eight or nine of the life insurance companies insure women at the same rate as men. Further experience is now convincing these companies of the injustice of this discrimination. The mortality rate among the female risks in one company did not rise above eighty per cent of its anticipation.—*The Nursing Women.*

PHOTOGRAPH.

RADIOGRAPH.

THE POSSIBILITIES OF THE X-RAYS.

We present here two half-tone illustrations which afford one of the most interesting subjects caught by radiography, and indicate, to some extent, the possible uses of the x-ray. The illustration of the photograph is that of a mummified hand of an Egyptian princess, believed to be between 3,000 and 4,000 years old, obtained near the Tombs of the Kings, Thebes, in 1892, and the illustration of the radiograph is of the same hand, made in the laboratory of the Keystone Dry Plate Works on a Carbutt x-ray plate by John Carbutt.

The x-ray has thus been made to go back further than it ever went before, and has opened the way for a new industry. The bones are inside a mass of pitch, perfume, delicately woven fabric, and dried human flesh, in full number, just the same as any one's hand, and presents a wonderful study. It is not a view within the warm and quivering flesh, but rather a sight beneath a golden covering in old, cold death. Is it the hand of Ma, the daughter of Ra? or of Nepthys? or of Safekh? or of Muth? or of the daughter of Pharaoh? That the ray does not tell.

BACTERIA IN ICE.

It has been shown by Foster that some kinds of bacteria live and grow in melting ice. Putrefactive bacteria having gained access to the ordinary household refrigerator, where the temperature is a few degrees above the freezing point, can live and multiply there, thus contaminating meat and other food kept therein. A butcher's refrigerator so contaminated will taint his meat and perhaps injure his patrons.—*Centralblatt fuer Bacteriologie.*

THE X-RAY IN THE CASE OF ARTHUR DUESTROW.

By Ex-Governor Charles P. Johnson.

It was Friday night, January 29, 1897, that I had my last interview with Arthur Duestrow. He was then under sentence of death, to be hanged on February 16th following. About every move or expedient possible within the judicial domain to save his life had been made and urged without avail, and there were but few chances left, the final one among these being evidently the possibility of impressing the governor of the state with the fact that he was insane. For years I had been constantly laboring, in connection with a number of the ablest and most conscientious alienists of the country, to obtain a recognition, through the regular channels of the law, of the insane condition of my client. A long and intimate association with him made me to know beyond the peradventure of a doubt that his mental condition was such as to make him irresponsible in law. But it had been, and was still, an utter impossibility to cause judicial tribunals or the public to believe the truth. This condition was owing to several causes, the principal ones being the continuous and persistent misrepresentation of the press that he was a multimillionaire, when in fact he was, comparatively speaking, a poor man, and that all his acts evidencing insanity were carefully planned and studied, and that he was simply an unscrupulous malingerer. This necessarily involved the integrity of a number of able and honorable physicians and attorneys, but that was of little account to those who were bent upon the consummation of a lynching under the forms of law. The brutal characteristics of the tragedy itself, together with the innocence and helplessness of the victims, were enough in themselves to arouse a widespread and deep-seated prejudice, which could only be fought and neutralized by proof of an affliction of the disease of insanity. That this proof existed is now beyond controversy; but the misrepresentations referred to kept alive and increased the prejudice to such an extent that the mob spirit entered and permeated every avenue of justice, and finally succeeded in the consummation of one of the most remarkable judicial murders in the annals of criminal judicature.

Inclined already to the belief that it might again be necessary to present evidence of Duestrow's insanity, either to the governor or a sheriff's jury, as a last resort, and knowing the great odds against which I had to contend, it required but a suggestion to cause me to assist in an endeavor to enlist in behalf of Duestrow the latest achievement of science, and have his brain examined under the penetrating and searching light of the Roentgen ray.

The experiment was conducted by Dr. Heber Robarts. Associated with him in preparing and working the machinery was his son, who, though but fourteen years of age, has already proven his capacity of being an able assistant. The x-ray machine, together with its accompanying coils of wire, cans of insulating oil, glass tubes, etc., were quite bulky, and, the opportunities for adjustment being inconvenient, some two hours elapsed after our arrival in the jail before the motor was started. We reached the place about 8 o'clock. At first the party consisted of Dr. Robarts and son, Miss Ada Patterson, reporter of the *Republic*, the writer of this article, two or three attaches of the jail, and one or more officials of the police department. During the time occupied in arranging, connecting, and adjusting the x-ray machine an almost continuous conversation was kept up with Duestrow by the reporter and myself. That conversation was in itself sufficient to convince any unprejudiced person of Duestrow's insanity. For over two years I had been conversant with the birth and development of the various delusions that had occupied his mind. I had been with him in that same jail the day following his desperate attempt at suicide, when he sat morose and sullen, not repeating more than ten monosyllabic words under continuous questionings for two hours. For six months that condition lasted. Then all of a sudden he became talkative and social. He claimed that he had seen his wife—that she had called to him at the screen of the jail. Then came another delusion that others worked electricity on him. He heard voices calling him opprobrious names. Strange odors were wafted to him in a mysterious manner. Telephones transmitted communications in his cell, and phonographs registered not only his spoken words, but his unexpressed thoughts. He discovered, in delusion, "Duestrow's System," which was a claim that the spleen was the seat of all diseases, and that he could cure any disease by sending electric sparks from that organ, which is the store-house of electricity. Again, in delusion, he hypnotized his enemies and others, present or distant. He could transmit odors, agreeable or otherwise, to persons, however far away, and chloroform them if needs be. In delusion, he could coagulate ink at a distance or change water into wine. In delusion, he often saw his child, little Louie, and sent words of endearment and love by imaginary transmission. His discoveries had merited appointment and promotion in the medical department of the United States. At one time the pope of Rome had recognized his achievements and conferred a cardinalate.

Yes, I repeat, for over two years, hour after hour, over a hundred times, have I sat and talked to him about all these various delusions and vagaries that at different times afflicted him — humoring, conceding, opposing, persuading, ridiculing, abusing; but always closely observing, analyzing, and studying. I groped continuously in the darkened avenues of a diseased brain. From first to last it was confusion, distraction, disconnection, and obscurity. About the time of his conviction, in February, 1896, a new delusion developed, of which there is no record in the court proceedings. He imagined that he had received an appointment in the regular army of the United States. This delusion had developed to such an extent about the time noted that he wrote a letter to his attorney, dated at Union a few days before the motion for a new trial was to be heard, to send his uniform, which he claimed he had ordered by electricity, so he could correctly appear in court. Shortly after this his identity changed. He received messages from Europe — William, emperor of Germany, particularly — informing him of his connection with the nobility of that nation. He exhibited a statement, genealogical in character, making the relationship with distinguished persons of rank, and assumed the name of Arthur Von Brandenberg, under which imaginary name he died. He was given in marriage, by order of the emperor of Germany, the Countess Von Brandenberg, whom he sent his love to just before dropping to death on the scaffold. It was as such imaginary character that the conversation was carried on with him during the time Dr. Robarts was arranging the machine in a manner to take the picture required. During the conversation he was somewhat exercised in seeing the movements going on in his cell. He demanded several times to know what it meant, and it required a good deal of ingenuity to keep him from interfering with and stopping the proceedings. Strategem was resorted to, and he was persuaded that the machine was placed for the purpose of having his picture taken, as was customary in the army — a picture was needed of every general, needed to preserve among the annals of that illustrious corps. By reason of my long association with Duestrow I exercised a power over him which no one else, I believe, had. Insane men are in many respects subject to the same influences as sane men. They have their likes and dislikes. They are moved by the same impulsions. They are subjects of fear, of hope, of desire, and generally susceptible to the same emotional impressions. At times he called me his superior officer, and would defer to me as if I were such. At another time he would address me as a subordinate, a major; and when he did this he adopted the tone of a superior. On this memorable night, fortunately in part, he addressed me as his superior or ranking officer, and seemed willing to obey orders. It was the ascendency of this idea which finally made it possible to get him in position before the Crooks tube. Finally every difficulty met in connecting and arranging for a perfect working of the machine was overcome by the indefatigable perseverance of Dr. Robarts, and Duestrow was seated in his cell alongside of his attorney. I had ordered him officially to repair to the place, and further informed him of General Miles' desire that the picture should be taken in that manner. He was first urged to lie down, but his dignity revolted so emphatically that the idea was immediately abandoned. After being seated I took hold of his hand and tried to compose him by light and pleasant conversation. The plates were in readiness and the motor in motion. I experienced at this time a feeling of intense gratification. Dr. Robarts evidently shared it with me. A new page in science, as it were, was about to be written. In a few minutes that piercing, searching electrical ray might solve the problem of life or death. It might reveal what was yet stubbornly denied—through ignorance, prejudice, and hate, and the conflicting and warring opinions of alienists—that Duestrow was suffering with the direst disease that afflicts mankind; and instead of hate, vengeance, and ignominious death he merited the sympathy of his fellowman, kind and humane treatment in an insane asylum, and a life to run its natural and allotted period. We were, however, doomed to disappointment. The motor had gotten fairly under way. The strange, buzzing sound vibrated in the narrow cell; the lights, vari-colored and radiant, flashed and scintillated hither and thither, painting in pale and ghastly lines the faces of those huddled in the small, attentive group. The effect on Duestrow was what we ought to have anticipated. His nervous organization was originally weak, and his long confinement and the excessive use of cigarettes had still further impaired it. Besides, his mental condition made it impossible for him to exercise a normal will power. He clutched me by the hand as a child seeking protection. His entire body quivered with nervous agitation. In a whisper he said: "Do not let me be killed—I know it is a machine for instant death. Good-bye." When I assured him that it was nothing of the kind, that if he died or was killed I would necessarily meet the same fate, that the object was simply to take our picture together, I felt him strain every nerve to try to compose and control himself. But he could not do it. It was asking too much. He sprang from his seat, and in an instant I had lost all control over him. His mind again wandered in the realms of confusional insanity. He lost all coherence. His delusion again took the ascendent. No manner of reason could reach him. He was a general, commanding intruders to depart. "It is irregular," "it is irregular," he kept repeating again and again. "I command you to leave here." "What is your objection to this experiment?" the reporter asked. "That is none of your affair," he responded. "It is nothing to you. I will only say that it is irregular." With this he broke away from us; disdained all persuasion and entreaty, and started on his accustomed walk across the long corridor of the jail building. It was a weird scene. The electric lamps suspended from several points above the tiers of cells reflected in shadowy outline the iron network of girders and rafters that support the lofty dome, and threw gleams of pale light below, enshrouding the various stationary and moving figures with a ghostly halo. Backwards and forwards, tall, slender, straight, with lithe figure, Duestrow walked. His carriage was that of a soldier. He turned neither to the right nor to the left. He pushed aside any one who obtruded in the way of his chosen path, and looked more like a lone night sentinel pacing his rounds on the ramparts of some ancient castle than a prisoner doomed to death. His hair, long, uneven, and unkempt, and a straggling beard covered his face; there was a strange look in his eye, and a nervous, restless energy in his every motion. To make one last effort for success in the desired experiment, I joined in his walk and explained to him the advantage of his allowing himself to be subjected to the x-ray. I talked to him as if he were sane—told him that the discovery of a brain lesion or adhesion might save him from impending death. It was impossible. He was General Von Brandenberg—and I ceased my efforts.

Before retiring from the jail, however, I thought I would address Duestrow in a manner to show the impossibility of his shamming. The original party entering the jail had been reinforced by the arrival of two other members of the press. It had been some time since I had seen Duestrow; in fact, I had not conversed with him since the affirmance of the judgment of the lower court, and his sentence to hang on February 16th. My questions were impromptu and delivered as rapidly as possible. The following is the conversation:

"See here, Arthur, I want to talk to you. Don't you know that the Supreme Court has decided that you must be hanged?"

"No," answered Duestrow, with a smile.

"There has been such a decision, and the date for your execution is February 16th. They will hang you then, unless something intervenes. You understand?"

He replied, with a smile, "They can't do it—they can't hang a superior officer."

"But they will do it, sure."

As I said this I had his hand grasped in mine, and my grasp he returned. There was not the faintest indication of a realization of the awful fact I was telling him. He simply looked at me, and with the same peculiar smile—broad, and to me idiotic—said: "They can't, I tell you."

Instantly I then changed the subject, and said: "What is your name?" He answered, "General Von Brandenberg."

"And where is Arthur Duestrow?"

"He is dead."

"Where did he die?"

"I don't know."

"What killed him?"

"He died of heart failure."

"Where is his son?"

"He is at home."

"What is his name?"

"Louis."

"And Arthur Duestrow's wife—where is she?"

"She is alive and at home." "Albertina."

There was not in this conversation the least indication of Duestrow's shamming. The idea of asking the questions I did was the result of an impulse to show those present his true mental condition. I knew it myself, but doubt whether this conversation, in the very shadow of the gallows, was looked upon as anything else than a ruse to enable the lawyer and client to play upon the credulity of the public. To such condition had the community arrived—their mental vision was so distorted—they were determined not to see the truth as long as their vengeance was unappeased. Do they see it now? On the morning of the execution, as Duestrow stood at the window of his cell and looked at the process of building the scaffold on which he was to hang—heard the hammering of nails, the sawing of the boards, and other accompanying sounds made by the workmen—a heartless guard told him it was being built to hang him on. His reply was in keeping with his reply when I told him. "They will hang you then, unless something intervenes," and he said "They can't do it; they can't hang a superior officer." He said to the guard, "They can't do it. I patented that gallows myself, and they can't hang me on it."

In the interests of science it will always be a source of regret that the effort of Dr. Robarts to get an x-ray picture of Duestrow's brain was not successful. Even a cursory and superficial examination at the postmortem showed a diseased condition of that organ, and since then Dr. Rolfing, under whose direction the microscopical examination is being made, has discovered an adhesion sufficient in kind to have interfered with the functional actions of the brain. True, as yet it can not be claimed that such condition warrants a definite conclusion of abnormal mental impairment, but it unquestionably raises a strong doubt in cases where the acts and sayings of the individual are of such a character as to raise a question of his mental soundness. In Duestrow's case there was what unfortunately arises in so many like cases—a conflict of opinion in the diagnosis of his disease. That his was a perfectly normal mind at the time of the tragedy, no one claimed; but the diversity of opinion as to the character and extent of the perturbation covered a wide field. Will it be possible even to reach such perfection in examination as will insure safety in like cases to the afflicted son of humanity, or turn over to just punishment the unscrupulous fraud? It is very doubtful, and will remain so as long as partisanship and pecuniary interest enter so largely into the investigations arising in the department of medical jurisprudence. What a glorious achievement in behalf of humanity will be recorded when the x-ray is the medium of determining with scientific precision the extent and character of that disease which dethrones reason and makes life a curse. Heaven speed the time of its arrival.

TREATMENT OF CHANCROIDS.

By John M. Langsdale, M. D.,
Kansas City, Mo.

A neglected chancroid or an improperly treated one may, and sometimes does, become the source of distressing complications, while, if taken in time and intelligently treated, it rarely gives trouble of any consequence. It is not my purpose in this short paper to deal with any phase of the chancroid other than the treatment, nor shall I attempt to give the various treatments of different writers, but will confine myself to a brief statement of the treatment which has proven entirely satisfactory in my hands for some time. I do not know how I can better give this treatment than by reporting a few cases from recent practice.

Case 1. C. W., male, white, single, aged 28, clerk, consulted me June 8, 1896. General health good. Examination revealed two preputial chancroids, one near the frænum, left side, the other just above this one and separated from it by a narrow margin of healthy tissue. These ulcers were first washed with hot water and soap, as well as the balance of the penis, and further cleansed by spraying with peroxide of hydrogen; they were then cainized and thoroughly cauterized with fuming nitric acid and dressed with campho-phenique powder and gauze prepared with the same drug, when the patient was allowed to go to his work. The after-treatment consisted of cleansing the sores with hot water and peroxide of hydrogen, and dressing with the phenique powder and gauze. The sores healed rapidly and completely. No complications; no other treatment.

Case 2. J. F., male, white, married, aged 42, agent, came to my office for treatment September 17, 1896. The prepuce was the seat of a large chancroidal ulcer, situated near the dorsum, involving both the dermal and mucous layers. There was a large suppurating bubo in the left inguinal region, which had received no treatment further than the application of tincture of iodine and laterally flaxseed poultices. The ulcer on the prepuce was thoroughly cleansed by the use of hot water, scraping, and the peroxide of hydrogen spray; after which it was dressed with phenique powder and gauze. Under thorough aseptic and antiseptic precautions the bubo was now freely incised and emptied, the cavity cleansed with hot water and peroxide of hydrogen and curetted. The wounded surface was covered with the phenique powder and packed with gauze, a bandage applied, and the patient put to bed. The subsequent treatment consisted of thorough cleansing, followed by the phenique powder and gauze dressing. Recovery rapid.

The third and last case I shall report is that of M. G., aged 24, male, white, single, clerk, who presented himself for treatment October 3, 1896. Examination showed large chancroidal ulcer on the mucous surface of the prepuce near the frænum, and a small one situated on the anterior surface of the scrotum. The scrotal chancroid was evidently due to auto-infection, being situated on that part of the scrotum exposed to contact with the pendulus penis. There was an unusual amount of inflammation in connection with these sores, and, while the patient could not afford to leave his work, it was thought best to use no cautery. The ulcers were cleansed in the same manner as in Nos. 1 and 2, and dressed with iodoform and iodoform gauze. There was little change for the first four days, but on the fifth day I noticed a dermatitis had developed, covering the front aspect of the scrotum. I at once came to the conclusion that the dermatitis was due to the iodoform, as I had seen the same results follow its use before. I substituted phenique powder for the iodoform; the dermatitis soon disappeared and the sores were healed in two weeks. I do not report these cases as unusual or remarkable, for I could report many more like them, but simply to show that they can be treated with absolute certainty of success by the course I pursued in the first two cases, and the latter part of the treatment of the third. I do not hesitate to say that the splendid results in these cases were due to the thorough cleansing of the sores and the free use of the phenique powder.

I thought for a long time, as many others do now, that iodoform was indispensable in the treatment of sores of venereal origin, and often forced my patient to submit to its use, in spite of his objections and the suspicion created by its too familiar and disgusting odor. The odor is, however, not the only objection to to use of iodoform, for I have seen some very aggravating conditions follow its use, such as posthitis, balano-posthitis, dermatitis, etc. Experience has convinced me that many times these conditions were due to the iodoform and not a result of the disease. I have never seen any such complications follow the use of the camphophenique powder, which is non-irritating and possesses decided anesthetic and antiseptic properties, rendering it peculiarly adaptable to the treatment of venereal sores and the resultant inflammatory conditions which may attend them.

EPILEPSY AND ITS TREATMENT BY ELECTRICITY.

Dr. W. H. Walling, in the *Medical Brief*, mentions a case of epilepsy of twelve years' standing which was greatly benefited by electricity—faradization of the spine, stomach and abdomen, and galvanization of the sympathetic. Then the anode was placed below the mastoid process, toward the median line, and the cathode on the forehead near the left temple, and one-half a milliampere allowed to pass for two minutes. The electrodes were cautiously changed, and the current continued for from three to five minutes. Improvement continued for a time, but the doctor had to use the tribromide of gold and the oxybromide of arsenic to complete the cure.

PAOLO (PAUL) ZACCHIAS.

PAOLO (PAUL) ZACCHIAS.

We present a portrait of this distinguished man, reproduced from the *Medico-Legal Journal* (Vol. III. No. 3), and was obtained by that journal from Dr. Herman Karnfeld, of Grottkau, Silesia, who had received a portrait of him from a friend in Florence, copied from an original painting.

Paul Zacchias was born in Rome in 1584, and died there in 1659, in the fullness of his mental vigor at 75. He was the father of medico-legal science. To him is due the systematizing of that peculiar combination which compels the jurist to examine into the physico-mental condition of the man who stands charged with violating the law, and forces the physicist to inquire into the working of the physiological machine, in order to trace a disorder, if any there be, and to bring to the light of day the mysterious cause that destroyed the harmony between mind and body, thus determining the responsibility of the will power and the irresponsibility of fatality.

Paolo Zacchias wrote independent works which were famous for their medical information and legal knowledge, though, of course, more or less tainted with the superstitious views regarding magic, demons, and witches which were so widely diffused at that time. He was the administration dictator over all matters pertaining to public hygiene, and was made expert to the *Rota Romana*, the highest Court of Appeals, composed of twelve princes of the church, elevated and inducted into these high offices by Pope Innocentius X., to whom he was body physician. The instigation of the practice of legal medicine was introduced into the courts by the penal code of Emperor Charles V. in 1532, but not until the remarkable production of Paolo Zacchias did medical jurisprudence become a science. He wrote the *Ques-*

tiones Medico-Legalis, which embraced three large volumes. The first contains the decisions of the "Rota," or Court of Appeals, and the others the questions propounded to him and his opinions. It is very remarkable, indeed, that there is hardly a question known to medico-legal science today which is not treated in that remarkable book, while problems are taken into consideration which our advanced position of physiology is not yet prepared to solve satisfactorily—such, for instance, as the questions of the formation of hermaphrodites, the animation of the fetus, superfetation, etc. Another treatise published by him discusses one of the most vital questions of medico-legal science. It is entitled "*De dementia et rationis laesione et morbis omnibus qui rationum laedunt questiones*," which furnishes hundreds of observations regarding mental disease that may be studied with interest and profit to this day. He wrote learnedly on medicine, and his talent was appreciated for poetry, music, painting, and theology. He was one of the foremost scholars of his time, a philosopher, an intellectual genius, and the peer of all his cotemporaries.

"W. S." X-RAY PLANTS.

Mr. James G. Biddle, 912 Drexel Building, Philadelphia (sole agent for Messrs. Willyoung & Co.), has been very successful in securing a large number of orders for the now widely known "W. S." x-ray apparatus. The most expensive part of an x-ray outfit is the induction coil, and this very important piece, as made by Willyoung & Co., is said to be remarkably effective and enduring. In addition to the adjustable condenser invented last year by Mr. Willyoung, a new improvement has been introduced in the "Ideal" automatic interrupter just placed on the market. It is claimed that only one-half the amount of current is required to energize a coil, as the apps or other form of hammer head vibrators require. Furthermore, the "Ideal" interrupter does away almost entirely with sparking at the platinum contacts, and can be operated continuously without sticking. It can be connected to any direct current up to 110 volts if the primary current is regulated by a suitable rheostat, but without necessity for rotary or mechanical break of any kind. The makers claim this to be the first automatic interrupter that can be safely connected to a 110-volt circuit in the manner indicated.

Other parts of these equipments are equally meritorious as the induction coils, and interested parties should avail themselves of Mr. Biddle's offer to mail his new x-ray catalogue No. 200 upon request. Some of the recent orders received by Mr. Biddle are from the Episcopal Hospital, Philadelphia; Jefferson Hospital, Philadelphia; German Hospital, Philadelphia; Girls' High School, Philadelphia; Johns-Hopkins Hospital, Baltimore; Pennsylvania Hospital, Philadelphia; United States Marine Hospital Service, Washington; Emergency Hospital, Washington; Williamsport Hospital, Williamsport, Pa.; West Penn Hospital, Pittsburg; Catholic University, Washington; Hospital, Alton, Ill.; Hospital, Boise City, Idaho; College of Medicine, Cincinnati; Hospital, New London, Ct.; Hospital, Lancaster, Pa., in addition to a very considerable number of private physicians and surgeons.

AVENIN.

Recent experiments show that oats contain a substance, easily soluble in alcohol, which has an irritant action on the motor cells of the nervous system. It is a nitrogenous substance apparently of an alkaloid character. The quantity present varies according to the quality of the grain and the soil on which it is grown. The darker varieties contain more than the light. Its composition is given as $C_{56}H_{21}NO_{18}$. The bruising and milling of the oats diminishes the quantity of this substance very rapidly, but it is quicker in its action.—*Hardwick's Science Gossip*.

The increase of dyspepsia, especially among young persons, is largely attributable to the extensive use of oat meal.

DR. WILLIAM KONRAD ROENTGEN
From a photograph by Hanfstaengl, Frankfort-on-the-Main.

LOCATION OF FOREIGN BODIES IN THE EYE WITH ROENTGEN RAYS.

Dr. Clark, Columbus, reported at the recent meeting of the American Ophthalmological Society at New London a case in which the presence of a small fragment of metal in the extreme angle of the anterior chamber and the iris, where it could not be seen, had been determined by radiography. The sensitive plate had been introduced into the adjoining nostril, the patient being put under ether, and the rays directed upon it through the eye from the temporal side. He also suggested that the plate could be placed in the cocainized conjunctival sac, or an opening could be made in the conjunctival and the small plate slipped behind it. He believed that this method of locating a foreign body in the eye-ball was perfectly practicable, especially if the particle were lodged anteriorly, as in the ciliary region, where it could not be seen with the ophthalmoscope.

Dr. Williams, Boston, reported a case in which a fragment of the copper case of a cartridge had passed through the cornea and lens. Nothing could be seen of it, and it was not certain that it was in the eye. The use of the x-rays showed the presence of the fragment, and it was removed. The radiograph was obtained with ten minutes' exposure by laying the patient's head with the side of the injured eye upon the plate, and placing the Crookes tube above and rather in front of the patient's head.

Foreign bodies are now being successfully radiographed after the suggestion made by Dr. Clark.

THE X-RAY IN SURGERY.

By Dr. George F. Shrady in "The Forum" for March.

Even independently of the knife the hitherto hidden intrenchments of mortality have been revealed by the electric light, which has opened for intelligent inspection and successful invasion the interiors of all the hollow organs.

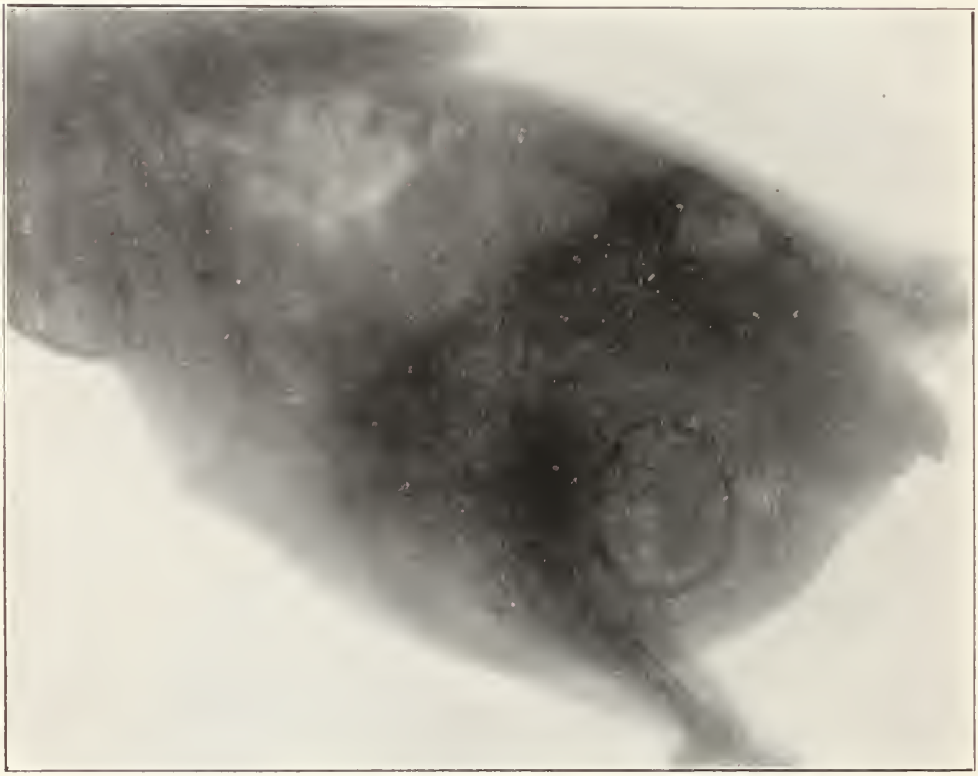
A still greater revelation was in store for workers in such fields, more especially for such as were in search of more marvelous methods. It is scarcely more than a twelvemonth since Roentgen of Wurzburg cheated reason and tricked prophecy by demonstrating the miracle of the x-ray. With the first announcement of the discovery came the application of the new light to the needs of surgery. The skeleton was laid bare in the warm and breathing body, and, for the first time, photographing the hitherto invisible was an overpowering fact. It is not necessary to speak of the world-wide astonishment with which this new discovery was received, nor of its probable benefit to the medicine and surgery of the future. In the enthusiasm of anticipation the possibilities of good appeared to be almost unbounded, but in the light of actually demonstrated results we must needs cultivate patience and perfect methods. Thus far the bones in the living subject have been very clearly and beautifully shown through various thicknesses of super-imposed solids, but expectations in other directions have not yet been realized. Opacity has lifted its veil and has approvingly blinked at the new light, but has not yet yielded absolute homage. Much more is yet to be accomplished. Although solid bodies of differing density have been duly located in the various tissues and cavities; though bullets, coins, and needles have by such means been discovered and removed, the outlines of the internal organs have not been so accurately rendered as was at first anticipated. This is in the main due to the want of distinctness in the demonstration of substance, and to the lack of sharpness of outline.

The best results so far from the x-ray have been obtained in cases of dislocated bones, of fractures, and in the discovery of imbedded bullets. In the present aspect of such accomplished facts there is a melancholy retrospect associated with the lost missile in the body of the lamented Garfield. All the devices known at that time were of no avail in locating the bullet. It was believed, and was thought to have been proven, that it had taken a downward course and lodged in the right groin, whereas in reality it traversed the body in an entirely different direction, through the spinal column, and at the autopsy was discovered behind the region of the stomach on the left side. With the Roentgen ray the whereabouts of the truant could doubtless have been accurately determined, and a successful operation for its dislodgement might have been possible.

Nurse—"I thought you would like to see the new baby. Isn't it awfully cunning and sweet?"

Papa—"Beautiful! Lovely! It is a peach."

Nurse—"Yes, sir; but ain't you glad it isn't a pear?"



HEN AND EGG.

Exposure, two minutes.

Radiograph of a hen at 9 p. m., showing the egg *in situ*. This egg was duly laid the following day at 10 a. m. The hen showed no inconvenience from the effect of the x-rays. The picture indicates under exposure.

In subsequent issues of this journal we will give full particulars of a series of experiments made on eggs at different periods of incubation. These investigations will be extended so as to include the animal and vegetable kingdom, to ascertain what effect, if any, the x-rays have upon vital cells. The effect of the Roentgen rays on fetal life under forty-five minutes' exposure at two, four, and six months has not apparently influenced the normal issue. Researches by others made in this line will be gladly accepted.

ODD CAUSES OF ELECTRICAL FIRES.

From the quarterly report of the Electrical Bureau of the National Board of Fire Underwriters we learn of the following odd causes of fire:

A plush curtain in a theater, on being hoisted, came in contact with a 32-candle power incandescent lamp. The common size is 16-candle power. The heat from the lamp ignited the curtain, but the fire was discovered, with no loss, except the curtain.

A stage hand was ordered to turn out an incandescent lamp, and, not knowing how to do it, instead of turning the switch, wrapped a damp towel around the bulb. Some time afterward the towel was discovered smoldering.

A portable incandescent lamp was allowed to remain lighted lying on a mattress. The heat from the lamp ignited the cloth and the excelsior of the mattress, and the fire spread through the basement and store.

An electric pressing iron was allowed

to stand with the current turned on. The heated iron after a time set fire to the table, and the flames communicated to the surrounding combustible material.

A wagon loaded with gasoline collided with an electric car. The wagon was demolished and the oil flooded the street. The accident attracted the attention of the motorman of another car, who ran his car up to the scene. Seeing the oil running under his car, he turned on the current to get away. A spark from the wheel immediately ignited the gasoline fumes and instantly the street was ablaze. Four people were injured, one seriously, and one horse was burned to death.

Fire occurred in a basement owing to dripping water falling on an electrical measuring instrument, thereby short circuiting it. No damage was done beyond the loss of the instrument.

Sparks from arc lamps in a department store ignited cloaks on a table underneath.

An elevator motor was burned out, having been left running when the employees left the store, the motor brushes having been badly adjusted.

A carpenter dropped a nut on the coils of a rheostat, short circuiting them with an iron frame resting against a gaspipe. An arc was formed between the frame and the pipe; the latter was melted and the escaping gas ignited. But small loss occurred.

Rats gnawed the insulation from a wire which lay on a gas pipe: an arc was established between the wire and the gas pipe, setting fire to the gas.—*New Ideas.*

THE BANANA CURE.

Crichton Campbell, writing to the editor of the New York *Sun*, speaks as follows of the banana:

Bestow a boon on humanity and help to popularize the baked banana as an article of food for rich and poor, especially the poor. One cent will buy a good sized banana, which, when baked in its skin in an oven for fifteen or twenty minutes, until it is quite soft and bursts open, alone makes a full meal. I say from personal experience that three bananas, weighing one pound, are equal in nourishment to twenty-six pounds of bread when baked.

Bananas should never be eaten raw. They are full of animal germs and very indigestible.

Baked bananas are also the ideal food for nervous persons and anemics, also brain workers. I learned their great power to sustain mental effort in India. I am as hard a brain worker as any person in New York, and I have subsisted for years entirely on baked bananas. When I see lean, blood-poor persons I advise them to eat baked bananas, and they unfailingly build up and gain flesh.

This subject, which might not inappropriately be called the "banana cure," because many diseases can be cured by eating baked bananas, merits the closest investigation. The introduction of the potato was a great boon to the people, but I predict that the spreading of the above facts over this country will prove of still greater benefit.

MEDICAL LONGEVITY.

The average duration of a medical man's life during the sixteenth century was thirty-six years, five months; in the seventeenth century it was forty-five years, eight months; in the eighteenth century forty-nine years, eight months; and in the nineteenth century fifty-six years, seven months. It would appear, from these data that—whether the survival of the fittest or not—the duration of medical life has been increasing in a marvelous manner. Should the same rate be maintained, practitioners of medicine may ere long look forward to centennial honors.

This is doubtless to be accounted for by the frugal diet and abundant exercise of the average doctor. He escapes the enervating effects of luxurious ease. If this continues, the surest method of obtaining longevity will be to become a doctor.—*The Alkaloidal Clinic.*

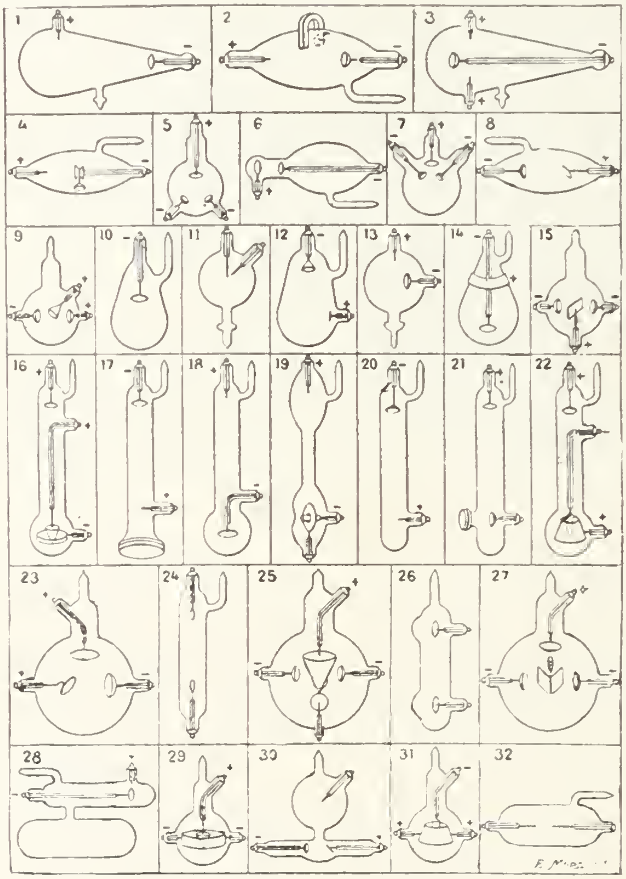
SOME VARIOUS TYPES OF X-RAY TUBES.

A large number of tubes have already been employed in different experiments with and applications of the x-rays for photography, and in connection with the fluoroscope.

Mr. G. Séguy has constructed and experimented upon several types, and he has gathered a collection which is illustrated in *La Nature*.

There exists at the present time three methods of obtaining the x-rays. That employed in the very beginning is based on the direct action of the ray. The second permits of obtaining instantaneity in the radiograph, and is based upon a reflection action. The third is the result of the combination of the first two methods.

In the accompanying engravings, Nos. 1, 2, 3, 4, 6, 7, 10, 11, 12, 13, 14, 17, 18, 20, 21, 24, 26, 28, and 32 are constructed according to the principles of the first methods. Nos. 5, 8, 9, 15, 16, 23, 25, 27, 29, and 30 employ the second method; that is the theory of the reflection of the cathode rays and of the phenomenon of internal electrolysis of the volatilized molecules. The tubes Nos. 19, 22, and 31 produce x-rays according to the two combined theories.—*Bubier's Popular Electrician.*



VARIOUS TYPES OF X-RAY TUBES.

SIMILIA SIMILIBUS.

"They say microbes are in a kiss,"
Quoth he—their lips had barely parted.
"I am a homeopath," the miss
Returned in tone not quite faint hearted;
"In 'like cures like' I put my trust."
Whereat their lips again concussed.

CATAPHORESIS AS APPLIED TO SENSITIVE DENTINE, RENDERING DENTAL OPERATIONS PAINLESS.

By Charles G. Pease, M. D., D. D. S., New York, in "The Journal of Electro Therapeutics."

I will not trespass upon your time in writing at full length upon so limited a subject. We are still experimenting, for, although the results which have been obtained by cataphoric action upon the dentine have been satisfactory, in the light of our present knowledge and in view of the purposes for which it is employed as limited by the scope of this paper, yet we do not know what the future may reveal.

The question arises, is there any damage sustained by the pulp that will result in permanent injury and final death through driving or carrying the obtruding medicament into the toothbone and pulp? (Arsenic, of course, not being used, cocaine being largely employed, as also some of the essential oils.)

To this question I reply, we have not been able to discover any damage to the pulp in cases in which anesthesia has been produced by cataphoresis up to the present. Whether any of these pulps will ultimately die as a result of the treatment time will tell. Years may be required before we can positively say they will not.

The fraction of a milliampere of the current will produce pain at the onset when applied to sensitive dentine, therefore the utmost care is required in controlling and graduating the current, which should be gradually increased, each increase of current causing pain at first. In seven to ten minutes there will be no pain on increasing current, which is then carried to two or two and one-half milliamperes, and continued for three or four minutes. Operative procedures may then be endured without pain.

During the application of the current the applicator should not be removed from contact with the part, that sensation may be avoided by reaction of current, and the current should not be increased until the pain of the previous accretion has subsided, and it is also advisable to place the medicament used into the cavity of the tooth about five minutes before the application of the current. This will modify the pain of first contact. The medicament is conveyed into and retained in the cavity by means of a small pledget of cotton the size of the cavity, and the applicator is placed against the cotton, which should be kept well saturated with the medicament by means of a pipet or other instrument.

In a recent operation a mesial approximal cavity, the dentine of which was extremely sensitive, was subjected to cataphoric treatment and then thoroughly excavated without pain. A disto-approximal cavity was then discovered in the same tooth, which was cut out without the cataphoric application and without any pain whatever, showing conclusively that the pulp had been invaded by the medicament sufficiently to anesthetize it, and the whole tooth could have been cut to pieces without pain. This is a great accomplishment and a boon to the sensitive patient. The rubber dam should be applied before making the application.

THE PASSING OF THE PHYSICIAN.

"It needs no prophetic eye," says the *Medical News*, "to see the extinction awaiting the practicing physician, using the term in contradistinction to the hospital or dispensary physician. Surgeons, aside from professors and hospital and dispensary surgeons, are already extinct. The dragnets of ambulance, dispensary, clinic, and hospital have secured such a 'corner' in surgery that no man outside the chosen few can make a living. What has occurred in surgery is now occurring in medicine. No patient able to walk or ride in a cab need pay a cent for medicine or treatment. If slightly hesitating on the brink, the maelstrom of dispensary, clinic, or hospital will suck him into its hungry and capacious maw, from which nothing is ever vomited back but statistics. If too sick to walk or ride in a cab, an ambulance waits to carry him tenderly, and without shock or exposure, to sumptuous hospital apartments, built possibly by misused funds donated to the hospital for charity. Ambulating and portable sick people being thus provided for, there remains only a small class of the desperately sick whose removal might mean death. To provide for these cases it is only necessary to slightly enlarge the staff of out-door visiting physicians, and, presto, the thing is done. And the weary and struggling outside general practitioner can go home, shut himself up with his emaciated wife and starving children, and turn on the unlighted gas."

This same death knell was preached when Gross was a student under McClellan in 1827. We recall the long, sad wail sent up against free clinics and the rich, the beneficiaries, by Dr. P. S. Connor, before the alumni of the Jefferson Medical College of Philadelphia in 1877.

Clinics have their abuses and should be restricted, but doctors today are better paid, and there are more of them in proportion to the population than at any previous period.

MORTALITY IN LARGE CITIES.

The mortality rate of sixteen of the largest cities in the United States in 1892 was as follows:

	Population.	Death rate per 1,000.
New York	1,687,072	25.9
Chicago	1,200,000	22.3
Brooklyn	871.723	24.37
St. Louis	460,000	19.4
Boston	459.062	23.02
Baltimore	455.472	21.92
San Francisco	330,000	20.82
Cincinnati	300.000	22.09
Buffalo	255.664	23.48
New Orleans	254,000	27.48
Washington	250,000	24.03
Pittsburg	247.000	24.3
Louisville	227.000	14.88
Detroit	220.000	19.33
Milwaukee	220.000	21.33
Minneapolis	200.000	10.93

The great disparity of mortality is more noticeable in cities of less population. Quebec, of the Province of Quebec, with a population of 62,000 has a mortality of 41 per thousand, while that of Des Moines, Iowa, with a population of 62.000, has a mortality of only 9.

FOREIGN BODIES SWALLOWED BY CHILDREN.

The *American Medical and Surgical Bulletin*, in an article on this subject, says that pins, safety-pins, pebbles, jackstones, etc., swallowed by children need occasion no alarm, as they will all pass through without harming the child. The greatest danger is from the castor oil with which the child is usually dosed in such cases: it is better to leave the bowels at rest and give gruel, crackers, baked potatoes, milk, anything that will constipate the child and make a pultaceous mass in which the foreign bodies will be imbedded and carried through.

When foreign bodies stick in the throat and the child is unable to swallow, it should receive an emetic, or the coin catcher should be introduced. This is a basket-like affair easily used. In one case both a 1-cent and a 2-cent piece were removed at the same time by this instrument.

MODERN MEDICINE.

"What are you studying so intently?" said Mullins to his friend, Dr. Paresis.

"I'm trying to ascertain whether a patient of mine can stand a consultation."

"That book you are reading treats of his ailment, I suppose."

"No, this is Bradstreet's."

THE latest exploit with the Roentgen rays is reported from Lisbon. It was at the instance of the Queen of Portugal, who takes a keen interest in science, that the ladies of her court submitted themselves to the searching action of these vibrations. The ladies have been startled at the sight of their distorted ribs and bones, the result of tight lacing. Henceforth they have determined to be free women. Corsets are to be cast aside.

BOOK REVIEWS.

Roentgen Rays and the Phenomena of the Anode and Cathode. By Edward P. Thompson, M. E., E. E., author of "Inventing as a Science and Art." Concluding chapter by Professor A. Anthony, with sixty diagrams and forty-five half tones. 8vo., cloth. Price, $1.50.

The book involves researches of Spottiswoode, Lichtenberg, Karsten, Hammer, Poggendorf, Gassiot, Plucker, Crookes, Goldstein, Hertz, Lenard, Kowalski, Roentgen, Righi, Varley, Elster, Geitel, Thomson (J. J. and Elihu), Lodge, Swinton, Salvioni, Rowland, Edison, Tesla, Borgmann, Pilichikof, Meslans, Chas. Henry, Branly, Stolstow, Pupin, Stine, Dufour, Sylvanus P. Thompson, Terry, Scribner, M'Berty, Rice, Minchin, Appleyard, Buguet, Rood, Mayer, Murray, Lafay, McKay, Perrin, Thomson (Lord Kelvin), and many other eminent physicists and electricians. The contents are arranged into chapters as follows: Chapter I, "Anode and Cathode Phenomena in Open Air, Compressed Gases, and Low Vacua;" II, "Action of the Magnet upon the Cathode and Anode Columns of Light, and other Kindred Occurrences in the Discharge Tube;" III, "Electric Images, Electrographs, Anode and Cathode Dust Pictures, Photo-Electric Pictures and Portraits, Bas-relief *Fac-similes* and other Curious Pictures based upon Discharge of Current;" IV, "Anode Radiations, Motions, Effects, Striæ, Velocity, and Kindred Occurrences, such as Heat Striæ and Sensitive State;" V, "Cathode Rays in High Vacua, Inside of Discharge Tube;" VI, "Cathode Rays Outside of Discharge Tube;" VII, VIII, XI, X, XI, XII, "Roentgen Rays; Properties, Laws, and Principles of;" "Applications;" "Instructions on Electrical Apparatus for Generation;" "Construction of Discharge Tube;" "Difficulties Experienced and How Overcome;" "Miscellaneous Phenomena;" XIII, "Roentgen Rays in Diagnosis;" XIV, "Generalizations, Theories, and Kindred Radiations." These are divided into 210 paragraphs, in which the author recites the experiments of physicists, and with each are numerous cross-references together with the lesson taught by each experiment.

The book opens with the investigations of Faraday in 1831, which marked the time when the first researches were made in electricity bearing upon the recent x-ray discovery. Separate chapters are devoted to Reiss, Gassiot, Lenard, Roentgen, Hertz, Thomson, Edison, Tesla, and miscellaneous researches on Roentgen rays. Chapter XIII gives "A few Typical Applications of X-Rays in Anatomy, Surgery, Diagnosis, etc." The book concludes with "Theoretical Considerations," ably written by Professor Wm. A. Anthony. The author has encompassed the scientific range of all x-ray phenomena, and epitomized this vast domain of interesting research. It is a thesaurus of information on all that pertains to the Roentgen ray, and it is doubtful whether its equal exists in any language. The book is a study. The student of radiant matter, discharge tubes, and all electrical phenomena bearing on this subject can not pass judgment on the history and intricacies of this science without having first studied Mr. Thompson's valuable book. The first edition has the fault of not being indexed, but the contents are, however, conveniently arranged and easily understood.

The X-Ray, or Photography of the Invisible. By William J. Morton, M. D., in collaboration with Edwin W. Hammer. New York: American Technical Book Company. Price, 75 cents.

This book is bound in cloth, covers about 200 pages of printed matter, illustrated throughout and with an additional ending of thirty well-executed x-ray half-tones. The authors show a technical familiarity with the subject, revealed in a most striking manner by elementary teaching, simplicity, and practical use of the x-rays. The book is divided into four parts, and these again into chapters, concluding with appendices A, B, and C. Appendix A is by Professor Wilhelm Konrad Roentgen, entitled "A New Form of Radiation;" appendix B is by Thomas A. Edison, "Experiments with the Roentgen Rays;" and appendix C is by Dr. Oliver Lodge, F. R. S., "The Surviving Hypothesis Concerning the X-Rays." While these subjects are interesting to those somewhat familiar with electrical phenomena in vacua, it is the more elementary portions of this book which will invoke the greatest interest. Part I, including seven chapters, is beautifully primary, defining the volt, ampere, and coulomb, the ohm, the watt, the farad and microfarad, induction, and conservation of energy. The definitions are made with familiar and commonplace examples, and are so rudimentary in detail and withal interesting that each sentence conveys to the reader a clear and well-defined understanding. "Sources of Electricity," "The Induction Coil," "Crookes' Tubes and their Variations," "The Fluoroscope and Photographic Apparatus," makes up the subject matter of Part II. Part III enters into "The Practical Detail of the Choice of Apparatus, and How to Make Proper Connections," "On the Nature of the X-Ray," "The Source of the X-Ray and How Demonstrated," "X-Rays and their Relation to Vacuum," "Taking the First X-Ray Pictures," "Photography with the Camera." Part IV gives the "Surgical Value of the X-Ray," and concludes with "Fractures and Dislocations," "Diseases of the Bones and Deformities," "Stiff Joints," "The X-Ray in Dentistry," "Foreign Bodies in the Body," "Soft Tissue and Location of Organs," "Medico-Legal," and "Curative Action of the X-Ray." Those persons who desire to extend their knowledge in this popular branch of science will find easy and ready information in this most excellent book. Those who are working with the x-rays will find labor, anxiety, and expense saved by carefully perusing these pages. The book reflects the author's knowledge of the x-ray work after exhaustive personal experience.

THE A, B, C OF THE X-RAYS. By William H. Meadowcroft. New York: American Technical Book Company. Price, 75 cents.

Whatever may be said of elementary works written on the subject of the x-rays, the A, B, C must always occupy an unoccupied field of information for students and beginners. Any one who will familiarize himself with this readable book can satisfactorily manipulate an x-ray apparatus. The sections are carefully arranged. The matter is written so plain and readable that the student, though unfamiliar with any part of the new science, will in one evening find himself in possession of a good understanding of the x-ray phenomena. The book is well indexed. Handsomely bound in cloth, about 200 pages, richly illustrated.

LIABILITY OF MEDICAL MEN.

An astonishing ruling has, according to the reports of the German medical journals, been recently made by the courts of that country on a point of alleged malpractice. In April of the present year a serving man was wounded in the chest with a knife, and was treated by a practitioner without antiseptic precautions. The man died from septic poisoning, and the practitioner was arraigned on the charge of culpable homicide, which was upheld by the magisterial court on the ground that a medical man should be so far abreast with modern science as to avail himself of the recognized rules of treatment, and that in the case in question the practitioner should have been aware that the procedure adopted by him might lead to the death of his patient. The Reichsgericht being appealed to, confirmed this decision. In view of the wide differences of opinion still obtaining among practitioners in England and America regarding so-called "Listerism," one can not help thinking what havoc would be made with professional reputations and pockets were such a cause recognized in either of the latter countries as a fit ground for legal interference.—*Boston Medical and Surgical Journal.*

THE ROENTGEN RAYS IN OCULAR THERAPEUTICS.

The unexpected result of the application of the Roentgen x-rays of relieving pain and reducing inflammation in the effort to detect the presence and location of a foreign body in the eye is worthy of a passing notice. A man had complained of severe pain in the ball, incapacitating him from work and causing sleepless nights, and had earnestly requested relief. The experiments undertaken by Dr. Stern in the Polyclinic laboratory were eminently successful in detecting the presence of a piece of metal in the vitreous. Coincidently the pain was relieved, and the man could both work and sleep. Whether this happy result was only a coincidence or a real effect of the rays can not be positively asserted, nor can its application be general until further experiments on a sufficiently large scale demonstrate the truth or falsity of the statement that the x-rays are a therapeutic agent.—*Philadelphia Polyclinic.*

EXPERIMENTERS are discovering that the Roentgen rays are quite complex. One electrician reports in *Nature* that he has differentiated them so as to be quite sure of three distinct kinds. To one kind wood is transparent and flesh opaque. To another kind bone is almost as transparent as flesh. The suggestion has been made that the difference is due to frequency rather than quality. Another experimenter has succeeded in taking photographs through a plate of iron eight inches thick.

FOREIGN BODY IN THE EAR RESULTING FATALLY.

Voss (*La Sem. Med. de St. Petersbourg*, January 10, 1895) reports the case of a child five years old who pushed a dry pea into his ear. Four doctors spent several days endeavoring to extract this body, but only succeeded in pushing it quite out of sight. On the fifth day the foreign body was imbedded in the tympanic cavity, whence it was removed after dissecting the ear forward and opening the posterior wall of the auditory passage; the tympanum was crushed, the ossicles were broken, the cavity was suppurating. The fever from which the child was suffering at the time of abstraction continued, and the patient became comatose and perished four days later. To determine the position of foreign bodies, the patient should be examined at once with the aid of the x-ray.

THE drinking cup as a carrier of contagious disease among school children is now under consideration by the New York Board of Health.

X-RAYS IN LEGAL CASES.

Lucien I. Blake, professor of electricity in the University of Kansas, went to Wichita, Kan., the other day to take a Roentgen shadowgraph of the wrist of Pete Noel, who has brought suit in the District Court against the Atchison, Topeka & Santa Fe Railroad for $10,000, claiming that the company's physician damaged him to that extent by bunglingly setting his fractured wrist. The shadowgraph will be introduced in evidence, plaintiff and defendants having agreed to accept it as final evidence.

In Denver, Colo., December 4, 1896, James Smith brought suit against Dr. W. W. Grant for $20,000 damages for false diagnosis of an injury that led to treatment of contusion instead of fracture. The x-ray was recognized in court as disclosing the true nature of the trouble.

In Waterloo, Iowa, recently a suit was brought against Dr. D. W. Overholt for alleged malpractice in setting a fractured leg. The x-ray was admitted in evidence.

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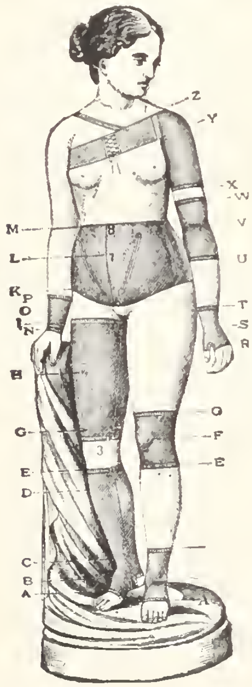

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HEBER ROBARTS, M. D., EDITOR,
2914 MORGAN STREET, ST. LOUIS, MO.

Entered at the postoffice at St. Louis, Mo., as second-class matter.

THE Jefferson Medical College, Philadelphia, will give a summer laboratory and post-graduate course.

THE old Alabama Medical College is to be congratulated upon its being received as a part of the State University.

DR. EMMA WAKEFIELD is the first colored woman who has qualified under the laws of Louisiana to practice medicine.

A COLORED woman passed the examination of the Board of Medical Examiners of the state of North Carolina in 1894, and received her license to practice medicine.

THE doctors of Richmond, Va., are crying out, and justly, too, against the heavy license tax that is imposed upon them by state and city governments. The average physician has to pay an annual tax of from $40 to $60.

THE Bellevue Medical College and the New York University Medical School have been consolidated under the name of the New York University-Bellevue Hospital Medical College. The faculty of the new college will number 116.

The College of Physicians and Surgeons at Chicago has recently become the medical school of the University of Illinois. Thus, one by one, the creditable medical colleges are attaching themselves to universities. The personal or individual medical school will soon be a tradition.

WHEN tubes are connected in series they will each give off Roentgen rays. It is said that inasmuch as two pictures are formed when two tubes are placed in this manner, the mathematical data forming triangles, one can calculate the exact position of bodies otherwise difficult to locate. It is likewise useful in connection with the stereoscope.

DR. DAVIS, of the Bellevue Hospital, New York, has been investigating the cause of visual hallucination in delirium tremens. Ophthalmoscopic investigation revealed a congested, almost black, condition of the blood vessels of the retina. The normal condition of the retina is pale, and the vessels almost invisible. In the condition of delirium the vessels are raised above and projected into the field of vision, where their tortuous shape and movements seem like the twisting of snakes.

THE *Medico-Legal Journal*, Vol. XIV, No. 3, published by Clarke Bell, Esq., No. 39 Broadway, New York, contains some original articles which affect American citizens in particular and civilization everywhere. The matter appeals more to the professional mind, but should also be read by laymen as well. Particular reference is made to the Medico-Legal Points in the Maybrick Case, by Harriette C. Keatinge, M. D.; Compulsory Vaccination, by Montague R. Leverson, M. D.; Sexual Inversion, by Havelock Ellis, of London; Impotency in Women, by R. W. Shufeldt, M. D., of Washington, D. C.; and Right of Possession of Dead Human Bodies, by Dr. Hermann Kornfeld, of Grotkau, Silesia.

We are in receipt of the following inquiry for information from Dr. N. Stone Scott, of Cleveland, Ohio. The doctor is professor of genito-urinary diseases in the College of Physicians and Surgeons, Cleveland, and consulting surgeon to several hospitals of that city. His investigations are certainly timely, and are looked for with great interest.

Cleveland, O., April, 1897.

Dr. Heber Robarts, St. Louis.

Dear Sir: I am very much interested in the reported cases of x-ray injuries, especially of the deeper structures. If you have seen bad results following x-ray exposures, will you kindly fill out the blank? All communications will be considered strictly confidential, unless expressly stated that other use may be made of them. Thanking you in advance, I am, yours very truly, Dr. N. Stone Scott.

Name of patient. Age. Date of exposure. Kind of apparatus used. Length of spark. Length of exposure. Number of exposures. Distance of platinum terminal from part exposed. Part of body submitted to exposure. Length of time from exposure to development of symptoms. Symptoms. Duration of symptoms. Remote results. Remarks.

Dr. Robert Koch, whose name is probably more widely known than any living investigator in bacteriological research, has recently written an article for the *Deutsche Medicinische Wochenschrift*, in which he announces the discovery of an immunizing tuberculin, which he calls tuberculin remainder. It is ten years since Prof. Koch reluctantly made public his immatured discovery known as tuberculin. Since then imitators claiming to have discovered cures for contagious diseases have probed the backs of credulous humanity with shots of sinister nominate serum, void of useful results, until the profession has grown weary and the people suspicious. The intelligence that ten years' labor has been rewarded, coming from a reliable source, is welcome news. This discovery contemplates immunizing the body so that it can not take consumption. The tuberculin simply gave immunity to the toxin, the tuberculin remainder gives immunity to tubercle-bacilli. The former was a toxin product; the latter is a micro-protean of the bacilli, divested of fatty acids, and contains none of the alkaloidal toxin. Bacilli can not live, it is claimed, in a body immunized with Koch tuberculin remainder.

The application of the static machine for electro-therapeutic work has been of long standing; indeed, accounts of the same run as far back as the sixteenth century. In this country it is well known that Franklin used this form of current, or, perhaps more strictly, frictional current for producing electro-therapeutic results. It was then thought necessary to use the spark discharge for all cures. It has now been demonstrated that while this is the most efficient, it is not at all necessary, and marvelous cures have been effected by simple electrification. The introduction of the x-ray feature has brought more forcibly before the minds of physicians the value of the electric current as a therapeutic agent. During the past few months a great deal of study has been devoted to this phase of the subject, and today no physician is credited with being up to date without a more or less intimate acquaintance with the benefits to be derived from the electric current, both from its electro-therapeutic and x-ray standpoint.

The question of what effect the high frequency current would have when used for electro-therapeutic work has been much discussed during the last few months. The recent reports which have been rendered concerning its application lead to the belief that it will result in an agent of more than usual interest. The ease with which the instrument generating this current can be used will insure its wide application as soon as physicians become sufficiently well acquainted with the results obtained by it. In the elimination of refracted tendency it has been found that local application is the method to be employed.

Dr. W. K. Grayson, White House, Texas, in the Texas *Medical News* for May, has written on the "Polarity of the Atoms Composing the Human Body, and their Relation to Mind and Matter." The article closes with reference to the sensitive machine of Mr. Emnner and x-ray analogy. He says:

"Mr. Emnner's machine is a cylinder about six inches long and an inch and a half in diameter. It is coated with an exceedingly sensitive chemical easily decomposed by the electric current. In front is a needle of aluminum, whose point is coated with another chemical. The needle rests upon the cylinder, while its base is set in a diaphragm of aluminum, a very thin plate of the latter metal being used. In front is a somewhat fan-like arrangement intended to convey the impressions direct to the recorder. The machine is connected with an electric induction coil, and run by means of a small motor, the thought impression being transferred by the needle to the sensitive surface of the cylinder. The person whose thoughts are to be read is seated about three feet in front of the machine, not in contact, and lets his mind pursue any train of ideas. The motor is set going, and in a few minutes the cylinder has done its work, leaving a fine tracing of vibrations, the result of the person's thought. A finer needle is substituted if the impressions are to be read, connected with the secondary induction coil, and wires leading from the electrode are placed at the base of the brain of the reader. The ideas which have passed from the brain of the first person into the machine are now transmitted into the mind of the second person, the thoughts being received in an unconscious manner, that is, not by any sound or written word, but the conception simply frames itself just as when it was given birth in the head of the owner. Mr. Emnner says in experimenting with the x-ray he will be able to make actual photographs of thought—that is, he can picture its vibrations just as those of light and sound can be caught by the camera. The machine is placed about three feet from a person, and on one side, about half way between them will be a camera, and just opposite the tube in which the x-ray is generated. The thought vibrations, in passing from the person to the machine, naturally have to pass the space between the camera and the x-ray, and a photograph of these vibrations will be the result. The scientific world will look with great interest on the future development of Prof. Emnner's experiments on these lines."

It is interesting to note the practice now being performed for the treatment of chronic heart disease known as the Bad Nanheim, or Schott system. The practice is quite new in America, having been introduced into the clinical service of the department of therapeutics of the Philadelphia Polyclinic only less than one year ago. Dr. Robert Babcock had used the system in 1893, the only practitioner, to our knowledge, in this country who antedated the polyclinic. Much interest is awakened in the subject since the increase in heart disease grows more apparent as laws upon hygiene and sanitation are enforced, to the end that less contagion occurs and diseases generally become less severe. Again, the method prescribed for treating affections of the heart have always been exceedingly unsatisfactory when taken in comparison with the results obtained from the Schott method. Seven cases were selected by the polyclinic, on account of their severity, as test cases to determine what effect, if any, the treatment would have on them. The result was beneficial in every case, even beyond expectation.

The system consists of the use of warm saline carbonated baths, ranging in temperature from 92° F., on entering the bath, gradually reducing the temperature while in the water to 85° F. The duration of the bath is from five to ten minutes.

Conjoined manipulation may be an accompaniment to the treatment. Artificially employed, 40 gallons of water are used, with sodium chloride (N_aCL) from 4 to 6 pounds, and calcium chloride (C_aCL_a) from 6 to 10 ounces, and later are added sodium bicarbonate ($N_aH.C.O_2$) ½ to 2 pounds, hydrochloric acid (HCL) ¾ to 3 pounds. These agents are used in gradual increasing strength from the smallest quantity to the largest, including six baths, one daily.

It is an interesting coincident to find this artificially employed water imitated by nature, with the exception of the hydrochloric acid, flowing from an artesian well in Louisiana, Mo. The effect of these baths reduce the area of cardiac dullness and slow the frequency of the pulse. Thorne's theory is that the baths and exercise dilate the arteries of the muscles and those of the periphery generally, and thus relieve the heart from backward pressure. Dr. Solis-Cohen supported the same opinion before the Philadelphia County Medical Society. If this theory is correct, then there is diminution in the size of the heart by depletion of its own vessels, and the organ gains strength by having room to contract, and moves more slowly because the contraction is more complete.

THE story goes that a reporter for one of Murphyboro's (Ill.) daily papers, speaking of a prominent young lady milliner who was laying in her spring stock of goods, said "he was pleased to see her stocking up." The next day the reporter was chased three blocks and a $4 parasol broken over his head.—*Exchange.*

It may be interesting and useful to divert this story into a little thought. A reporter for a metropolitan paper happening to be in my office while x-ray experimentations were being made, presented me with a photograph as a fair comparison with radiography. The next morning, July 2, 1896, there appeared in the paper:

In connection with the Roentgen rays, Capt. J. B. White, of Grandin, Mo., manager of the Missouri Lumber and Mining Company, has sent to the *Globe-Democrat* a photograph secured from a negative taken by W. H. Kennedy, a photographer of that place. During his work Mr. Kennedy had occasion to take some pictures in the mill of the Missouri Lumber and Mining Company's mill. In one of these his negative shows that the rays from his camera, which is an ordinary one, penetrated through the dress and cap of a girl, and the picture shows what was back of her almost as clearly as though the Roentgen rays had been employed. Some experimenters with the rays account for this by saying that the girl's dress and cap were blue, a color they say is favorable for Roentgen ray purposes.

Roentgen Rays and Phenomena of the Anode and Cathode. Sec. 134*a*. Hodges' Experiment. Electrical Engineer. New York. March 4. 1896:

"Attention has been invited in the scientific press to the penetrating power of heat rays and of light of low refrangibility. In conjunction with this, let it be remembered that the photographic plate has the property of being impressed practically only by rays having a higher refrangibility than red. It would be natural, therefore, to conclude that if the spectrum could be turned around, the photographic impression might be produced through opaque bodies. This, perhaps, was the kind of reasoning which prompted Mr. N. D. C. Hodges, formerly editor of *Science*, to perform an experiment, the gist of which consisted in attesting the permeability of rays of light which had been passed through fuchsine. Christiansen, Soret and Kundt performed experiments with an alcoholic solution of this material and found that the order of the colors in the spectrum was somewhat reversed—namely, violet was the least refracted, then red, and then yellow, which was the most refracted. Mr. Hodges used a pocket kodak, carrying a strip for twelve exposures. This camera was placed in a closely fitting pasteboard box Thus protected, some portions of the film were exposed to sunlight, so far as it could penetrate the end of the pasteboard box, while other exposures were made with a prism on the end of the box, containing an alcoholic solution of fuchsine. The portions of the film exposed to the anomalous rays produced by the fuchsine solution were fogged, while the central experiments with ordinary light shadowed none. The anomalous rays must have penetrated the pasteboard, and probably the wood and leather of which the camera was made."

Stokes' theory. Philadelphia Transaction, 1852, "Change of Refrangibility of Light," assumes that some substances have the power of reducing the refrangibility. For example, ultra-violet light, highly refractive, is changed to yellowish green, less infrangible, by reflection from uranium glass.

In the case of the photograph there was probably a highly electrified condition of the air or an unusual luminosity of the air, or both, which facilitated the transmission of actinic rays through the meshes of the clothing. The x-rays will cause shadowgraphs to be produced upon sensitized plates, but do not reflect rays of light from an object, or cause them to be reflected upon a sensitized plate, as is the case with photography. The x-rays had nothing to do in the production of the picture.

It was reported in the press that Columbia College was trying to unravel the mystery which surrounded the formation of the picture of an eye upon a pair of glasses taken from the head of a dying woman. The St. Louis *Post-Dispatch* referred to it as a freak of the imagination, or certainly a unique freak of nature.

Roentgen Rays and Phenomena of the Anode and Cathode, Sec. 36*b*:

"Mr. Hammer recently had on exhibition at the Electrical Exhibition of the National Electric Light Association in New York city, 1896, a portrait formed of fine dust upon a pane of glass. The circumstances were as follows, as remembered by the author. Mr. Hammer happened to be in some place where an artisan was removing a photograph from an old frame. The glass which protected the portrait exhibited a fac-simile in dust on the inner surface. The glass had not been in contact with the photograph, because a thick passe-partous surrounded the picture. Neither was the glass an old negative photographic plate. Further test and inspection tended to prove that the dust picture was executed by some action of the heat or light of the sun. Prof. Benjamin F. Thomas, of the University of the state of Ohio, in an interview scarcely thought that the result was due to convection, because the dust print was so sharply defined. The principle of the discharge of bodies by light may be applicable, perhaps, but further experiment would be necessary as a more secure foundation.

"Mr. Hammer and Prof. Anthony intimate a connection by differentiation of temperature as a possible cause.

"Mr. William J. Hammer has a historical collection of incandescent lamps (*Electrical Engineer*, New York, April 29, 1896, p. 446) which were arranged on shelves in a glass case standing obliquely in the sun-light about an hour a day. After the lapse of many months the very fine glass within the case lodged upon the inner surface of the glass in such a manner as to produce oval dust figures corresponding somewhat to the shapes of the lamps. No one can doubt that the sun and lamps acted as agents in their formation. As to the correct explanation, the matter has not been scientifically discussed by scientists (presented here for the first time) to enable the author to render the opinions of others, but it is of interest in connection with Roentgen rays and the discharge of electrified bodies by light. As a matter of course, the surface of the lamps would reflect the light in such a way as to make bright spots (movable, however, with the sun) upon the glass of the containing case, and if the latter were in any sense charged by negative atmospheric electricity, this light would cause a variable amount of dust to be attracted according to the intensity of the rays striking the glass."

It is not unlikely that the light reflected from the eye, which is well known to be, under certain conditions, a reflective mirror, falling upon the glass spectacles and there forming a bright spot, acted upon the finer particles of dust which was on the glass, producing the dust figures of the eyes. As has been suggested, it is probably necessary for the formation of such pictures that the glass should be charged by negative atmospheric electricity, or possibly so artificially charged.

Electric Images, Reiss' Reibungs, Vol. II, Sec. 739:

"He laid a coin upon a plate of glass and charged the same electrically about one-half of an hour or more. Upon removing the coin and sprinkling the plate with dust, an engraving of coin was visible upon the glass."

Electrograph—Original communication by Prof. McKay, of Packer Institute, Brooklyn:

"The picture of a coin is produced by the photographic plate in utter darkness, resembling in this respect sciagraphy."

The coin is placed upon the sensitive side of the photographic plate and both securely wrapped in black paper. Tinfoil is placed upon the opposite side of the plate and attached to an influence machine or induction coil, while the other plate is made to touch the coin. This discovery was first described by Prof. Sanford, of Leland Stanford University, three years ago.

WITHIN a few months following Prof. Roentgen's announcement of the x-ray phenomena the editor of this journal had

constructed a Tesla high-frequency coil for x-ray work. It was the first apparatus of the kind made for this purpose. Constant application of the instrument to fluoroscopy and sciagraphy revealed a want and imperfection in the picturing. It was this fault which caused us to conceive a method for its improvement. The fluoroscope and switch in handle herein shown was made by an Eastern concern on receipt of the following from us:

L. E. KNOTT APPARATUS CO., Boston, Mass.

Gentlemen—The power of the Roentgen rays is all that is required, but some method of utilizing it to better advantage is demanded.

Radiographic pictures as well as fluoroscopic views of the softer structures are essential.

It is impossible to get a good picture of a tumor, or of any consumptive area, or of any fleshy induration with any existing device. It also requires much study to differentiate with the fluoroscope diseased from healthy tissue in the interior of the body. This fault lies with the slow method of cutting off the electric current, which should be instantaneous. The cut-off should be under control of the operator, on the fluoroscope, and under the thumb. The picture, consciousness of it, and interception of the current should be, as nearly as possible, simultaneous.

There should be a slide space contained in the outer fluorescent end of the fluoroscope for the purpose of receiving the sensitized plate. A perfect apparatus will excite a discharge tube which will readily cast a shadow of the softer tissues followed immediately by transparency, then a shadow of the denser structures, progressing in this way until all of the parts are lost. The view wanes before the sight not unlike the mellow receding rays of the northern lights.

With the improved method of cutting off the ray a picture of the internal structures is readily produced. When such a picture is brought well into view, cut off the current, slide in the sensitized plate, keeping the eyes still in the fluoroscope. When all is ready turn in the current. The picture will now soon appear in the fluoroscope, and at the same instant on the sensitized plate. This is the moment when loss of time destroys the picture. With some degree of care, combined with the instantaneous cut-off under the operator's control, a perfect picture can be obtained.

Since this was written, and since the instrument has been put to actual test, we desire to retract some of the claims made for it. While it is a practical and valuable device, experience has proven the inadequateness of a sensitized plate to be affected by the x-rays at all times sufficient to make a picture at the moment of fluorescence. When the rays stream out in great quantity and force, a picture of denser structures in rapid succession dawn before the eyes, but the plates fail to respond to the outlines of softer tissue with the promptness suggested. The plate is not influenced as by light rays. Visible shadows upon tungstate of calcium or other fluorescent material has not been made to synchronize with a fixed shadow upon a sensitized plate.

ASEXUALIZATION.

An enacting bill has been recently introduced in the legislature of the state of Michigan which provides for asexualization. Feeble-minded and epileptics who become inmates of the feeble-minded institution of the state, "before he or she is discharged, shall be caused to submit to an operation that causes asexualization, that such person shall cease to be able to reproduce their kind."

All persons convicted the third time for felony, and those convicted of having ravished a child or woman, after the first year's incarceration, must submit to the operation which causes asexualization. A fee of $25 is provided for when a physician is employed not a member of the hospital staff, and for non-compliance with the law the superintendent or other officer pays a penalty of removal from office.

A PREMIUM OFFER.

The subscription price of the American X-Ray Journal is $1.00 per year. While this price is low when the character of the journal is taken into consideration, we have made arrangements by which we can offer additional inducements to subscribers. We will send the Journal for one year and the following named books pertaining to x-rays, prepaid, at the prices annexed:

"A B C of the X-Rays" (price 75 cents) and the Journal for $1.50.

"The X-Ray of Photography of the Invisible" (price 75 cents) and the Journal for $1.50.

Both of the above books and the Journal for $2.00.

"Roentgen Rays and Phenomena of the Anode and Cathode" (price $1.50) and the Journal for $2.10.

These three books are richly illustrated, beautifully printed on coated paper, and handsomely bound in cloth.

SELECTING AN X-RAY OUTFIT.

This question is a practical one, and one which sooner or later every physician will be forced to consider for himself. Having had fifteen months' experience in this work, and we believe worked with nearly every kind of an outfit which has been placed on the market, it is expected that we should answer, in a general way at least, the many inquiries which almost daily reach us relative to the best or most efficient apparatus.

The first and most important thing for the prospective purchaser to consider is the means obtainable for operating such an outfit. The electric incandescent lighting current, either direct or alternating, is the power in most instances to be obtained. Battery power may be used, but objectionable reasons obtain which will be mentioned later. Water motor may be practical under some conditions, and hand power, also available, is productive of good results.

Our reasons for considering that battery power has objectionable features is that no battery has yet been constructed which does not require more or less attention, and this is likely to be needed just at the time the instrument is required for use. The average physician will use an outfit only a small fraction of the time, making the cost of the street current trifling after the wires are laid. In such places where this power can not be had, the induction coil or hand power static machine will render efficient service.

The ideal apparatus would seem to be one which can be attached to the lamp socket of an incandescent lighting current, as there is then no cost of maintenance except when in actual use, and the power is always ready when the instrument is needed. There is also reliability and efficiency in the hand power machine.

Suppose that means for operating have been arranged for, what kind of a generator shall the physician employ? This is a point on which only one who has had experience with all kinds can safely advise. However, we find men who have used only one device speak most enthusiastically of that particular form, ignoring entirely the merits of other machines. First of all, let the physician select the one which is easiest to operate and most sure to give results at all times. In order that these conditions may be met, the number of parts should be as few as possible. The starting of the apparatus should be as simple as the turning on of an electric light. The entire instrument should be so adjusted that one can not readily make an error in operation. The question of deciding which one of the various forms most nearly meet these conditions will be mentioned briefly.

The various forms of induction coils, on the whole, seem to be easy to operate—that is, the induction coil pure and simple, which can be operated without the aid of rheostats, rotary breaks, and other appliances, is simple enough not to be confusing. Where, however, these coils are adapted to the incandescent lighting current, it is necessary to use in conjunction with them rheostats, rotary breaks, or air blast blow-outs. If the induction coil could be operated without these extra appliances, we should not hesitate to recommend it for simplicity, and we are not sure but that these objections are now being obviated. Concerning its reliability, there is no question but that in the hands of a skillful operator it would be productive of excellent results. Unfortunately, however, the quantity of current delivered is larger than is absolutely necessary for the best results. This causes rapid change in the vacuum. Limitation of the rapidity of discharge by an automatic interrupter renders any change in the vacuum an extremely unfortunate attribute, as a very small percentage of variation will often entirely destroy results. The difficulty, then, in the induction coil seems to turn largely on the question of the advisability of using an extra battery current, and the inconvenience caused by the extra appliances which are necessary when operating by incandescent lighting circuit.

Various kinds of influence machines are now coming into prominence, and the results obtained with them are surely worthy of careful investigation. With these the frequency is only limited by the degree of efficiency tube. Furthermore, there is so little heating effect that the vacuum seems not to change from time to time to any perceptible degree. In addition to this feature, the possibility of varying the discharge by varying the length of the spark gap renders a greater change in the degree of the vacuum admissible. Until recently it has not been possible to obtain a static machine so constructed that it would operate in all seasons of the year. There have, however, been machines of this class recently placed on the market which seem to warrant the assertion that they will operate under all climatic conditions. The simplicity of operating a static machine is surely obtained. If it be operated by hand power, there are no extra appliances to look after. If it be operated by motor, it is only necessary to close the switch and the machine is in operation. Some slight degree of care is necessary in operating such a machine to keep a jar of calcium chloride, or some other efflorescent liquid, within the case. Electric heaters are now also used inside the case. The best work brought to our attention has been produced by the influence machine, and that not in the hands of a skillful operator, so that we feel warranted in asserting that such a machine must of necessity be easy of operation.

There is one class of x-ray generators which has not yet been mentioned, viz.: the high frequency coil, which has attracted wide attention during the past year. When first constructed, these coils were made of a large number of parts, all of which must be properly correlated in order to secure good results. Manufacturers have now, however, learned to so permanently adjust these parts, and to mount them as one machine, that the difficulty of operation is now reduced to a minimum. The high frequency coil which has come under our notice, being operated by simply opening and closing the switch, requiring no more skill or attention than the turning on of an electric light, seems specially well suited for practical surgical work. The rapidity of discharge is of great value, but the rapidity can not be so great as the discharge in a static machine. Other x-ray apparatuses have recently been constructed capable of doing practical work, in which it is clearly demonstrated that it is not essential for the production of x-rays that the break should be so enormously high.

Questions concerning any portion of this subject will receive prompt reply.

RADIOGRAPHS.

This radiograph shows the right elbow of an adult and the forearm held in the hand by another person. A tenaculum is shown beneath the head of the radius and a pin through the upper third of the forearm. The picture is reproduced here in evidence of rapid radiography, the time of exposure being 1½ minutes.

This radiograph of the foot and shoe of an adult was taken from the inner and planter aspect, the outer and dorsal surface resting upon the sensitized plate. The hooks and eyelets, steel spring, and nails in the heel are distinctly seen. The flesh became almost transparent under short exposure.

WHAT X-RAYS WILL DO.

A fond mother reported that with their aid a coin which her son had swallowed had been distinctly located in the sarcophagus. That is not quite a match for the society lady in New York who fell on the pavement in a sitting posture with such violence that she feared she had broken her sternum.

It is probably true that the life of President Garfield would have been saved if the Roentgen rays had been known in 1881. No difficulty now is found in locating a bullet distinctly in the deepest recesses of the body.—*St. Louis Globe-Democrat.*

The above is a radiograph of C. W. Dawson, aged 42, White Hall, Green county, Ill. Injured October 12, 1896.

Fell from spring wagon while shooting at a bird; horse shied, throwing him off his seat; fell between wagon bed and wheel; his head was caught between the spokes and twisted. Was paralyzed immediately for about one hour; paresis in limbs for some weeks longer. On inspection there is prominence of fifth to seventh cervical vertebræ, with lateral deviation. Head is thrown forward, gradually sinking more and more; no power to straighten up voluntarily; since, short time, muscles of left arm atrophied; fingers bent upon palmar aspect of hand.

It was necessary to go to press with the June number before Prof. Brokaw was able to get a post-surgical radiograph of the neck. The picture, when taken, will show the heavy silver wires bound about thes pinous processes of the fifth to seventh vertebræ, and the body of the fifth cervical vertebra tilted upwards from crushed body of the sixth.

Inquiry for clinical report was given as follows:

Heber Robarts, M. D.

Dear Doctor—The case of Dawson I am not quite ready to report in full, as I am too busy to write it up; besides, I must take a radiograph when he returns, showing the wire in situ. In this case I cut down upon the fracture, forced the neck in as nearly a proper position as possible, wired the spinous processes with heavy silver wire, closed the soft parts with silkworm gut, and placed a supporting bandage to hold head in fixed position. Dawson remained in St. John's Hospital three weeks; wound healed and he is wearing a supporting banadge; will wear a cervical collar to support parts for some time. I shall take a radiograph of his neck on his return to St. Louis in the near future (he is at present at home).

The result in this case was all that could be desired, and today Dawson is relieved of all pains in his upper extremities and the numbness and disagreeable tingling in his hands. Marked improvement in his "grip" is already manifest. Yours, A. V. L. BROKAW.

CLARIFICATION OF WATER BY ALUM.

By HENRY LEFFMANN, M. D., Bacteriologist City of Philadelphia.

The clarifying action of alum depends on its decomposition by the carbonates present in the water. Almost all natural waters contain some carbonate, either calcium, magnesium, or sodium carbonate. When these are brought in contact with alum a double decomposition occurs by which several ingredients are formed, among which is aluminum hydroxid. This forms a flocculent precipitate which has an attraction for many forms of organic matter, and thus a coagulum is formed which entangles the suspended substances, living and dead, and causes them to settle much more rapidly and completely than they would under ordinary conditions. This collecting of the suspended matter in larger masses also permits of rapid filtration, so that the addition of a small amount of alum is regularly resorted to in the so-called mechanical filters, the water being forced through at high speed by means of a pump.

The amount of alum needed is small; one grain to the gallon is usually sufficient. In the household use of alum for purifying water on a small scale the water should be drawn into a jar or tub, a solution of alum stirred in, and the water allowed to stand for a few hours. All the suspended matter will settle in the form of a slimy mass, and the clear water may be drawn off almost to the last drop. The appearance and the wholesomeness of turbid water are much improved by this method. There seems to be no reason to regard the employment of a small amount of alum (1 to 2 grains to the gallon) as injurious, but this amount should not be largely exceeded.

WATER-PURIFYING COAGULANT

Dr. Henry Leffmann, of Philadelphia, of chronic fame in water analysis and treatment, writing in *Public Health*, gives in part the chemical explanation so often made in this journal (by Professor P. T. Austen in the first instance) of the action of alum in precipitating and coagulating impurities dissolved in water, and commends its use for the clarifying of turbid drinking water. For that purpose it has been used, time out of mind, in the South; and with the small but sufficient quantity of a grain of alum to the gallon of water, as recommended by Professor Leffman, it has no injurious effects, for the simple reason that it *is not there*—that is, it is instantly broken up in combination with the impurities of the water, and falls to the bottom a new and neutral substance which any filter will arrest. Professor Leffman omits to mention what he probably knows, that not only carbonates, but all organic matters in solution (that is to say, nitrogenous matters), enter thus into combination with alum, and thus and only thus can be filtered out of drinking water, taking with them the microbes and other microscopical suspended matters present which no sand or stone strainer could otherwise arrest.—*Modern Medical Science*.

FOR the wave-length of the x-rays some observers obtained values about one-tenth that of the extreme violet, while another obtained a value greater than that of the extreme red.

PLATE 10. L. M. Q.

Double reflector tube, high frequency coil. Exposure, two minutes, 16 inches distant.

Radiograph of both forearms and wrist of a man 31 years of age. The palmar surface faced the sensitive plate. The left ulnar and radius fractured at the junction of the upper and middle third, and the carpal end of the radius fractured in one-half of its articular surface. The scaphoid and semi-lunar are also fractured. The wrist is almost completely ankylosed. The injuries are two years old and were caused by falling from a scaffolding 35 feet. The radius is bent in the shaft at the site of injury, the upper fragment leaning towards the ulnar side. The fragments being, however, in apposition, the union has kindly taken place without retained provisional callus, and the cancellated tissue can be seen throughout the entire shaft. The ulnar clearly shows vicious union, the cancellous tissue terminating openly at the end of each fragment, and a large provisional callus is thrown out and retained about the fracture. A fluoroscopic study of this injury at the time and immediately after the dressing would have occasioned a better result. The right arm and wrist are healthy; the two forearms are placed in contrast.

THE LOCATION, BY TRIANGULATION, OF FOREIGN BODIES IN THE HAND.

By N. Stone Scott, A. M., M. D., Cleveland, Ohio, Professor of Genito Urinary Disease, College of Physicians and Surgeons; Consulting Surgeon to the City Hospital; Consulting Surgeon to St. John's Hospital; Visiting Surgeon to the Cleveland General Hospital; in collaboration with Harold W. Brown, Electrician.

One of the earliest practical uses to which the x-rays were put was in the location of foreign bodies, and in this it marks a distinct advance in surgery for the year 1896. Any one who has hunted for a

needle which he supposed was in the palm of the hand, but which he could not feel, will be only too glad to be able to call to his assistance the use of the x-rays.

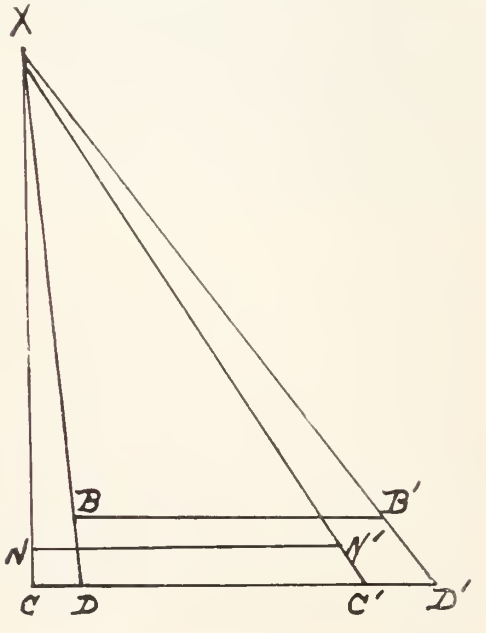
In locating a foreign body it is not enough to get a general idea of its position, but we desire its exact location, that we may decide on the best way to proceed to its removal. This is easily done in the arm or other nearly circular portion of the body by taking two observations—one from before backwards and one from side to side. With the hand the observation from before backward is easily and accurately made, but the one laterally is not so satisfactorily taken, owing to the great difference in the thickness of the part in these two directions.

For surgical purposes the position of the foreign body relative to the bones is the point of importance—whether the foreign body be imbedded in bone or in the soft parts. If it is nearer the dorsal side of the bone, the incision will be made from the dorsal surface; but if nearer the palmar

side of the bone, the incision will be made from the palmar surface, irrespective of the depth to which the incision must be carried. I have found that this relationship can be easily ascertained by taking two pictures on different parts of the same plate. One end of the plate is covered with a heavy sheet of lead, practically impervious to the x-rays, while the other end is being exposed to the x-rays through the hand. The first picture is taken with the tube directly over the hand, and the other picture on the other end of the sensitive plate without moving the tube or the plate.

In the accompanying picture the needle in the left-hand figure, which is the one taken with the tube directly over the hand, appears to be by the side of the metacarpal bone of the middle finger and almost parallel with it, whereas in the right-hand figure the needle seems to be at some distance to the left, and seems to diverge from the axis of the bone, thus showing, when the location of the tube with respect to the hand is borne in mind, that the needle is in the palm of the hand, and that the end of the needle toward the fingers is the more superficial.

If the distance from the needle in one to the needle in the other picture is less than the distance from the center of the bone in one to the center of the bone in the other, the needle is below the axis of the bone; but if the distance between the two pictures of the needle is greater than the distance between the two pictures of the bone, the needle is above the axis of the bone. That is, if the needle seems to move farther than the bone seems to move, it is above the axis of the bone; in the same way the end of the needle that moves farther is located nearer the upper surface. This can be shown geometrically as follows:



If X is the source of x-rays, B the axis of the bone in the first position and B^1 in the second, N and N^1 the needle in the two positions, C and C^1 the pictures of the needle on the sensitive plate CD C^1D^1, and D and D^1 the pictures of the axis of the bone (practically the center of the picture of the bone in each case), then we know by similar triangles that

$$\frac{XC}{CC^1} = \frac{XN}{NN^1} \text{ and } \frac{XD}{DD^1} = \frac{XB}{BB^1}$$

But if the Crookes tube is some distance away, XD is practically equal to XC, and $BB^1 = NN^1$, since each is the actual distance the hand is moved. Making substitutions,

$$\frac{XC}{CC^1} = \frac{XN}{NN^1} \text{ and } \frac{XC}{DD^1} = \frac{XB}{NN^1}$$

Dividing the first equation by the second,

$$\frac{DD^1}{CC^1} = \frac{XN}{XB} \text{ or } \frac{DD^1 - CC^1}{CC^1} = \frac{XN - XB}{XB}$$

or, changing the form slightly,

$$XN - XB = (DD^1 - CC^1)\frac{XB}{CC^1}$$

That is, the distance that the needle is above or below the axis of the bone equals the distance that the needle has apparently moved from the axis of the bone, multiplied by the distance of the axis of the bone from the source of x-rays, divided by the distance between the two pictures of the needle.

In the case here shown the source of x-rays was ten inches away, the distance between the pictures of the needle four and three-fourths inches, and the apparent distance that the outer extremity of the needle moved away from the bone one-fourth of an inch, so that that end of the needle was $\frac{\frac{1}{4} \times 10}{4\frac{3}{4}}$ inches, or a trifle over half an inch. The other end was much nearer the axis.

Among the recent discoveries made by means of the Roentgen rays, reported from Berlin, are several relating to diseases of the heart. It has been observed in cases of asthma that the right half of the diaphragm stops work during the attack, and the left half is compelled to bear all the exertion.—*Sun.*

THE GODS AND TELEPATHY.

By J. J. Fly, M. D.

Creeds and dogmas have long ruled the world; the pendulum has sometimes swung to the purely ideal, and at other times to gross materialism.

Disease was considered by the savage man as a curse inflicted by the wrath of God, or evil spirits, and no attempt was made to effect a cure by material remedies, but every effort in this direction was turned into appeasing the vengeful deities. Hence medicine in the earliest times fell into the hands of priests, the most artful of the tribe, exorcising, beseeching, and praying away the offending genii.

Æsculapius was the first physician, who lived before Homer, and the date of his birth is lost in the dust of mythology. He was said to have been the son of Apollo, and was educated by Chiron, the fabled centaur. His skill was so great that he even raised the dead, and on one occasion, when he had raised Hippolytus, the son of Theseus, King of Athens, Jupiter became so offended that he slew him with a thunderbolt.

According to Cicero there were three deities of this name—one the son of Apollo, who invented the probe and bandage for wounds; one a brother of Mercury, who was killed by lightning; and a third, son of Arsippus and Arsinoë, was the first to teach both drawing and purging. There were many statues erected to Æsculapius, and they were adorned in a rich profusion of gold, ivory, and laurel. About five miles from the city of Epidaurus stood the famous temple of Æsculapius, in a beautiful valley in the heart of the mountains, and in its neighborhood were buildings for the accommodation and recreation of the patients who flocked thither in quest of health, so that it was practically a prototype of our modern watering places. To this temple there belonged a number of priests, who had some skill in medicine, and subjected their patients to a treatment closely resembling magnetism or mesmerism.—[Brit. Encyclopedia, vol. VIII.]

In 292 B. C. the Roman Senate sent a solemn embassy to Epidaurus, to implore the aid of Æsculapius in mitigating the terrible pestilence that was then raging in Rome. A similar institution now exists in Lourdes, at the mouth of the valley Argeles, France. Here it is reported that the Virgin Mary had appeared to a peasant girl repeatedly in 1858. Upon the spot where the Virgin appeared a large church has been built, and a multitude of pilgrims resort to this place every year from all quarters of the globe, to bathe in the healing fountain, and carry away rosaries and other charms that chase away their ills.

The shrine of Our Lady in Gaudalupe, is to Mexico what Our Lady of Lourdes is to France. It was founded on the same pretext that gave rise to the latter, only the Madonna appeared on this occasion several times to an Indian Catholic.

The priest was finally convinced of the truth of the Indian's story by her image being impressed upon his cloak, and by the desert place in which the apparition appeared having suddenly bloomed with flowers.

Since the year 1661 there have been many wonderful cures in order by visiting the shrine of Ste. Anna Beaupre, near Quebec, Canada. In 1670 a notable fragment of a finger bone of Saint Anna herself was found and conveyed to the church, and has not ceased to be the object of fervent devotion, and marvelous efficacy in the cure of disease results from a dip in the waters of a spring situated a few steps behind the old chapel.

We have a parallel of these in the house of mercy, Bethesda, a pool at the sheep gate of Jerusalem, built round with porches for the accommodation of the sick who sought benefit from the healing virtues of the waters.

We might go on and fill a volume with this kind of history of disease and its cure, but the above will suffice our purpose in quoting it; that is, it is seen that from the earliest dawn of history to the Indian medicine man of today—all along the line of the world's history—there has been a degree of mysticism interwoven in the phenomena of disease and relief therefrom.

The question now arises with the modern physician. Was there, or has there been, any basic element of truth in the claims that are and have been made by these idealists? I am aware that, owing to the latter day training of the medical profession, it has drifted out on the currents of materialism with the rest of the scientific world, and has determined that what can not be demonstrated by the scalpel, microscope, the alembic, or crucible remains disproved.

But we must remember that many of the most important discoveries have been accidental; that many of the most useful remedies were long domiciled around the domestic hearthstone, and were used by our grandmothers and the laity long before they were taken up by the profession.

The true physician never becomes too much learned to ignore the smallest ray of light that is struggling to cast a reflection upon the acquirements of his profession.

We denominate medicine and its therapeutic application to disease as a science, but every physician feels that the environments that make it so are very indefinite, and that in most instances its lines of demarkation fade out into speculations and astral compounds that casts a blur on its escutcheon.

The reason is obvious. Life is at the base of his study, and until he knows what life is, and how it operates upon matter, he never can resolve the study of disease and its cure into an unimpeachable and substantial fact.

Life has many phases, and, as disease is only a mode of life, we may expect disease to assume as many variations as this life is susceptible to changes. The tendencies of life within the body are toward a state of universal harmony and well-being, and it accords with the universal laws of nature. The trend of its action is to antagonize error, to remove all inharmonic elements to its well-being, and *this* is what is called the *vis medicatrix naturæ*, or the instinctive healing power in an animal or vegetable, by virtue of which it can repair injuries inflicted upon it, or remove disease. This act accords with the function of the mental and metabolic forces that brought it into existence, and sustains its individuality as a mundane being. In the constitution of man there appears to be two departments of life—one subconscious and the other conscious. The subconscious plies its powers upon the care and support of the various organs of the body, and in the cerebrum resolves its kinetic energy into a new and outer phase, which we call conscious sensation. There is a world of mystery in the subconscious domain of organic life, and who will say that intelligence is not just as prominent a factor here as in the conscious and sensational life? We believe it is, and, further, that there is a potentiality existing here that the conscious life of man has but vaguely understood from time immemorial. Conscious life is but an extenuation of the subconscious, which becomes only an attribute whose function is to bring the ego into relation with the external world. We know of our own existence, and all that we do know through sensation; yet we will never be able to know why we are conscious, why we are intelligent, or why a conservation of energy or a correlation of forces become transformed into a sensation. We only know, or think we know, that it is through the explosion of these forces that are embraced in our being that a state of conscious sensation is culminated.

Who is it that can fathom a duam? Duam life is inordinary to waking life; the imaginary here becomes a reality; forgotten scenes and incidents are again brought up into the realms of conscious knowing; and new scenes, new companions and adventures are made real, and we may rejoice or be sorrowful over the phantasmagora that here appears. But stop, let us inquire: Are the scenes of dream life only phantasms? Are they hallucinations? What are phantasms and hallucinations?

A friend has passed away to the great beyond—perhaps a husband, wife, or a brother; he was near to us; we dream of seeing him; or, while pursuing our daily avocations, we hear him speak to us—pronounce our name; or, while we are walking along thinking of him, he suddenly appears in real form before us; he is so natural, and appears so real, that we forget at the moment he is dead, and do not feel surprised until we can pull ourselves together by reflection. Is this only imagination? Please explain imagination?

Again, I am sitting at my table reading; my mind is absorbed working out some intricate problem. I am aroused by a call; a familiar voice sounds upon my ear. I recognize it and go to inquire, but I find no one present. I am sure I heard a voice and named the man—well, it is funny! But hold on—one-half hour has elapsed, and I again hear the voice—same call, same voice—and now we have the real person waiting at the gate, sitting on his winded horse. Will you please explain these? I know such experiences are not uncommon, and I further know that a man must not necessarily be insane to have such experiences.

Let me tell you, the subconscious nature of man is an intelligent entity; it is the real ego of man, and is the tablet upon which is written the whole history of his life; it can and does commune with the purely spiritual, and regards not time nor space. I am sitting pondering over a case of typhoid fever—a near friend is struggling in the dilemma—now I see his daughter, who has been bending over him for weeks anxiously tending him. Suddenly she appears before me, her face covered with smiles, and holding in her hand an omen of good luck. This may seem strange, and not worth mentioning; but what does it mean?

On another occasion I am attending a child—a pet of the family; she is very ill, the family is extremely anxious. I am thinking about the little fellow and suddenly the home of the little fellow appears before me, draped in mourning. I have had numerous experiences like this; they sometimes come when I am not thinking of the subject that appears; at other times they appear when I am thinking about them, sometimes when I am riding along, and at other times when I am lying down. They used to surprise me very much, but are common-place with me now.

I come home tired, throw myself down on a sofa to rest, and I see a friend who is some ten miles away. I note what he is doing, and the next day or two when I meet him I describe where he was and what he was doing at the time mentioned. He looks at me in surprise and asks, "How did you find it out?"

Verily, is there a communion between souls that the consciousness sometimes overhears? Do souls communicate with each other at times when the consciousness does not recognize?

Let this be as it may—we are satisfied that the oracles of Jupiter at Dodana, of Æsculapius at Epidaurus, of Apollo at Delphi, and the hundred other shrines established since these, were founded on suggestions arising from the subjective sensations coming through man's subconscious nature. It is through the energies, of this prime source of our being, that the life of the body is maintained, not only in the natural metabolic resources, but it is through its energies that the wrongs coming up in the process of life, which we call disease, are removed, and under certain conditions it can thus be on the impulse of a moment.

I was called to see a case, sciatic rheumatism. He had been confined to his bed for five months, and his suffering was almost unbearable. He had worn out the hypnotic effects of morphine, chloral, etc. The purpose of my visit was to try the effect of hypnotism upon him; the idea was novel to me, but he desired it and I concluded to try. As I approached him I smiled, but he said, "I believe in it. I had rather be dead than to suffer like I do. I am willing to submit to anything from which there is a shadow of hope."

I took him by the hand and made a few passes from his shoulder down to the hand I held. After a half minute I asked him if he felt any peculiar sensation in his arm. He replied that he did; that it felt numb and tingled. I then told him to close his eyes, then made a pass or two over his face and said, "Now you can not open your eyes—they are fast shut," and to his own surprise and also to his wife's he could not. I then snapped my fingers and said, "Now you can." They flew open with a jerk, and we both laughed. I then placed his hands and arms in different positions, and they remained immovable at my commands. I then made a few passes over his body from head to foot, and said to him very positively, "Now, sir, you are not sick; you have no pains now, neither will you have them any more. Your disease is gone, and you will soon be around attending to your business." I spoke without any doubt in my mind and sent the suggestion home to his subconscious life. It received it and acted on it, and the second day he walked into the dining room for his meal, which he had not done for five months.

He never suffered any pains that he cared for after this, and made a speedy recovery. I only repeated the operation one other time, and I do not think this was necessary. He took no more medicine.

Was this cure the effect of suggestion alone, or was there a magnetic emanation associated with it? If animals can influence animals without verbal suggestion; if a man grows restless under your gaze and concentration of thoughts when his back is turned toward you, and is impelled to turn and look at you when you know he did not know that you were there before, we must conclude that man has some method of influencing man outside of conscious acts or words.

I must now close this article, which has been extended to a greater length than I intended. I will do so by making the suggestion that every mind has a battery, which, when brought into use, can send an x-ray that annihilates distance and can penetrate all solids, and brings friends face to face that reside on different continents.

PHYSICIANS are said to average only $1,500 per year in New York, and the reason may be found in these statistics: There are 114 dispensaries and 26 hospitals in New York County. In the 26 hospitals, in the year 1895, 75,368 patients were treated free, and in the dispensaries 661,803, making a total of 737,171. This is a goodly proportion out of 1,851,000 population—nearly 40 per cent. There have been 92,529 free visits of patients to hospitals, and 1,387,170 free visits of patients to dispensaries. In attendance upon the 114 dispensaries in 1895 were 949 medical men, which is 27 per cent of all the physicians in the city, who number 3,430. Here we have more than 1,500,000 free visits and more than 1,000,000 free prescriptions, and more than one-quarter of all the physicians in the city of New York engaged in treating the population free of charge.—*The Engineer.*

THE belief that lightning will not strike a feather bed was shown to be mistaken by an incident of the electric storm of Saturday. A bolt struck a chimney on the house of Charles Steates, who lives on the Deerfield road. Part of it jumped to the house of Bernard Huss and tore off the conductor pipe. The other part went down the chimney, ripped the plaster and paper from a bedroom, and then struck a feather bed. The bed was torn and the feathers scattered about the room.—*Utica (N. Y.) Herald.*

TOPIC ANTISEPTICS.

By Robert Peter, M. D., Toledo, O.

It is desirable to conserve impaired tissue as much as possible. The harm once done can not be undone. Structure entirely destroyed must be replaced in one way or another. Such as has not been totally sacrificed can be restored; such as has been only crippled in integrity will, under favorable conditions, reassert itself by the *vis medi-catrix naturae*. When the environments are unfavorable, and nothing occurs to render them favorable, crippled tissue can often not reassert itself by its resisting power, and then it is doomed to succumb to the inevitable. As soon as tissue is impaired it becomes a *locus minoris resistentiæ*. It is open to invasion, since it has become most reliable to infection, and the natural enemy to tissue will usually find it out. It is by their means that tissue generally goes to disintegration. Like the magnet draws the steel, so impaired tissue attracts the ubiquitous germ.

Topic antiseptics might be defined as a process which tends to convert a condition of local sepsis into one asepsis. Such a meaning of the phrase would be truly ideal and positive, but, unfortunately, it is not always to be obtained. Always trying to do the most that we can conducive to this end, we must be satisfied with what we may achieve. It depends in no small degree upon the defensive power of the tissue itself what the tissue of any one instance will be. It is true, however, that local antisepsis, well directed, does accomplish much.

While cleanliness is the most powerful therapeutic agent of the present day, it takes all the most scrupulous foresight and all the wits that we possess to safely carry it out. The mere unwitting routine of its fulfillment lures one into danger which must know no excuse. In its execution we must positively know that we are wide awake to its full requirements. A boon must not be made into a bane.

The tendency of modern times on the treatment of tissue has been to allow the healing process to go on with as little disturbance as possible. When we make an aseptic wound, or should we be so fortunate as to make a wound aseptic, we endeavor to keep it in this condition. We employ all the means and precautions possible as safeguards to accomplish this one end. The process, uncontaminated, is physiological, and the rebuilding of tissue is prompt and enduring. It is therefore desirable to place impaired tissue into such ideal envelopment that will insure all this, if possible.

It is stupid to suppose that a thing can be so germ-proof that, unless impaired tissue is primarily aseptic and maintained in this condition, it will otherwise so remain. Dressings must be watched. In this way only can we ascertain whether they are being surcharged with secretion which may be more abundant than can be readily neutralized by surrounding influences, which, of course, points to removal. In the enthusiasm of good intentions all possible aids have been brought into account in trying to attain security and uphold it. Tissues have been doped both differently and indifferently in the vain hope of creating an all-pervading influence of tissue sterilization, and thus a great deal of harm has frequently been done. Tissue still intact was then rendered of minor resistance. The means employed were well meant, but too destructive. Tissue was thereby simply overwhelmed, and what was already bad enough was made still worse. It is such influences that we must avoid if we desire to be truly kind and conservative.

It is not only not objectionable, but it often becomes advisable and even imperative, that some medicament be locally applied to impaired tissue in powder form or otherwise. This is indicated in various, manifold conditions. For this purpose iodoform has been extensively used in the past, and is very good in all but its "loud" odor, on which latter account many surgeons prefer to employ campho-phénique powder—an iverb powder the medicament of which consists of campho-phénique. The latter is a compound of 495 parts of pure camphor and 505 parts of crystalized carbolic acid in chemical combination (not a mere mechanical mixture, which it is needless to say would produce a violently escharotic liquid). This campho-phénique powder is non-irritant (in fact, producing a decided anesthesia of the skin), non-toxic, and powerfully antiseptic. It does not dry off rapidly, and it readily adheres to the integument, forming an excellent special dressing, and meeting all the requirements of topic antisepsis.

CATAPHORESIS.

By H. C. Sample, M.D., Chicago, Ill., in the *Medical Brief.*

Cataphoresis is a term used to indicate electric osmosis. The word cataphoresis is derived from two Greek words—*kata* (down) and *popecin* (to carry), and means the carrying of a medicament into the tissues by the aid of electricity.

Chemical bodies are classified in this science as either electro-positive or electro-negative. The alkalies are electro-positive and the acids are electro-negative elements.

The benefits derived from this science to the practitioner are manifold. It reduces the volume of dosage. It is put at the seat of ailment. It prevents injury to the digestive tract. It prevents the druggist from stealing your thunder, and it helps to reduce the vacuum in your pocket-book.

These I think should be sufficient inducements for the practitioner to give this branch of electro-therapeutics a hearing.

In the cataphoric process some medicines are carried more rapidly than others. The alkaloids more rapidly than the acids, some alkalies more rapidly than others, and some acids more quickly than others.

I will give a few of the many elements that are electro-positive and electro-negative.

Electro-positive solutions: Hydrogen, potassium, sodium, silver, copper, tin, nickel, zinc, lead, magnesium, calcium, ichthyol, ammonium, gelsemium, jaborandi, iodoform, cocaine.

Electro-negative solutions: Oxygen, chlorine, bromine, nitrogen, sulphur, fluorine, phosphorus, carbon, iodine.

This shows that there is a law of polarity that must be observed in cataphoresis, also a chemical law that must not be forgotten, and that is: In cocaine we have the chemical formula of $C_{17}H_{21_2}NO_4Hc_1$: when used upon the positive pole the acid part of the chemical will remain at the anelectrotonic zone, and the base, cocaine, will be driven into the tissues.

Chloroform having the chemical symbols of CH, CL_3 and which may be considered as being the chloride of the trivalent radical formyl, would theoretically be used upon the positive pole, but some electro-therapeutists claim it is electro-negative. This claim, no doubt, is due to its quick absorbent properties, but it is electro-positive and so is ether.

Lithium solutions generally are electro-positive, but benzoate of lithium is electro-negative. In this case the benzoic acid and lithium are in such close union that if it be placed at the positive pole will remain in that vicinity with the acid, and can only be carried into the tissues at the negative pole.

Iodine has a strong affinity with the ingredients that are usually united with it, carries them with it in the cataphoric process.

When we are satisfied that we have a neutral agent and are desirous of its action, it is best applied by putting equal amounts on both poles and in close proximity to each other.

In skin affections, such as eczema, erysipelas, or any disease of a parasitic nature, cataphoresis surpasses any other method, using one one-thousandth of bichloride. In uric acid deposits, piperazin or propylamin, which are electro-positive elements, will give gratifying results.

For a lateral curved spine use ichthyol on the convex side of spine. Anchylosis or gleet, use ichthyol. For pain use gelsemium; edema, use jaborandi.

The dosage depends upon the conditions presented, and while we put very little of the drug into the body, not more than about one-third of the amount used during a ten minutes' seance, yet it is put where it is needed and very little of it is necessary.

The volume of current used in cataphoresis varies from ten to twenty milliamperes. After a ten minutes' seance, or if forty milliamperes be used, the acids of the body accumulate at the anelectrotonic zone to such an extent that the medicine is partially destroyed, and a similar effect occurs at the negative pole; therefore a mild current, and of not more than ten minutes' duration, should be used.

THE X-RAYS IN THE DETECTION OF RENAL AND VESICAL CALCULI.

A. P. Laurie and John T. Leon, of London, in the *Lancet*, January 16, 1897, report a series of experiments in museum specimens with a view to determining how far different calculi were opaque to the x-rays, and comparing their opacity with flesh and bone. The result showed conclusively that calculi composed of oxalate and phosphate of lime were more opaque than bone, uric acid calculi of almost the same opacity, and gall-stones slightly more opaque than flesh. Mr. Henry Morris confirms these results, which seem to show that there should be no difficulty in photographing stones in the bladder or kidney. After some inconclusive experiments on living subjects, they inserted a uric-acid calculus of about five-eighths inch in diameter into the kidney of the cadaver of a man about 50 years of age. This was done with as little disturbance to surrounding parts as possible. To photograph the stone he used a "focus" tube and an induction coil giving a 6-inch spark, with four storage cells connected to the primary circuit, and took the photograph on a "Lightning Cadett" plate. After an exposure of thirteen minutes, with the body lying on its back, the plate was removed. On development it showed a faint, but distinct, image of the stone, though the spine was only very faintly indicated.

The next experiment on a living subject gave a negative result, which was subsequently confirmed by operation.

The next case was that of a boy aged 8 years, who had symptoms of vesical calculus. On this occasion the same induction coil and the same number of cells and an *xxxx* Fayet plate were used, the exposure to the rays being seven minutes. The untouched negative showed the calculus was a little over an inch in diameter. A few days later lithotrity was performed, a No. 9 lithotrite being used, and the detritus weighing 98 grains. It was composed principally of uric acid, and was oval in shape.

Another case was that of a boy aged about 15 years, in whom a skiagraph showed the presence of calculus in his bladder quite distinctly.—*American Medico-Surgical Bulletin.*

An English lady in making a cake lost her diamond ring in the dough, but did not discover the loss until the baking was complete. Rather than sacrifice her production, or run the risk of having a guest swallow the ring, she sent the cake to an x-ray studio. The ring being located by the shadowgraph without spoiling the form of the cake, extraction was readily accomplished.

The x-rays have shown that the tibia and femur in Justice Stephen J. Field's knee have almost grown together, and that the hinge has partially solidified.—*St. Louis Post-Dispatch.*

CONDENSED X-RAY INFORMATION.

X-Rays. Villari. *L'Eclairage Electrician*, April 10.—An abstract of a paper from the Italian discussing the action of an ozonizer on gases subjected to the action of x-rays or the electric spark and on the gases of combustion.

Action of X-Rays on the Heart. Seguy and Quenisset. *L'Eclairage Electrician*, May 1.—An abstract of an Academy note in which they show that when a person is subjected to the action of x-rays for a very long time peculiar heart troubles are produced, manifested by unendurable palpitations and very violent and irregular beats.

Vertical Earth Air-Currents. Bauer. London *Electrician*, May 7; abstracted briefly from *Terrestrial Magnetism*, March.—After discussing the work of others in this direction, he makes deductions from Schmidt's computations eliminating some errors, and then finds that there appear to be such currents; between 40° and 50° N., for instance, they amount to an average of 0.091 ampere per sq. kilometer; a general resemblance is traced between them and the electrical currents resulting from the rotation of a magnetized sphere in a conducting liquid.

Therapeutics of the X-Rays. *Electrical Review*, April 28; reprinted from the London *Lancet*.—A brief mention of an experiment by Vortet, in which guinea pigs were inoculated with tubercle; those treated for one hour a day during 25 days did not show the illness which those not treated did. Bausset treated a long-standing case of pulmonary and abdominal tuberculosis; the action of x-rays was followed by apparent benefit not otherwise accounted for.

Do Roentgen Rays Make Air a Conductor? Minchin. London *Electrician*, April 9.—He holds that they do not; he refers to a previous communication in that journal about a year ago, in which some experiments were described, and in which he gave a table of the metals according to the sign and the magnitude of the charge conferred by the Roentgen rays, the table agreeing closely with the ordinary table of the E. M. F. series of metals immersed in a liquid. According to J. J. Thompson's theory the air which is traversed by Roentgen rays becomes a conductor, and it was at first thought that this was correct, but he has since questioned it and conducted a series of experiments, which are described, and which gave a negative result. The paper is discussed editorially in the same issue.

New Use for X-Rays. Heycock. London *Electrician*, April 9; reprinted in *Electricity*, N. Y., April 21.—A brief abstract of a Royal Institution lecture on metallic alloys and the theory of solution. When a salt, such as potassium permanganate, is dissolved in water and the mixture slowly frozen, the salts separate themselves from the ice and form a core in the center; it has always been very doubtful whether the metals composing alloys form a homogeneous mixture or exist in distinct particles capable of being separated from each other; to test this he made an alloy of sodium and gold and allowed it to cool very slowly, after which a very thin section was cut and photographed by means of Roentgen rays, which showed that the sodium had crystallized out from the general mass; this he believes opens up a wide field of research in microscopic photography; it is suggested that x-rays might be used in a similar way to study the true nature of various brands of steel and iron—that is, mixtures of iron and carbon.—*The Electrical World.*

The electric railway companies are now using x-rays to detect fraudulent claims for personal injuries. A man asked a Baltimore company $3,500 damages for the alleged breaking of his arm. He was offered $100 as a compromise, but refused it. His arm was then subjected to the x-rays and found not broken. He had it heavily bandaged, but the deception failed.

WHAT IS THOUGHT OF THE AMERICAN X-RAY JOURNAL.

Central Christian Advocate, St. Louis.—I have been much interested in your journal.—J. B. Young, Editor.

New York.—Your favor of May 17th has been duly received. I welcome your publication, and will be obliged if you will forward me all the numbers that have so far appeared, as well as those which will follow. I inclose a check for subscription for the following year.—N. Tesla.

New York.—Your most excellent journal meets a long-felt want, and I am only too glad to subscribe. I am very busy with my text book on operative surgery, but I hope I will find time to send you a short article and a few illustrations.—Carl Beck, M. D., Professor of Surgery of the New York School of Clinical Medicine, etc.

War Department, Surgeon General's Office, Washington, D. C.—Please send one copy of the American X-Ray Journal, commencing with No. 1, to the Library of the Surgeon General's Office, U. S. Army, Washington, D. C. Bill will be paid on presentation.—Library Surgeon General's Office.

The latest journal to come to our desk is the American X-Ray Journal, a monthly devoted to the practical application of the new science and to the physical improvement of man, and in its salutatory says no apology is considered necessary for undertaking the publication.—*North Carolina Medical Journal.*

We are in receipt of No. 1, Vol. I, of the American X-Ray Journal, published by Heber Robarts, M. D., at St. Louis. It is not a very big book, but it shows care in its get-up, both mechanical and literary. It is the only magazine of its kind in this country. We hope the Doctor will achieve success with his publication.—*Waterloo Times.*

Dr. Heber Robarts, of this city, is the editor of the American X-Ray Journal, the initial number of which appeared last month, and which is devoted to the practical application of this new science. It is somewhat remarkable that St. Louis should enjoy the credit of having the very first magazine of this kind in the world.—*Central Christian Advocate.*

No. 1, Vol. I, of the American X-Ray Journal has just reached our table, and is a bright, spicy journal, illustrated, and edited by Dr. Heber Robarts, St. Louis, Mo., issued monthly, price $1 per year. There is undoubtedly an opening for a journal of this kind, and we gladly place it on our exchange list, and hope it will prosper.—*Oklahoma Medical Journal.*

Smithsonian Institution, Washington, D. C.—I take great pleasure in acknowledging the receipt of No. 1, Vol. I, of the American X-Ray Journal. The secretary authorizes me to say that he is desirous of obtaining this journal for the library of the Smithsonian Institution, and will be glad to send regularly in exchange the Smithsonian Annual Report.—Cyrus Adler, Librarian.

Compania de Luz Electrica y Fuerza Motriz de Monterrey, Sociedad Anonima, Monterrey, N. L.—Acknowledging your favor of the 6th inst., we beg to advise that the journal and the book have been duly received, and are greatly appreciated.—Campania de Luz Electrica y Fuerza Motriz de Monterrey, Sociedad Anonima, el Administrador de Planta. E. Dysterud.

Minneapolis, Minn.—Your very successful American X-Ray Jounral arrived Saturday. I congratulate you on the appearance and text of the paper. I believe it will fill a hitherto vacant place in the way of medical journals. X-rays are on the boom up our way. I have been invited to read papers before the State Medical and Minnesota Valley Societies.—A. A. Law, M. D., Surgeon Northern Pacific Railway.

The American X-Ray Journal has just made its appearance. It is a monthly, devoted to the practical application of the new science and to the physical improvement of man. The initial number contains twenty-six and a half pages of text and a number of engravings. Dr. Heber Robarts is the editor, and he has given us a very presentable initial number.—*St. Louis Medical and Surgical Journal.*

Phenique Chemical Co., St. Louis.—Replying to your favor of the 27th inst., will say that our advertisement in the American X-Ray Journal has brought us splendid returns—in other words, "the best of results." The character of your journal is scientific and scholarly, and we feel sure under your management it will prove a grand success.—Phenique Chemical Co., per Jno. Crouch, Manager.

The Corpuscle, Journal of Rush Medical College, Chicago.—It is needless to inform you that the special field occupied by your journal is one cultivated by the leading surgeons and practitioners of this city and the northwest. Rush College is especially interested in the development of the x-ray, and her graduates to the number of 4,000 are scattered throughout the northwest.—H. G. Cutler, Publisher.

No. 1, Vol. I, of the American X-Ray Journal, edited by Heber Robarts, M. D., St. Louis, has reached our sanctum, and promises to be a monthly devoted to the practical application of the new science and to the physical improvement of man. We are always glad to extend the right hand of fellowship to any enterprise that looks to the betterment of mankind, and at the same time give them a bottle of the milk of human kindness with our left.—*Columbus Medical Journal.*

City High School, I. N. Keyser, Principal. Central Ohio Scientific Society, I. N. Keyser, Corresponding Secretary, Urbana, O.—I am in receipt of your American X-Ray Journal, and am much pleased with your venture. My own experience in the Roentgen experiments has been most gratifying and instructive, viewed at least from a purely scientific standpoint, but through a disastrous fire in our laboratories I lost everything but my coil, which I now offer for sale.—I. N. Keyser.

The National College of Electro-Therapeutics, Indianapolis, Ind.—Allow me to offer congratulations upon the admirable American X-Ray Journal I have just received. It will be of the greatest interest and value to physicians and electricians, and I predict for the journal a warm reception from all progressive practitioners. I would be pleased to exchange journals with you if you care to receive the *Electro-Therapeutist*. The latter will soon be enlarged and improved.—Wm. F. Howe, M.D., President.

The American X-Ray Journal, a monthly devoted to the practical application of the new science and to the physical improvement of man, Heber Robarts, M. D., editor, St. Louis, Mo. The first number of this journal has just made its appearance, and if succeeding numbers are as good as the first one, as no doubt they will be,every physician and electrician interested in Roentgen photography should take this journal. The first issue is a credit to the editor and publishers.—*Electro-Therapeutist.*

About one year ago Roentgen made known to the world his discovery of the x-ray. Development has followed rapidly. The most skeptical of one year ago today admit of its varied uses in medicine. The profession are eagerly seeking to learn, not only of the uses of the x-ray to surgery, but of the therapeutic uses as well, and to meet this demand comes the American X-Ray Journal of St. Louis. This journal will fill a real want, if not a "long-felt" one. Turn on the x-ray, Brother Robarts, and the profession will look to you for light.—*Southwestern Medical Record*, Houston, Tex.

Spokane, Washington.—I have just returned from the northern country after a long trip, and find your letter, together with the first copy of your paper, the American X-Ray Journal, which I wish to compliment you upon. This surely should be a journal largely subscribed for by the profession, as it is almost invaluable to a first-class practitioner. The copy you gave me I presented to Dr. H. B. Luhn, one of the leading practitioners here. A policeman was shot in the jaw a short time ago, and Drs. Luhn and Russell have been treating him. The bullet could not be located, and, the doctors disagreeing as to what part of the head it was, the man was x-rayed yesterday.—Chas. S. Warren.

We acknowledge receipt of the American X-Ray Journal, a monthly devoted to the practical application of the new science, by Heber Robarts, editor, St. Louis. No. 1, Vol. I, is a beauty, illustrated and up to date. We welcome this addition to x-ray literature. The editor says: "It is the design of this journal to give the readers and thinkers a faithful resume of all x-ray work done in any portion of the globe. The editor's personal experience with the x-rays for practical purposes, together with seventeen years of medical and surgical experience, renders the task of imparting x-ray information more appropriate for those who read and think."—*Daily Capital Journal*, Salem, Oregon.

There has just appeared No. 1, Vol. I, of the American X-Ray Journal, a monthly devoted to the practical application of the new science and to the physical improvement of man. This is a very neatly gotten up pamphlet, edited and published by Heber Robarts, M. D., St. Louis. The subscription rate for the United States, Canada and Mexico is $1 per year in advance. The first number very appropriately gives a most excellent portrait of Dr. William Konrad Roentgen, together with a number of x-ray shadow pictures of interesting subjects. The new journal, doubtless the only one in the world devoted exclusively to the Roentgen phenomena, will deal largely with the medical uses of this new radiation, and therefore may be expected to cater rather to the medical practitioner than to the electrician. However, it will be of interest to every one engaged in this absorbing subject, and we bespeak for it a prosperous future, and extend to it a hearty welcome into the realm of electro-technical journalism.—*Electricity*, New York.

St. Louis is maintaining her reputation for progressiveness in medical journalism as well as in other enterprises. Her geographical position, the cosmopolitan character of her people, and her unexampled achievements in the arts and sciences entitle her to be crowned as the queen metropolis of the Mississippi Valley. The seed of enterprise could not be planted in a more fertile soil than is here to be found. The uniform success of established industries encourages efforts in the creation of new ones, while the widening field invites and fosters friendly competition. The latest product of this progressive tendency is a new medical journal, just published, entitled the AMERICAN X-RAY JOURNAL, edited by Heber Robarts, M.D. It is restricted to a branch of science which is increasing in usefulness every day, and offers a large field for further investigation. The first number presents a neat appearance, and contains a variety of instructive and interesting reading matter. There is every indication that it will be a success. We extend to the editor our best wishes for a bright future in the new field he has chosen.—*St. Louis Medical Era.*

THE AMERICAN X-RAY JOURNAL, No. 1, Vol. I, May, 1897, Dr. Heber Robarts, editor, monthly, St. Louis. $1 a year, is devoted to the "practical application of the new science and to the physical improvement of man." The title page is attractive, the electric goddess with x-ray apparatus penetrating the globe. There are the usual familiar cuts, the mummified hand, plate of Dr. Roentgen, hen and eggs, book reviews; "Roentgen Rays," by Prof. Thompson, $1.50; "The X-Ray, or Photography of the Invisible," by Dr. Wm. J. Morton, of New York, 75c., the best brief book for the physician; and the advertisements of electrical apparatus. Dr. Joseph Marsee, the dean of the Medical College of Indiana and professor of surgery, has a complete x-ray outfit, which he exhibited at the annual reception given by the Medical College of Indiana to the county and city health board officers at their meeting in Indianapolis Tuesday evening, May 10th. There is no doubt a field for such a journal devoted to electricity as used in medicine and science, and this journal, if kept up to a scientific standard, will doubtless meet the need.—*Indiana Medical Journal*, Indianapolis.

THE name of Heber Robarts, M.D., is familiar to our people. Dr. Robarts, who has taken one of the most advanced positions in the field of science, for some time practiced medicine in our city, winning the esteem and confidence of all with whom he came in contact, not only by his graceful, courteous manner, but by his high standing as a physician as well. He removed to St. Louis about two years ago, where some six months ago he electrified the scientific world by his discoveries in the appliance of the x-rays for diseases of the eye. He even went so far as to make practical demonstrations of the fact that with the proper use of this invention of Professor Roentgen the blind could be made to see. In order that his discoveries might be sent broadcast to the world, so that all mankind might benefit by the same, Dr. Robarts has established the AMERICAN X-RAY JOURNAL, a monthly publication devoted to practical x-ray work and allied arts and sciences. A copy of the first number of this journal has been sent to this office, the receipt of which we gratefully acknowledge. The work is overflowing with valuable treatises on the application of the x-ray for different diseases and for certain purposes. It is of invaluable worth to all men of a nature scientific, or those who desire to keep abreast of the times. To such as these the journal should decorate their libraries.—*East St. Louis Daily Journal.*

ROENTGEN RAYS AND THE SOFT TISSUES.

Messrs. Remy and Contremoulin, says the *Literary Digest*, has presented to the Academy of Sciences a new result of their researches on the application of the x-rays to anatomical study. With the aid of chemical preparations they have put the muscles, ligaments, and tendons of dead bodies, both of men and frogs, in such condition that they have given radiographic images. The muscle appears of a somber shade that reveals its full outline, but within the boundaries thus indicated are perceived still darker portions that correspond to muscular bundles. The muscle is masked by bundles of longitudinal fibers, very clearly outlined. The muscular tendons show very clearly in many cases, and some interosseous ligaments are also seen plainly.

IN a hospital at Florence a patient was submitted to the x-rays, when, to the astonishment of the operators, it was discovered that his heart was on the right side instead of the left. This did not appear to trouble the patient in any way. It may be remembered that Picchianti, the noted scientist, also had his heart on the right side, and that he died at sixty-four years of age without ever having been seriously ill.

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Deering J. Roberts, M. D., editor *Southern Practitioner*, Nashville, Tenn., states (original paper, "Nervous Diseases and Treatment"): "Neurosine, not containing opium, morphia or chloral, makes it more commendable, as we all know the danger resulting from the use of such hypnotics and narcotics, and the general unsuitability of drugs of this class in the treatment of all nervous diseases. I have found Neurosine so uniformly satisfactory that I but deem it my duty to let others know the benefit I have derived from its use."

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THE AMERICAN X-RAY JOURNAL.

A Monthly Journal devoted to Practical X-Ray Work and Allied Arts and Sciences.

VOL. 1. ST. LOUIS, MO., AUGUST, 1897. NO. 3.

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HEBER ROBARTS, M. D., EDITOR,
2914 MORGAN STREET, ST. LOUIS, MO.

Entered at the postoffice at St. Louis, Mo., as second-class matter.

Particular attention is directed to the laborious and exhaustive report made for this journal by Dr. N. Stone Scott, which covers the study of "x-ray injury," and deserves the closest attention. It is the only catalogue raisonne made of this irritating subject by an impartial, ardent investigator.

I desire to supplement briefly what has been here said, quoting from three eminent men, and also from my own experience.

Nikola Tesla says, in the Electrical Review: "It was known to me that a certain irritation of the skin is caused by very strong streamers* which mostly at small distances are formed on the body of a person through the electrostatic influence of a terminal of alternating high potential." Tesla discovered that by the interposition of substances capable of conducting an electric current, as aluminum, or a substance occluding the skin from air, as oil, both of which are readily pervious to the x-rays, would shield the body from injury. He further says: "These facts impressed me with the conviction that, whatever the nature of the hurtful influence, it was in large measure dependent either on an electrostatic action or electrification, or secondary effects resulting therefrom, such as are attended to the formation of streamers." Tesla tested the action of the x-rays upon the skin by placing three bone buttons on the body. The x-rays are propagated in straight lines, and it was impossible for the rays to have reached the skin through the openings in the buttons. At this point, however, the skin was injured. Tesla says: "Concomitant causes were at least in part responsible."

* Not x-rays.—ED.

Assuming that the x-rays may cause injury to the skin, Prof. Tesla concludes with four "specific actions:"

First. The thermal effects. Considering velocity of x-ray particles, they correspond to temperature which may be as high as 100,000 degrees, Centigrade. These particles with such intensity of heat would be injurious to the elements of life.

Second. There is the purely electrical effect, x-rays conveying electricity, and the amount can be measured. These bodies being highly electrified, coming in contact with the body, may destroy the tissues.

The *third* effect is the electro-chemical. The charged bodies giving rise to an abundant generation of ozone, which is a destructive agent to the skin.

The *fourth* is the purely mechanical. By mechanical means alone bodies moving with great speed might be sufficient to deteriorate the tissues, and, of course, deeper layers then would be influenced.

Carl Beck, M. D., Professor of Surgery in the New York School of Clinical Medicine, one of the largest users of the x-rays in the world, having daily occasion to use it in his abundant surgical clinics, makes use of this language in his "Roentgen Rays in Surgery," read before the Pan-American Congress in the City of Mexico, Nov. 9, 1896: "Although having made more than 300 skiagrams since February, 1896, and knowing of many others, I have never observed any ill effect that could be traced to the rays. I once exposed myself to the rays for more than five successive hours, and did not note the slightest reaction."

Dr. W. J. Morton, of the New York Polyclinic, and the most widely known x-ray expert in America, author of "The X-Rays, or Photography of the Invisible," etc., writes in the Items of Interest: "Never in my experience, and I have continuously taken x-ray pictures of every sort since the first announcement, more than a year ago, have I seen the slightest injury to a tissue result. This I believe to be due to the fact that I have used a powerful x-ray, and have thus been enabled to place my Crooke's tube at a considerable distance from the patient." Beyond the hurtful influence of electric streamers, of course.

I have continuously made use of the x-rays since July, 1896, and have in no instance observed the slightest inconvenience. In order that the so-called x-ray dermatitis or destruction of tissue might be imitated by another method, but caused by the same conditions, I united in a chain or string of cotton twelve Grecian sponges. The first sponge was united to a No. 32 wire six feet long, the other end of which was hooked into an exposed electrode of a Crooke's tube incapable of generating x-rays. The current of electricity divided, just as it would do in a live tube, and passed with considerable resistance to the twelfth sponge, which by the aid of an insulator I was able to brush over and very near to the thigh of a paralytic. After a time the sensation was perceptible, which resulted in a dermatitis. The experiment was repeated with a live tube, with similar result. If this wire is coiled about the glass tube it will manifest the same result. If the skin is exposed to any point of the wire connecting the stand with the Crooke's tube, the result is the same. If the skin is exposed to the tube while an electric current passes, the effect will be the same, and it is not modified by the direction of the reflector. Any substance capable of shielding the body from these electric streamers, but pervious to the x-rays, not interfering with their free passage through the body in the least, immures the body from all injury, and provides a reason for the conclusion that the x-rays have no hurtful properties.

I exposed a feeble child five years of age to the x-rays 45 minutes, distance from the discharge tube 16 inches. The current was the high frequency amplified from the alternating incandescent street current. In the months of December and January nearly 600 eyes, representing every nature of disease and cause of blindness, were exposed to the x-rays. No ill effect was noted in any case, and many were exposed at 6 inches for 10 minutes. Exposure was made to powerful x-rays of women in the first, second and third months of fetation. The rays penetrated the pelvis twenty minutes duration at 12 inch distance, the subjects objecting to longer exposure, without any noticeable effect. Maternity was normal in each case. A hen laying eggs was exposed to the x-rays on several occasions of 15 minutes at 6 inches. Exposures were made at night when the hen was quiet. A setting was made of nine of these eggs. During the period of incubation the hen and nest were exposed to the rays at a distance of 6 inches from the tube and 15 minutes duration. All the eggs hatched and the chicks appeared normal.

With all that has been written for the lay press, medical journals and scientific publications, I am unable to find a rational conclusion for the belief that the x-rays ever injured in any instance human tissue. A doubt lingers around every report, speculation pervades the mind of nearly every writer, or sensation titillates the ambition for place in the press of erstwhile investigators.

X-RAY INJURIES.

By N. Stone Scott, A.M., M. D., Cleveland, Ohio.

Consulting Surgeon to the City Hospital; Consulting Surgeon to St. John's Hospital; Surgeon to the Out-Patient Department, Cleveland General Hospital, Etc.

The question of x-ray injuries is of so much importance that it has excited great interest, and has received extensive notice in the medical, electrical and lay press. As regards the medical press this is especially true of a case reported by a physician, who, without x-ray experience, has relied on his medical knowledge alone, and has advanced an erroneous theory of the first importance.

It has been evident for a year past that the x-rays are sufficiently powerful to produce under some conditions most disastrous results, but very diverse views have been held as to the cause, the frequency, the kind of apparatus most likely to produce them, and the best way to avoid them.

In order to assist in arriving at a proper solution of these questions, I have sent a circular to most of the leading medical and electrical men who are doing x-ray work, asking for particulars of x-ray injuries. The questions asked include the kind of apparatus, length of spark, number of exposures, distance of platinum from the part exposed, and inquiries relating to the characteristics of the injury itself. The results of these investigations are shown on the accompanying chart. Some fifty personal replies have been received; one quarter of these report forty-five hundred cases, and, since a large number of the leading men in x-ray work are to be found among the writers of the three-quarters giving no estimate of the number of cases examined, it is certainly not an over-estimate to say that this report includes at least twenty thousand examinations, exclusive of those made by x-ray exhibitors. This list contains thirty-one cases of injury, or one in about thirteen hundred.

Dr. Gilchrist, of the John Hopkins Hospital, has collated from the literature twenty-four cases of injury. I have, mainly by personal letters, increased this to sixty-nine. This includes the case of J. Lynn Thomas, of cystitis, which the author thinks was not due to x-rays; one reported by Dr. Wallace, in which she attributes an aggravation of renal colic to the action of x-rays; and one reported by Prof. Blake, in which there was the formation of abscess, evidently due, as the Professor thinks, to an increase of the original difficulty. It includes a similar case of my own, of a felon, which I think an incident rather than a result of the x-ray examination. The chart also shows twenty-three cases listed as x-ray exhibitors, as well as several cases in which the injury was doubtless an increase of the trouble for which the case was examined, rather than an x-ray injury.

Many of the reported injuries occurred in the early days of the discovery, when the apparatus was crude or the operator inexperienced. It is not difficult in most of the severe cases to see how it might have been avoided.

The symptoms of all cases, except the

few where deeper structures were supposed to have been affected, present the picture of a dermatitis, the distinctive feature of which is its slow onset and tendency to assume a chronic form. Those who work extensively with x-rays are frequently compelled to give up their work. The first symptoms appear as a rule, in from three to seven days. Fuchs, however, reports a case of one exposure of an hour, in which the hand had a frozen appearance during the exposure, with pain, redness and swelling, which commenced at once continuing to vesication. Profs. Daniels, Marcuse, Kolle, J. Mont Bleyer and others, mention cases which were several weeks in developing symptoms that were noticeable.

The skin directly over that strongest source of x-rays, the platinum terminal, first commences to swell, becoming red and painful; this gradually extends to parts farther from the source of x-rays, even to those parts not directly exposed. The pain is of a deep-seated, dull, aching character (although some cases run their course without pain). Vesicles then appear filled at first with a serous exudate and purulent material; in severe cases a sphacelus forms which is gradually thrown off, leaving a raw granulating surface slow to develop and slow to heal.

The kind of apparatus seems to make no difference; the Ruhmkorff coil, the Tesla coil, and the static machine have all given severe cases. The majority have been given by the Ruhmkorff coil; but this is due simply to the fact that this was the kind first in use, and is yet by far the most frequently used.

Distance of the platinum terminal is of importance, because when the platinum is near, the x-ray is concentrated upon a small surface; but if the ray is strong enough to produce desired effects, it will be strong enough to produce the undesired if continued too long. Kolle and Richardson both report cases where the platinum was eighteen inches away; Richardson's case being submitted to three examinations (on successive days) of twenty, thirty and thirty-five minutes, a total of only eighty-five minutes.

The length of time is also important. On the chart five cases are reported from exposures of less than one hour. In cases No. 1 and No. 57 the distance of the terminal is not given; the time is forty-five minutes. No. 21, which is exactly one hour exposure, with quite severe symptoms, had the terminal at only five inches. Number 41, though extremely short in time, only five minutes each on three successive days, was only one inch from the terminal. If the experiment had been made at a distance of eight inches this would have been equivalent to some five hours exposure; not so very short a time after all. It seems probable that the most susceptible would not be affected by an exposure lasting an hour if the terminal is at least ten inches away; this, under all ordinary circumstances, is amply sufficient for a medical examination.

Consideration of the causes of x-ray injuries would take us too far beyond the scope of this paper, and belongs legitimately to the electricians, who are at wide variance with one another. I shall only mention in passing the various theories. Elihu Thompson advanced the theory that the burns were caused by ultra violet light; he has since proved to his own satisfaction, although not to the satisfaction of some others, the falsity of this hypothesis. Tesla considers the injury due to ozone generated at the point of contact of the x-ray. Another believes it to be nitrous acid. Several experimenters think it is produced by particles bombarded off the terminal. One observer believes the particles floating in the air are bombarded into the skin by the x-ray. A number of operators have advanced the theory that the burns are caused by static or other electrical discharge. It seems certain that if it be not due to the x-rays directly, it must be something which goes where they go, and any thing which would protect would stop the ray, since cases of injury have occurred through clothing of various kinds and through many protective substances, such as vaseline, zinc ointment, thin aluminum, etc.

That the x-rays do affect the skin, seems certain, but that deeper structures are affected primarily, is at least doubtful. Among the reported cases there are but six which can possibly be so classed.

Dr. A. G. Wallace, in the Kansas Medical Journal, February, 1897, reports a case of renal colic, which prior to the x-ray examination had been having attacks about once a month; after the x-rays were used these occurred every day and a large quantity of sand was passed. This "disintegration of the calculus" the doctor attributes to the x-ray. There have been many cases of renal calculi examined by x-rays, and, since this case is the only one in which such a result has been noticed, it seems much more probable that this increase was a coincidence rather than a result.

Dr. J. Lynn Thomas, in the British Medical Journal, March, 1897, reports a case of stone in the bladder, which the day following an exposure to the x-rays lasting sixty-five minutes, developed a cystitis. Dr. Thomas does not think the x-ray caused the cystitis; a conclusion which seems eminently proper, in view of the fact that a bladder with a stone in it is sure, sooner or later, to develop cystitis; yet it may be possible that the irritation of the stone, while not enough to produce symptoms of its own, may have been enough so that the slight added irritation of the x-ray brought on the cystitis. The case is certainly of great interest, and worthy of record.

The Electrical Journal, December 1, 1896, contains an account of a case in which Prof. Blake examined the ankle by x-rays; six weeks later an abscess opened in the region of the ankle joint. Prof. Blake in a personal communication to me says that he thinks the abscess due to the original trouble for which the examination was made.

This leaves three cases in which there is a reasonable doubt as to the existence of a periostitis. One was reported to me by my friend, Dr. B. Of this case the doctor says: "The periostitis which resulted from the x-ray examination delayed an operation which was necessary for an old dislocation of the ulna, and the exudate which was thrown out tended to interfere with a better result." That this bad effect was due to the x-ray is at least doubtful. Hundreds of examinations have been made for fractures and dislocations without producing such results. On the other hand, medical history is replete with cases of comparatively trivial fractures and dislocations which later developed periostitis. Thus it certainly is not proven that the x-ray was an etiological factor in the production of the periostitis.

My own case was that of a quadroon, twenty-eight years old, who had her hand severely crushed and burned five years before in the hot mangle of a laundry. As a result of this there was extensive sloughing of the soft parts, and consequent cicatricial contraction when the hand finally healed. December 18, 1896, the hand was viewed several times in the fluoroscope, and two skiagraphs were taken. The apparatus consisted of a Tesla coil and double focus tube, made by the Warren Tube Works after my own drawings. The hand was placed eight inches from the platinum terminal, the exposures lasting one and a half minutes each. January 14, 1897, almost a month after the examination, she presented herself with an inflammation of the distal phalanx of the middle finger. The pain, she said, started at the time the examination was made, and had been very severe until some days since, when an abscess broke between this finger and the next, to which it was closely bound. From this time on the pain was comparatively slight, lasting for a number of weeks, until, finally, a small sequestrum was discharged, after which it healed rapidly. At no time did I see any inflammation of the skin. There was undoubtedly in this case an ostitis and accompanying periostitis, that this developed soon after an x-ray exposure is equally true, and it is impossible to prove that the inflammation was not due to the x-ray. It has to be borne in mind, however, that these cases of scar tissue and consequent lowered vitality are especially prone to inflammatory reaction; and some other accident, possibly slight, which she either unconsciously or wilfully overlooked, might easily have been the determining cause.

The case of Dr. Gilchrist I have reserved to the last, because of it's importance, of the wide publicity given it, and because of the harm done by the erroneous deduction which the doctor has drawn. In the beginning of the x-ray work, many physicists, because they were in a position to manipulate a Crookes tube, undertook to pass judgment upon medical subjects. Much wild semi-medical talk and writing was indulged in, and not a little harm done, so that the profession was not slow to see that medical men must equip themselves to retain control of medical subjects. As an illustration I would cite a little book entitled "Something About X-Rays for Everybody," by Edward Trevert, Electrician. On page 61 he says: "Figure 38 shows the bones of a young woman's arm, consisting of the humerus (upper bone), the hinge joint of the elbow, and the ulna and radius (the lower bones). A fracture of the radius near the elbow is distinctly shown." This fracture, which is so distinctly shown, is nothing else than the bicipital tuberosity. Such mistakes were very natural, and arose from a lack of medical experience and knowledge. But a medical knowledge is not the only requisite, and Dr. Gilchrist, who is not an x-ray operator, has made a very natural mistake on the other side, and given a wrong interpretation to his skiagraphs when he infers that there is an osteoplastic periostitis present. The case was, briefly, that of an x-ray exhibitor, who, after exposing his hand four hours daily for three weeks, had a dermatitis develop over the hand, wrist and forearm. The points on which the doctor relies for a diagnosis of "osteoplastic periostitis, and probably an ostitis," are:

1st. Pain which was of an aching, throbbing character, so that he frequently could not sleep at night.

2d. The phalanges were noticed to be distinctly thickened.

3d. Voluntary movements of both fingers and hand were abolished; he complained of the joints being very stiff.

4th. Photographs show all the phalanges of the right hand much thicker than those of the left, normal hand. The increase in size is particularly marked in the first phalanges of the index and second fingers. It cannot be said from the photographs, alone, that any of the carpal bones were increased in size.

5th. The spaces between the bones at the joints were much less marked and narrower than those of the normal hand.

6th. The outlines of the affected bone was more irregular and rougher.

7th. The bones were denser in appearance.

Let us review his reasons and, if possible, answer them:

1st. Pain of a dull, aching, throbbing character, might suggest bone pain, but it is also characteristic of most x-ray burns, even those on the thigh and abdomen, where it cannot be due to injury of underlying bones.

2d. The sensation of the phalanges being thickened, might be due to a thickening of the bone, but, if the skin is thickened and infiltrated, it would be very easy to imagine that the bones were thickened. A comparison between the diseased and normal finger by the sense of touch would be most deceptive.

3d. The feeling of stiff joints and loss of voluntary movements would certainly be the result in a severe dermatitis with infiltration of the deeper portion of the skin, and, furthermore, if the bones involving the finger joints had been involved and the carpal bones not—as judging from the skiagraphs is the case—the fingers ought to be stiff, the wrist movable. The history distinctly says, however, that the wrist was stiff.

4th. When one views the hand through a fluoroscope, and has the strength of the x-ray gradually increased, the first thing seen will be an outline of the hand, then gradually the bones become clearer, and after a little the thinner parts of the flesh gradually fade out, as it were, and, lastly, even the bones seem to dissolve, commencing at the thinner and smaller ones. So, too, if one takes a skiagraph of the hand, and gives sufficient time to properly bring out the wrist and thicker parts, the thin parts will be overtimed. It was while conducting a series of experiments some time since, to overcome the unequal exposure, that I got some pictures of normal hands, which offer an explanation and refutation of the fourth, fifth, sixth and seventh points made by Dr. Gilchrist. These pictures were made by shading the thinner parts, during part of the exposure, with lead plates. Apparently the infiltration of the skin and its consequent thickening has brought about tbe same result that the lead plate produced with a normal hand.

5th. In the under-exposed hand the joints are much less marked and narrower than in the one over-exposed.

6th. The under-exposure is also the cause of the affected bones being more irregular and rougher, because in the over-exposed bone the lesser projections and irregularities are first to disappear, thus diminishing the apparent size and smoothing off the outline.

7th. The same reason accounts for the apparent density of the bones.

8th. Aside from these points, an examination of the outlines of the soft parts shows that those of the affected hand are plainer than those in the other, adding to the proof that the affected hand is relatively under-exposed. And last, but not least, I must criticise any deductions drawn from a comparison between one picture of each hand on the assumption that they are taken under similar circumstances. One cannot be sure that a tube is working just the same during two exposures, and since we have no standard of measure for x-rays, it is impossible to say that the relative exposure is the same. This case of Dr. Gilchrist's should have had a series of pictures taken of each hand.

In conclusion I would recapitulate:

1st. Injuries are very rare when proper precautions are taken.

2d. Injuries are limited to the skin and contiguous structures, at least it is not proven that deeper parts are injuriously affected.

3d. It is probable that the bones or deeper structures are not affected.

4th. The proper precautions consist in confining x-ray examinations to short exposures, not to exceed one hour for a distance of ten inches from the terminal, and not to be repeated until sufficient time has elapsed to show that no bad effects seem likely to develop.

5th. If repeated short exposures are made, the slightest bad symptoms should be an indication to cease all farther exposures.

No	Name.	Reported by	Where Reported.	Age.	Apparatus Used.	Length of Spark.	Distance from Platinum Reflector	Exposures. No.	Exposures. Length.	Date. Time of Developm'nt	Part Expos'd	Duration of Symptoms.	Symptoms	Remote Results.	Remarks.
1	P.	Dr. B.	Personal.	28	Ruhmkorff.			1	45 min.	Mar. 15, '97. 3 Weeks.	Left Thigh.	Ulcer, 3"x 6" 2 mos. after.	Blebs followed by Dermatitis Ulcer, 6"x 8"	Epidermization.	Progressing Slowly.
2	G. W. M.	Dr. W. E. Parker New Orleans.	New Orleans Med. and Surg. Jour. p. 158, Sep. '96.					5	July 1—20 mi. " 3—40 " " 4—40 " " 6—60 " " 9—80 "	July 4, Swollen and Red. July 7, Swollen and Red. 2½ Weeks.	Left Inferior Maxilla.	2½ Weeks.	Swollen and Red. Peeling of Epidermis.	Hair on Left Side of Face no longer grows.	Bullet Subsequently Located.
3	C. Smith.	Mr. Green.	Personal.	20	7-in. Coil Experim'nt'l Tube.	6"	8"	3	1 hour each.	Dec. 18, 19, 20, '96. 10 Days.	Head.	3 Months.	Appearance of Scald—Loss of Hair.	Thoroughly Recovered, Hair Returned.	Since using short exposure with Static Machine—No bad results.
4	Elihu Thompson.	Elihu Thompson.	Personal.	43	Static Machine, Single Focus Tube.	4"	1¼"	1	30 min.	9 Days.	Little Finger of Left Hand.	7 Weeks.	Dermatitis and Ulceration.	Scar.	
5	Elihu Thompson.	Elihu Thompson.	Personal.	43	Static Machine. Single Focus Tube.		5/8"	1	12 min.	11 Days.	Third Finger of Left Hand.	3 Weeks.	Dermatitis.		No effect thr'gh lead and tin foil. Effect through Al'min'm and on exposed surface
6		Elihu Thompson.	Boston Medical and Surgical Journal Dec. '96.										Severe.		Occurred in Edison's Laboratory.
7		Elihu Thompson.											Severe.	Severe Symptoms.	Had to Stop Work.
8	Tube Tester.	Elihu Thompson.												Had to Stop Work.	Owing to arms being affected thr'gh clothing.
9	H.	Mr. T.	Personal.	22							Hands.				Letter implies he worked with X-Ray.
10	Jno. McA.W.	Capt. W. B. Banister.	Medical Record, Jan. 23, '97.	45				3 8	1½ hours ea. Total, 12 hrs.	Aug. 11 and 12, '96 Sept. 9, 10, 11, 12.	Abdom'n	Aug. 11 and 12, Slight Redness Signs on Sept. 9, Gradually increase—Dermatitis and Ulcerat'n—15"x 8"		Lost Hair on Face and Hands—Change color at 6 mos. Ulcer, 8"x3"	
11	Dr. A. D. Rockwell.	Dr. A. D. Rockwell.	Medical Record, Apr. 24, '97.		Static Machine.			Frequent Short.		March '97. During and immediately following exposure.	Left Hand.	Dermatitis with Exfoliation.		Not entirely well 6 weeks after--Pain deep seated--Hot.	
12	N.	Dr. H.	Personal.		Edison 4" Coil.		6"	100 a day for 2 weeks. 3 a day for 2 weeks.		Nov. 20, '96, 2 Weeks.	Left Hand.	5 Weeks.	Dermatitis Pains and Swelling.	Roughness and Slight Lack of Nutrition.	

13	H.	Prof. C.	Personal.		Ruhmkorff Coil.	12"	3"	2	30 min. each.	4 Days.	Breast.	2 Months.	Like burn—more persistent.	No injury.	
14		Prof. C.	Personal.		Ruhmkorff Coil.			1	5 min.		Wrist.	2 Weeks.	Slight burn.		
15	Dr. G. C. Skinner	Dr. G. C. Skinner	Personal.	27	Tesla Coil.	9"	4"	3	20 min. each.	Sep. 20-22, '96 10 Days.	Wrist.	3½ months.	Dermatitis with Ulceration.	Implication from	of Tendons Inflammation.
16		Dr. G. C. Skinner	Personal.		Tesla Coil.						Abdom'n		Dermatitis with Ulceration.		
17	P.	Prof. H.	Personal.		Tesla Coil. Double Focus Tube.	8"	6"	1	20 min.	July 2, '96 2 hrs.	Knee.	Several Weeks.	Spot 2½" steam	Diam. like burn.	Inflamed and painful before exposure.
18		Mr. S.	Personal.					1	20 min.		Thigh.		Burn.		
19		Mr. S.	Personal.					1	30 min.		Thigh.		Burn.		
20	M.	Prof. M.	Personal.	30	Ruhmkorff 10" Focus Tube.	10"	3"-12"		Various short for 4 days.	Sept. 15, '96 Week or more	Left Hand.	2 Weeks.	Dermatitis like Ivy poison.	None.	
21	S.	Dr. B.	Personal.	50	Ruhmkorff Coil.	8"	8"	2	30 min. each,	Sept. '96 10 Days.	Arm and Hand.	2-3 Weeks.	Symptoms of Periostitis.	Inflammatio tion for dislo Interferes by better	n delays operacated Ulna. exudation with results.
22	J.	Mr. J.	Personal.	27	Ruhmkorff Coil, Single Focus Tube.	7"	4"-20"		1—4 hours daily for two weeks.	July, '96.	Hand and Face	5 Weeks.	Like Ivy poison suppuration.	Scar, Loss of Beard, Injury to sight.	Beard grows in more scanty and of different color.
23	H.	Dr. K.	Personal.		Ruhmkorff Coil.		6"	3	1½ hrs. each.	Dec. 12, '96 3 Weeks.	Abdom'n	Several Weeks.	Dermatitis and Ulceration		Cloth over skin.
24	G.	Dr. K.	Personal.				6"	3	1½ hrs. each.	Jan. 31, '97 4 Weeks.	Left Hip.		Dermatitis and Ulceration.		Used vaseline freely at each exposure.
25		Dr. J. C. White.	Boston Med. and Surg. Journal. Dec. '96.					2	30 min. 45 min. following day.	July, '96 Day after 2d exposure.	Sternum.	Nov. 15, two spots unhealed.	Dermatitis and Ulceration.		
26	G. S. Newcomb.	G. S. Newcomb.	Mod. Med. Science, Nov. '96								Hand.		Dermatitis and Ulceration		Had to renounce further investigation.
27		Dr. W. V. Gage.	Medical Record								Body.		Dermatitis and Ulceration.		
28		H. C. Drury.	Brit. Med. Nov. 7, '96.	35				2	1 hour. 1½ hr. 6 days lat r.	Nausea after each exposure. Derm. 2d, after 2d exposure.	Abdom'n		Nausea, Dermatitis and Ulceration, 7⅓"x8¼"		Symptoms of Renal Calculus.
29	Prof. Reid.	G. E. Armstrong.	Montreal Med. Jour. Apr. '97.		10" Spark Focus Tube		3"	4	20 and 40 mi. 50 " 50 "	Nov. 2. " 3. " 5.	Abdom'n and Chest.	33 Days.	Dermatitis and Ulceration, 30 sq. in.	Hair removed.	Waistcoat lined with scarlet flannel.
30		Dr. E. H. Lee	Jour. Amer. Med. Ass'n. Jan. 16, '97.					3 or 4 a day for a wk.	¾-1 hour.	After three exposures.	Head.		Dermatitis and Ulceration.	Eye closed but has gran of con	during exposure ulated surface junctiva.

31	E. H.	Dr. H.R.Crocker	Brit. Med. Journal. Jan 2, '97.	16	Coil and Accumulat'r		5"	1	1 hour.	1 Day. Oct. 13	Epigastrium.	3 Weeks.	Dermatitis and Ulceration.		Lower border sharply defined where trousers were turned down.
32		Prof. Daniel.	New York Med. Record, Apr. 25, '96.				½"	1	1 hour.	21 Days.			Bald Spot, no inflam'tn.		
33		Marcuse.	Deutsche Med. Woche, No. 30, '96.	17	Hittorff			1 or 2 a day fr a mo.	5-15 min.	14 Days.	Face.	3 Months.	Dermatitis, Ulceration with Loss of Hair.		
34	Dr. A. B. Kibbe.	Dr. A. B. Kibbe.	New York Med. Jour. Jan. 16, '97.		Single Focus Tube.		4"	L H 20. R H 5, Elb 2.	5 min. 7-10 min.	2 Days Like Sunbr'n	Face and Elbow.		Dermatitis.		Covered with clothing.
35		Fuchs.	Deutsche, Med. Woche, No. 35.			16 cm				During Exposure.	Left Hand.		Vesicles, 15 min. after exposure.		Hand looks as if frozen.
36	R.	Dr. E. E. King.	Canadian Proct., Nov. '96.								Hand.		Derm. with Blebs.		
37	J. K.	Dr. F. S. Kolle.	Brooklyn Med. Jour. Dec. '96.	12	Induction Coil. Thomp. dbl. Focus Tube.	10"-12"	18"			Oct. 21 19 Days.	Scull.	4 Months.	Loss of Hair. No inflam'tn	Complete recovery.	Alopecia Areata.
38	S. J. R.	S. J. R.	Nature, Oct. 29, '96.		8"				Several hrs. a day.		Hand.		Dermatitis —Blebs.		
39	A. J.	Leopold Freund.	Wiener. M. W Mar. 6, '97.	5	Ruhmkorff				10 days 2 hrs. daily.	Nov. 24, '96.	Back.		Dermatitis, not serious.		Removed hair from hypertricosis.
40	L.	Mr. L.	Personal.	32	Induction Coil. Greiner.	6"-8"	1"-2"	3	5 min. each.	April 4 10 Days.	Chest over Heart, and Hand.	2 Weeks.	Dermatitis, Ulceration Slight.	None.	
41		Dr. S.	Personal.		Ruhmkorff.	6"-8"	2"-8"	1	5 hours.		Head	Not well yet.	Ulceration extended to the Bone.		
42		Dr. S.	Personal.					1	10 hours.		Abdom'n		Very severe		
43		Dr. S.	Personal.								Chest.		Superficial.		
44		Dr. S.	Personal.								Chest.		Superficial.		
45		Dr. S.	Personal.								Thigh.		Superficial.		
46		Dr. J. Lynn Thomas.	Brit. Med. Journal, Mar. 27, '97.	60						Next Day.		1 Week.	Cystitis.	Stone in bladder. Does not think cystitis due to x-ray exposure.	
47		Dr. A. McK. Wallace.	Kansas Med. Journal. Feb. 13, '97.						1½ hours.	Apr. 14, '96				Severe case of Renal Colic attributed to x-ray by reporter.	
48	Miss C. Liebengood	Prof. Blake.	Electrical Journal. Dec. 1, '96.							Few Days	Foot.		Abscess after abscess.	Tested 6 weeks before for disease. Reporter thinks not due to x ray.	

49	E. C. A.	Dr. A. Forster.	Deutsche Med. Woche, Feb. '97.	30			10 cm	1	25 min.	Jan. 1 5 Days.	Head.		Dermatitis, Loss of Hair.		
50	C. B. E.	Dr. A. Forster.	Deutsche Med. Woche, Feb. '97.	40				2 3	15 min. each. 30 min. each.	Dec. 8, 2 days " 15, 3 "	Head.		Slight Redness, Dermatitis, Loss of Hair.		
51	Prof. Wilson	Caffrey & Wilson.	Electrical World, Jan. 9, '97.					2	3 hrs. each. 2 days.	Sept. '96	Fingers, Left Hand.		Dermatitis and Ulceration.		
52	T.		Personal.	50	Induction Coil, 6" Spark.	10"	3"-4"	2	1 and 2 hrs.	Several days	Abdom'n		Dermatitis and Ulceration.	Still confined to house after 10 mo	nths.
53	O. Leppin.	O. Leppin.	Deutsche Med. Woche, July 9, '96.						Frequently for many days.		Left Hand and Fingers.		Dermatitis with vesicles.	After 5 weeks hand still looked older	than the other.
54		Dr. Feilchenfeld	Deutsche Med. Woche, July 23, '96.				Exhibi	ted	case similar	to Dr. Mar	cuse's.	No details	given.		
55	Photographer.	Dr. Conrad.	Codex Medicus, Aug. '96.						Frequently and for some time.		1st & 2d Fingers Left Hand.		Dermatitis—Slight.		
56		Sehrwole.	Deutsche Med. Woche, Oct. 8, '96.					1	95 min.	2 Weeks.	Abdom'n	9 or 10 Weeks	Dermatitis and Ulceration.		
57	J. MacIntyre	J. MacIntyre	Nature, Nov. 19, '96.	35							Hand.		Dermatitis and Exfoliation		Thinks electricity chief cause.
58		M. S. Stern.	Am. Med. and Surg. Bulletin, Nov. 21, '96.					3	40-50 min. each.	2 Days.	Chest.		Dermatitis, face to umbilicus, and Ulceration.		
59		Dr M. H. Richardson.	Med. News, Dec. 26, '96.				18"	3	20-30-35 min. each.	2 Days.	Abdom'n	4 Months, 4" Ulcer.	Dermatitis and Ulceration, 8".		
60		Univ. of Minn.	Med. Record, Dec. 19, 96.					1	Several hours.		Ear.		Hair lost surrounding Ear.		Frozen appearance.
61	X-Ray Exhibitor.	Dr. T.C.Gilchrist	Johns-Hopkins Hosp. Bulletin, Feb. '97.						Frequent.		Hands.		Dermatitis with Exfoliation.		Reporter thinks it case of osteoplastic periostitis.
62		Dr. W. Downe.	Lancet, '96. ii 1049.							10 Days.	Neck and Scalp.		Dermatitis, Vesication and Loss of Hair.		
63		Dr. Sewell.	Lancet, '96. ii 1049.		Reported	similar	case.								
64		Dr. M. Rendy.	New York Med. Jour. Feb. 20, '97.					1	55 min.	Erythema soon after.	Chest.	Several Weeks	Dermatitis and Ulceration.		

65		Dr. B.	Personal.	40	Ruhmkorff with break.	10"-16"	10"-20"	1	15-30 min.	May '96 14 Days.	Chest.	10 Days.	Burning Pains.		Thinks cause floating particles propelled into skin.
66		Dr. B.	Personal.	31			10"-20"	1	15-30 min.	Nov. '96 7 Days.	Back.	10 Days.	Burning Pains.		
67		Dr. B.	Personal.	37			10"-20"	1	15-30 min.	Dec. '96 10 Days.	Back.	10 Days.	Burning Pains.		
68		Dr. C.	Personal.												
69		Dr. N. Stone Scott.		28	Tesla Coil Double Focus Tube.		8"	2	½ min. each	Dec. '96 soon after.	Hand (m'ngld)	Several Weeks.	Felon No Dermatitis.	Complete recovery.	Probably not due to exposure

X-RAYS AS A DEPILATORY.

Dr. Freund, of Vienna, has used the x-rays as a depilatory. The experimenter tried them upon a boy whose spine was hidden by an abundant crop of hair. This malady is known to the profession as hypertrichosis. Dr. Freund turned the x-rays upon the boy's back and the superfluous hair roots and all, vanished. The boy had been shown to the medical society in Vienna, and photographs of his condition before and after the application of the x-rays taken, which confirm the success of the application. The permanency of the cure may be questioned, as similar experiments in this country have shown that after the removal of hair by x-rays the follicles after a time appear to be stimulated and the hair then grows more vigorously than before.—*Magazine of Medicine.*

Dr. Freund can run the same electric current through a tube which is dead, or will not generate x-rays, and obtain precisely the same results. The x-rays had nothing to do with the removal of the hair.

RADIOGRAPH OF AN ADULT.

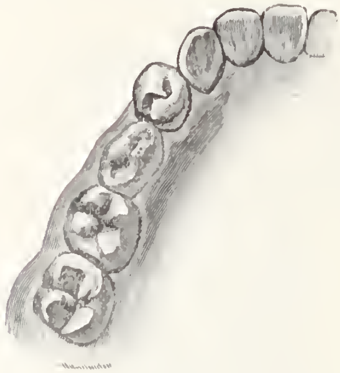
We are under obligations to Dr. Wm. J. Morton, of the New York Polyclinic, for courtesies extended in securing this half-tone, and to Joseph Wetzler, editor of the Electrical Engineer, in which paper the picture first appeared, and who kindly reduced the plate for reproduction in the AMERICAN X-RAY JOURNAL.

The radiograph is of a healthy, well muscled woman 30 years of age, 5 feet and 4 inches high, and weighing 120 pounds. Tube was 4½ feet from the body, and active 30 minutes. It is the first x-ray picture of the entire body of an adult. The picture is under-exposed. The x-rays were evidently very powerful, because, if the intensity diminishes inversely as the square of the distance, it would take about twenty times as long to take a picture 4½ feet from the sensitive plate as it would one foot. Due to the casting of long shadows, distorting the picture, the tube was required to be placed 4½ feet above the stomach. Dr. Morton had made attempts to radiograph the entire body with 2 and 3 discharge tubes working at the same time, but independent pictures, and unequal power of the discharge, necessitated failure. This shadowgraph shows not only the bones and skeleton, but also the flesh and the texture of the clothes worn. The silk folds of the sleeves are mainly visible to the naked eye, as well as the folds of the skirt and its hem. The gold necklace about the neck, the bracelet on the arm and the finger rings on the hands may be noted. Some of the rings contained diamonds, in which case the rings appear to be stoneless, as the diamond is a carbon and not opaque enough to be affected by the rays. The garter buckles appear clearly, the one on the right being more visible than the one on the left, which shows directly over the knee bone. The high-laced patent leather shoes show the eyelets and the nails in the heels. The portions of the internal anatomy showing the heart, liver and stomach.

RADIOGRAPH IN DENTISTRY.

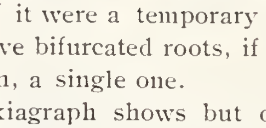
By C. Edmund Kells, Jr, New Orleans, La.

The illustrations herewith demonstrate the great value of skiagraphy in dentistry, in one class of cases only.



The cast of lower teeth upon the right side of a young girl about 14 years of age, shows a tooth occupying the place of the second bicuspid, to be abnormal in shape, resembling greatly a temporary molar, and the question arises as to whether it is only a temporary molar, or permanent bicuspid.

In this individual case, which was shown to a number of prominent and well-informed dentists, opinions were divided, some pronouncing it a temporary molar, which should be extracted, others a permanent tooth which should not be disturbed.



Now if it were a temporary tooth, it would have bifurcated roots, if a permanent tooth, a single one.

The skiagraph shows but one root, and so settles the question beyond dispute.

This is but one instance in which the use of the Roentgen ray is most valuable in dentistry.

SKIAGRAPH OF FRACTURE OF TIBIA AND FIBULA.

By Dr. John T. Pitkin, Buffalo, N. Y.

On August 15th, 1896, the gentleman whose foot appears in the accompanying half tone, while riding on his bicycle homeward bound from business, was struck by a passing vehicle, dismounting him with great violence.

By the impaction of his right ankle against the street curbstone, he sustained a fracture of tibia at its lower third, and two fractures of fibula, one at upper, the other at its lower extremity. So great was the resulting loss of bone support that the foot could be flexed or extended, everted or inverted on the leg ad libitum.

For six days subsequent to foregoing traumatism the fractured bones were sustained by loosely applied splints, to allow the acute inflammatory action to subside. At the expiration of that period plaster of paris bandages were substituted, and worn for a period of about one month, statu quo. The limb now is, as revealed by skiagraphy, as follows: The tibia has reunited with osseous union, but its lower third has been allowed to rotate forward about forty-five degrees, the internal maleolus rests anteriorly upon the superior articular surface of astraqulus, forcing the same away from the corresponding articular surface of tibia.

The upper peroneal fracture has healed properly, but the lower third presents a cartilaginous union, as shown by vertical line in skiagraph. Thus the ankle is left with but little lateral bony support, and therefore requires the constant employment of metallic braces.

Every one who cares for children, and who does not, will be interested to know that another volume is about to be added to our rapidly growing pediatric literature. The Medical Gazette Publishing Co. announces a book "About Children," to be issued in September. It is written by Dr. Samuel W. Kelley, Professor of diseases of children in the Cleveland College of Physicians and Surgeons. As Pediatrist to the Cleveland General Hospital, his course of six lectures in the Hospital Training School met with such approval that it was decided to publish them in book form.

It is said that carbolic acid, if dissolved in glycerine or alcohol, is not caustic, whatever be the degree of concentration. A small proportion of water added to the alcohol or glycerine solution will cause it to act as a caustic.—*Medical Argus.*

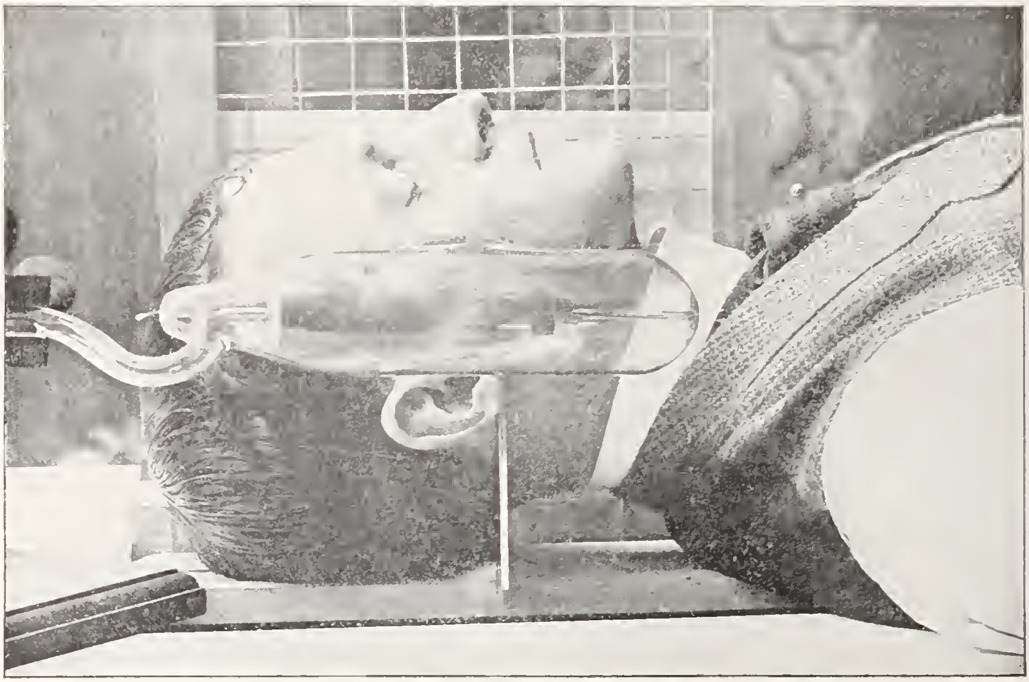
Campho-Phenique, which does not injure human tissue in full strength, and is a better germicide than carbolic acid for surgical purposes, may be used with water or glycerine with perfect impunity.

THE DENNIS FLUOROMETER.

By JOHN DENNIS, Telegraph Editor of the *Democrat and Chronicle*, Rochester, N. Y.

The object of the Fluorometer, in its use in connection with the Roentgen energy, is to enable the surgeon or physician to ascertain, with exactness, the position which any foreign substance which can be seen on the field of the fluorosope, occupies in the human body. To accomplish, this it provides:

First—A position of the body or limb, by which what may be called, for want of a more precise term, a perfected

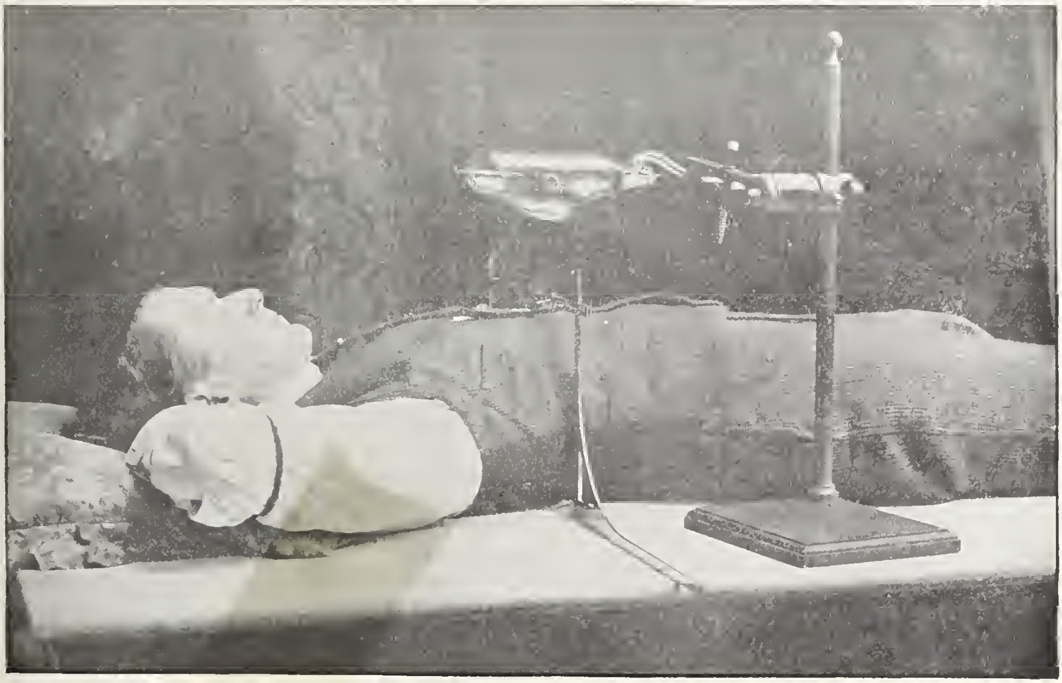


shadow, on the field of the fluoroscope, or, in the other case, on the sensitive plate, at the same time giving the surgeon data which will enable him to make his measurements not only, but to reproduce the exact position of the body or limb, for purposes of exploration or operation. In other words: it eliminates the element of distortion in the shadow caused by the changing position of the body or limb.

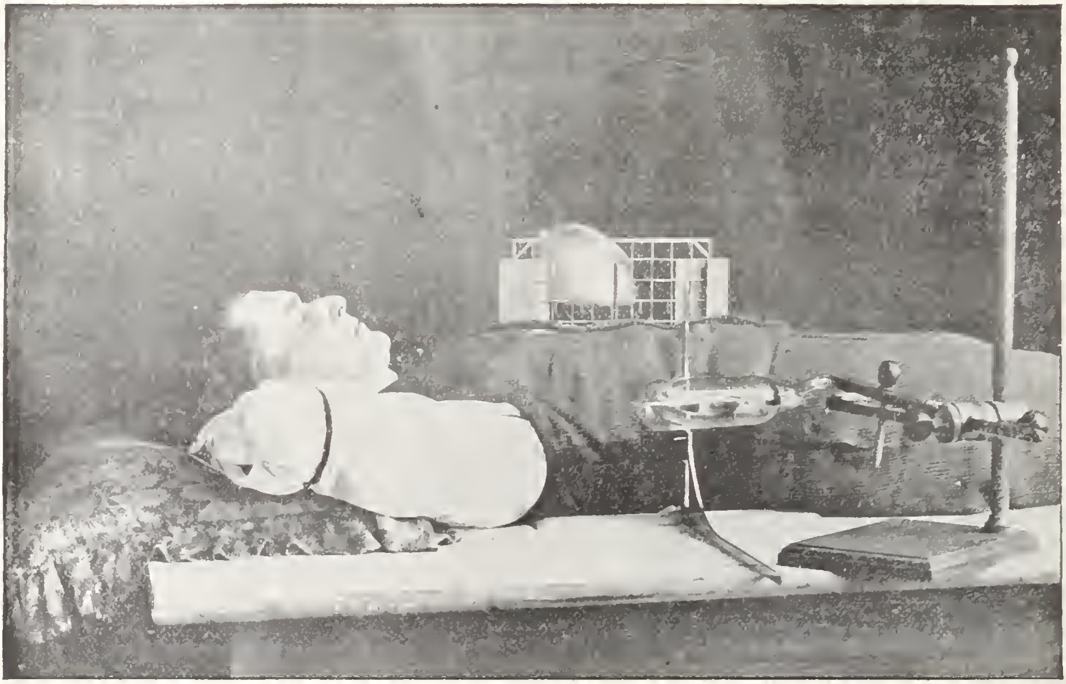
Second—The Fluorometer eliminates the distortion resulting from the radiation of the force or energy known as the X or Rœntgen ray.

Third—The distortion caused by the position of the subject and the distortion caused by the radiation of the energy, having been eliminated, the Fluorometer provides an acurate cross-section of the body or limb, and supplies an absolutely correct right-angle, at the intersection of the lines of which the foreign object will be found in the body or limb.

In its last analysis the Fluorometer consists, essentially, in a set of carefully designed metallic angle pieces, which conform generally to the shape of the body or limb, and which in their use in connection with the x-ray, are susceptible of being squared with a simple and conveniently adjustable table. The patient being laid on the table and a fluorometer appliance adjusted, as shown in the accompanying engraving, the Fluorometer is brought with the body, into the parallelism of the rays. That is, when the proper position of the cross-section is obtained, the two arms of the Fluorometer will present the characteristic single shadow on the field of the fluoroscope. Attachable to the arms of the Fluorometer are two pins or sights. By means of these sights, the foreign object having been brought in line with them and the proper adjustment having been made, a correct line is produced, with the sights and foreign object coincident. By means of a metallic grating of inch mesh, which is placed adjacent to one side of the body and consequently



one side of the Fluorometer, exact measurement can be made with the eye from the base line of the Fluorometer and from points on the circumference of the body, to the foreign object. Then, without moving the body or the Fluorometer, the tube is placed directly over the subject for the purpose of obtaining the vertical line. By means of an adjustable cross piece which is placed over the arms of the Fluorometer, exactly the same result in a vertical way is obtained by viewing the subject from beneath the same condition of muralysm having been produced. Another set of pins having been placed in position. It will be seen at once that while the first operation locates the foreign object on an exact cross-section, the second observation shows the exact position occupied by the foreign object in that cross-section. All the elements of distortion having been eliminated, the foreign body will necessarily be at the intersection of the two lines of the right angle.



In practice the surgeon indicates the first cross-section obtained by a line of India ink or iodine on the body, and is thus enabled to establish the position of the object by measurements from points on the exterior of the subject, with as much exactness as if the body or limb were actually severed at the first cross-section and presented to view.

If it is desirable to preserve a record of the observations, all that is necessary is to produce a fluorograph by substituting a sensitive plate for the field of the fluoroscope, back of the grating, and make the necessary exposure.

IMPROVED ROENTGEN RAY APPARATUS.

The increased demand by the medical profession for Roentgen-ray apparatus, which may be used with ease and certainty, and applied without fear of failure to what are now considered difficult cases, such as fracture of, or dislocation of the hip, has led Messrs. Queen & Co., Philadelphia, Pa., to institute in their laboratory a series of careful experiments for the improvement of this apparatus in the various parts. One of the most important results of these experiments is the Queen Self-Regulating X-Ray Tube, which has been fully described in previous publications. As further results important improvements have been made in induction coils, vibrators and condensers, and in the complete outfits.

In designing the new line of coils, Messrs. Queen & Co. have given careful attention to proportioning the different parts so as to get a very heavy and continuous secondary discharge with the smallest possible amount of wire. As every improperly placed or unnecessary turn of wire in the secondary winding of an induction coil increases its resistance and cuts down the volume of the discharge without proportionately increasing the length of spark, this is a point of very great importance, which has been too often overlooked in coil designing. The distribution of the wire on the secondary was determined by measuring the discharge from single coils

insulating material of the secondary. By this means it is not only impossible for the coils to break down, but small leaks which diminish the efficiency and may develop in time into serious breaks, are entirely prevented.

The induction coil, illustrated in Fig. 1, has neither vibrator nor condenser, being intended for use with an adjustable condenser and independent vibrator, described below.

The spark points are adjusted by the hard rubber disc, shown at the left of the base, which is so well insulated that

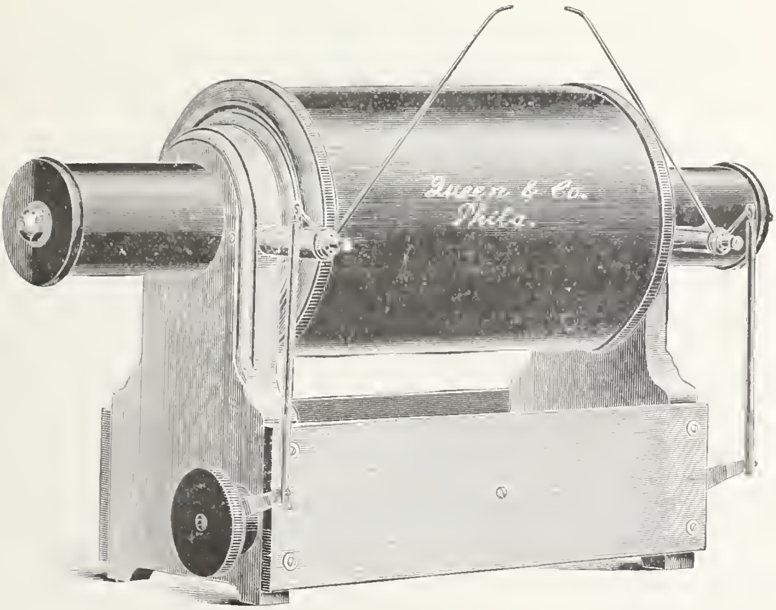


FIG. 1.

of a few turns of wire which were placed at intervals throughout the field of the primary. From the data obtained by these tests curves were platted showing the proper distribution of wire for coils of all sizes.

Similar methods were used to determine the size and number of turns of the primary, and the amount of iron in the core.

In the choice of insulating materials, and in assembling the greatest possible care is used. Methods are employed which remove absolutely all air from the

the operator is in no danger of receiving a shock, even when the points are opened out to the full extent.

The coil is finished throughout in polished mahogany and hard rubber.

The condenser and vibrator for use with coils, illustrated in Fig. 1, are mounted together, and are shown in Fig. 2. Two of the binding posts, shown at the right, are connected to the batteries or lighting circuit, and the other two to the induction coil. The vibrator is operated by means of a small coil (shown at the back of the box) which is a shunt from the main circuit. An independent set of contacts makes and breaks the circuit through this coil (they are shown in the front of the main contacts), and the switch near the binding post opens and closes the shunt circuit. The main circuit is controlled by the reversing switch, shown at the left.

The vibrator, which is a very much improved form, is shown more in detail in Fig. 3. The moveable platinum contact is carried on a small vertical spring behind the vibrator spring. When the contact is made the movement of the vibrator is not arrested, as in other forms but continues to its full amplitude, thus allowing a long "make." The length of the "make" can be varied by screwing in or out the other platinum contact. The most important advantage of this arrangement is the suddenness of the "break," which is accomplished by the collar in the vibrator spring striking the moveable contact while at full speed. In the old forms of interrupters, the break was made when the vibrator started to move, consequently it was not only much slower, but did not make use of the momentum of the iron head of the vibrator. Sometimes the welding action of the current joined the two pieces of platinum so tightly that the magnetic pull was not sufficient to separate them. In the new form, as the break is made when the vibrator is at the middle of its swing, the sudden blow with the entire momentum of the vibrator head is always sufficient to break the platinums apart, and once started, the vibrator continues in motion until the current is

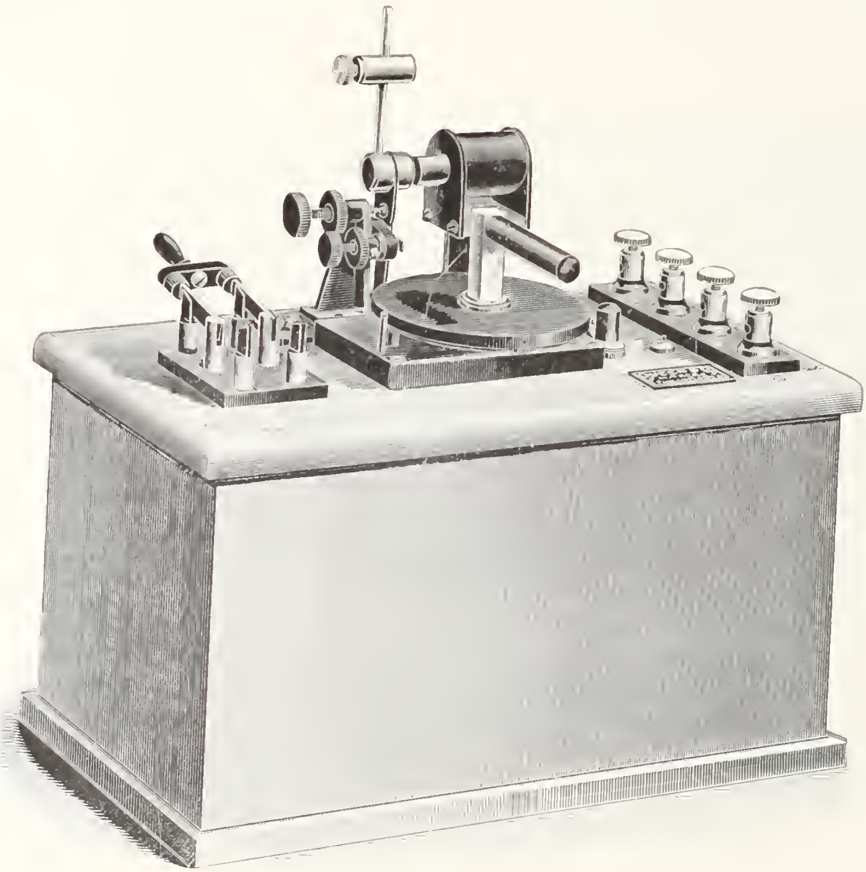


FIG. 2.

turned off. The suddenness of the break makes it possible to use this form of vibrator on the 110 volt, as well as battery circuits; it also adds very greatly to the efficiency of the induction coil with which it is used.

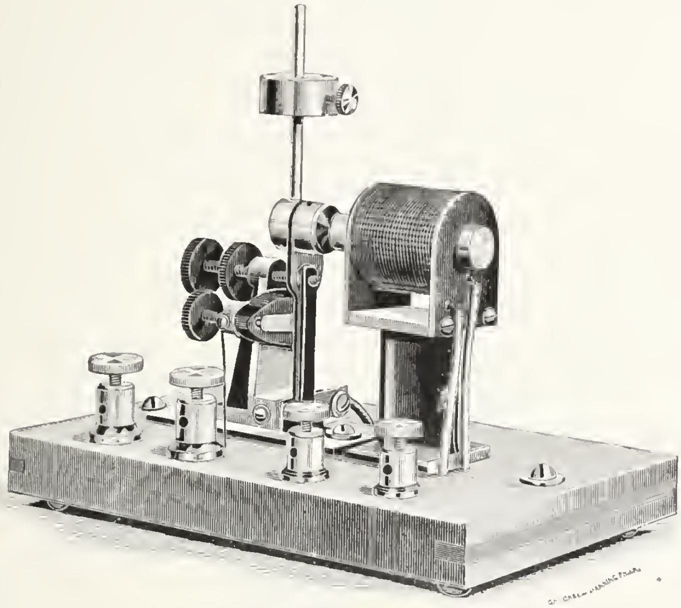


FIG. 3.

A rod screwed into the iron head carries a weight which may be moved up and down and clamped in any position with a set screw. By this means the rate of vibration may be varied within wide limits. To summarize, the new vibrator has the following advantages over older forms:

First. Its action is independent of the current going through the coil.

Second. Its rate of vibration is adjustable.

Third. It permits of a long "make," and the length of the "make" and "break" are adjustable.

Fourth. The "break" is very sudden, increasing the efficiency of the coils and making it thoroughly adapted to the 110 volt circuit.

Fifth. It never sticks.

The outfits, complete for x-ray work, consist of a coil mounted on a base, with rheostat if used for 110 volt circuit, and with an adjustable condenser, and independent vibrator mounted on the same base, as illustrated in Fig. 4. In addition to this, a number of tubes, suitable stand, fluoroscopes, etc., are included with each set.

In making up these outfits Messrs. Queen & Co. have aimed to combine the apparatus in such a way as to secure ease and certainty of operation, and at the same time powerful results.

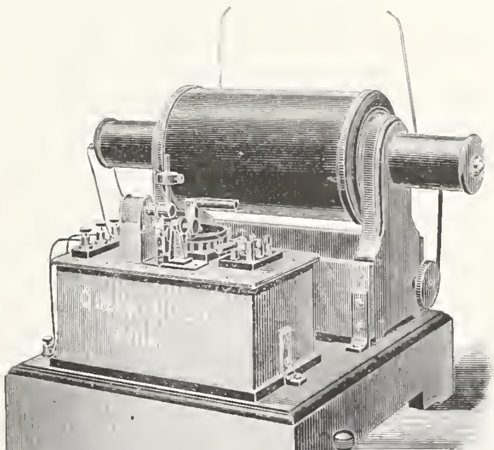


FIG. 4.

BEYOND.

BY MRS. ELLEN KNIGHT BRADFORD.
[Written for the AMERICAN X RAY JOURNAL.]

With vision clearer than e'en tears could make
The eyes whose limit was the violet ray,
We now may see, and things which lie beyond—
(Life's mysteries long screened) are ours to-day!

Yea, now we see! Blest be these mortal eyes!
The veil is pierced! How like magician's sleight
This bringing of life's marvels to adjust
Within the focus of our second sight.

And if our waiting eyes are made to see
New visions, then perchance our ears may hear
New sounds; each sense be quickened, till at last
All nature's secrets grow divinely clear!

What if our ears might catch the gentle tread
Of the Spring's coming—hear the sparkling dew
Sprinkle the lily's cup, and thro' the mold,
List the procession of the violets, blue!

If we might hear the crocus part the sod,
And come with merry face to meet the light,
Or learn the symphonies of the pulsing stars,
That breathe the benediction of the night!

Then soon, with quick perception we might find
Heaven all about us! Ah, so let it be:
That with these human senses made divine,
We may put on our immortality!

MOLINE, ILL., June 30, 1897.

The American X-Ray Journal Pub. Co.
St. Louis, Mo.

GENTLEMEN: I will take the liberty of reporting to you what is to me at least a novel and interesting surgical manipulation, and to my knowledge the only one of its kind on record.

The 15th day of June, 1897, a boy, apparently about five years old, accompanied by his father, called at my office. The boy was fair-sized, rather emaciated, large deep set eyes, a little nervous, complained of a pain after eating, with two or three small hemorrhages the past three weeks, with a somewhat profuse hemorrhage the day preceding their call at the office.

Father also stated that the boy had lost his appetite—in fact, was afraid to eat from the pain that it caused him after eating. Father stated that 17 months previous the boy had swallowed a book case key during an attack of coughing. That he had consulted a number of physicians, and they advised him to let it alone while it did not inconvenience the child. For a period of a little over twelve months little or no trouble was experienced from the presence of the foreign body in the stomach.

I, without asking any more questions, applied the fluoroscope, readily outlining the key. Not being prepared as to what course of treatment to pursue, I dated my next call June 19th. In the meantime I looked over my case pretty thoroughly. The novel idea struck me that could I procure a forceps that I could introduce from the mouth into the stomach, and thus by the aid of the x-ray extricate the key, that it would, if possible, be of least danger to my patient and most convenient for myself.

I therefore got a forceps in spiral form, made to remove foreign bodies from the esophagus, manufactured by Sharp & Smith. With this at hand, I waited for the arrival of my patient. Having given instructions not to give him any dinner or supper, I proceeded at once to give him an anæsthetic. Placing the fluoroscope over the region of the stomach, I introduced my forceps, to find that it was from two to three inches too short. Having my little patient on a Clark & Roberts operating table, I simply turned this contrivance in an inclined position, head down. This brought the key in reach of the forceps. After manipulating the forceps in the stomach for some little time, I found it difficult to bring the forceps and key in contact, as I had no control whatever of the forceps. I therefore placed my hand on the abdomen in the region of the stomach. By making deep pressure in one position or another, I could readily move the key. The forceps being more stationary, I worked the key into the forceps, as it were, but the angle did not seem to be right. I used all the force that I thought prudent. The third or fourth time I did not grip the key quite so hard, when it slightly changed its position in the active extraction, immediately after which quite a profuse hemorrhage occurred. I changed the position of the lad that the blood might not enter the trachea, and awaited his recovery from the anæsthetic, which I promoted by artificial respiration.

When he was able to swallow I gave him small pieces of ice; gave him a rather strong solution of chloride of iron, upon which all bleeding ceased.

He was taken to his home. The next morning he found it difficult or almost impossible to swallow liquids, but could with very little inconvenience swallow semi-solids, he was, therefore, given milk or water toast. Experienced very little pain; vomited considerable blood day after the operation—none since. When last I heard from him he felt well in every particular, with the exception of the difficulty in swallowing liquids, in which he was improving from day to day.

The key, which was about three inches long, was so corroded that the handle part was no thicker than a sheet of paper. The tongue of the key was so nearly rusted off that it was broken a day or so after on the slightest pressure. On that part which had fitted over the pin in the lock, the action of the acid in the stomach had access to that part of the key, both on the inside and out, was so corroded that in two or three places the circle had been destroyed, making sharp and ragged edges. Had this key remained, it would, without question, have killed the child, either from the loss of blood or inanition or inflammation, as the sharp points would only have been increased in number.

The accompanying picture is a photograph of the end of forceps and key. I am at present getting up a forceps with a little screw on the handle, so that I can turn forceps at any angle at will while in the stomach, and about six inches longer. Armed with this instrument and the L. E. Knott high frequency induction coil, with their improved Crooks tubes, I defy any metallic substance to remain in the stomach if I have opportunity to remove same.

Yours truly, A. H. Arp, M. D.

CAMPHO-PHENIQUE IN THE TREATMENT OF SEVERE BURNS.

By Frank L. James, Ph., D. M. D., St. Louis, Mo.

The results in the following case, which I am now asked to write up after the lapse of several years, were so remarkable that I would scarcely venture to put them on paper, were not other physicians who saw the case yet alive and willing to corroborate what I have to say:—

W. L. C., single, about 20 years old, white, a waiter at a cheap restaurant, was one day, some ten years ago, assisting the cook to remove from a high range, a large tin boiler full of boiling green corn. A brick, that he had stepped on, to get a better hold on the can, turned as he lifted his side of the latter, and he fell, the can being turned over at the moment, and nearly its contents thrown over him. A bucket full of cold water was thrown over him and he started for my office on a run. When he arrived at the door, seeing a little girl in the operating chair and a lady standing by, so great was his nerve, and the innate politeness of the man, that he stopped at the entrance for a moment.

I saw that something unusual had happened, and turned to ask him what was the matter. He replied in a steady voice: "I am scalded, badly scalded, sir!"

The child jumped out of the chair, and the lady bade him come in, and at once took her departure.

On attempting to remove the undershirt, large pieces of skin, some of them of an area equal to the palm of the hand came off with it. His right arm and shoulder were nearly pealed; there was a burn across the chest extending from nipple to nipple, from which the skin hung in tatters, and there was a strip of parboiled skin extending from the hip to the knee of the right leg. The left side of the body had not suffered to the same extent, but it had not escaped entirely. There were several severe burns on the forearm and wrist, and on the buttock of that side. Altogether it was the worst scald that I had ever seen in my practice of then nearly twenty years.

I was at the time experimenting with an article that had not yet been put upon the market (Campho-Phenique) and had found that it promptly relieved the pain of minor burns; so without stopping to think of the danger of phenol absorption, etc., I poured about two ounces af it into a bowl and emptied about twice that much salad oil in with it and with the mixture commenced to swab the burns. In the course of two or three minutes the poor fellow began to say: "Oh don't that feel good! Don't that feel good!" Repeating the words over and over again.

I had scarcely made the application before doubts and fears began to crowd into my mind--fears of carbolic acid poisoning (by absorption) being uppermost. After I had avourted the wounds I dusted over them plentifully some corn starch powder that I chanced to have by me, and started to ring for a conveyance to carry the patient to his rooms, two or three blocks away. He declared that he felt strong enough to walk, and that he could not afford a carriage; so throwing over him a linen duster, he was permitted to go to his room.

This was about noon, and about 7 o'clock p. m., still fearing an accident on account of the large amount of phenol contained in the agent employed (I was then only experimentally acquainted with Campho-Phenique) I went to the patient's room to see him.

I found him *sitting up*, *reading*, and inquiry developed that he had slept a couple of hours during the afternoon. As the man was comfortable, nothing further was done that evening dxcept to prescribe a saline aperient to be taken early next morning.

The next morning I received a note requesting me to visit the patient—"at my leisure, sometime during the morning, as he was feeling too sore to walk down" (to use the words of his note). I did so, found him without a fever and he reported that he had slept the better part of the night. I opened some large blisters, emptied them and dusted the surface with starch, after having applied Campho-Phenique, and left the patient comfortable.

That afternoon an accident (a slip upon the stair) compelled me to keep the house for several days. In the emergency I sent for Dr. Joe Leslie, now of Hot Springs, Ark., who took charge of C.'s case, after I had explained the situation to him.

Dr. Leslie treated the case on the lines that I had commenced, using no dressing but Campho-Phenique and starch powder, and a few days later the patient called on me and asked if I thought he could go to work.

Most of the wounds had healed completely, but there was still a bad sore on the chest and another on the knee (I've forgotten on which side) which were several days (possibly a couple of weeks) longer in healing. There were no bad scars, and needless to say no trace at any time of phenol poisoning.

Since that time, and up to my retirement from active practice, some five years ago, I have frequently used Campho-Phenique in burns and scalds, and always with the same results—rapid alleviation of pain, and rapid resolution.

I have related the experience as the events occur to my memory, after so long a lapse of time, and while I may have forgotten some points, the statement is essentially true in all respects. I consider that the entire Materia Medica contains no agent superior to, or the equal of Campho-Phenique in burns of every degree.

FRANK L. JAMES, M. D.,
615 Locust St., St. Louis, Mo.

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THE AMERICAN
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and Allied Arts and Sciences.

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HEBER ROBARTS, M. D., EDITOR,
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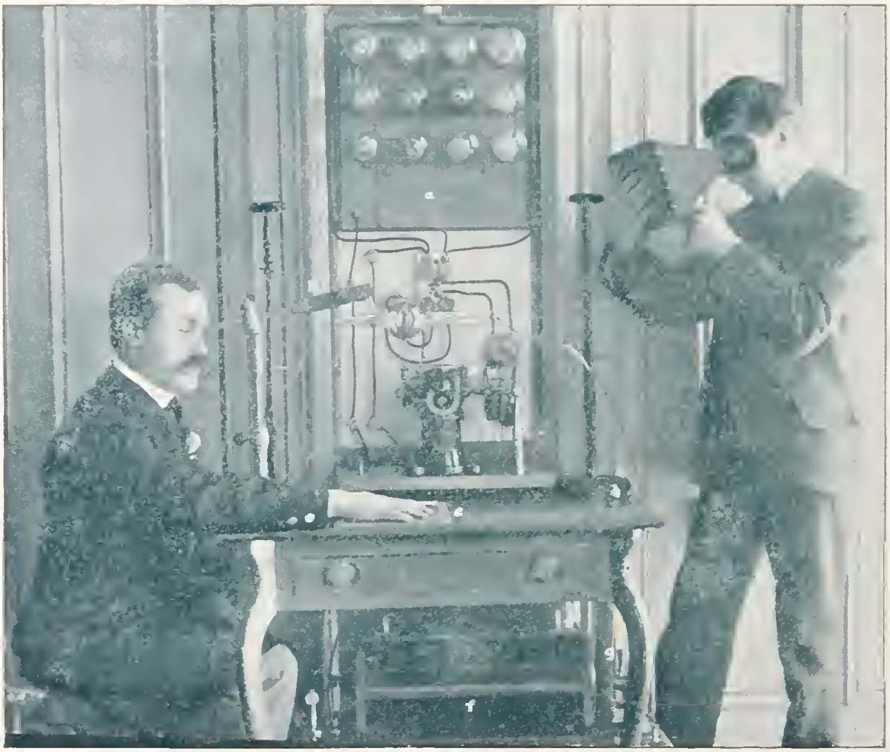
The use of the x-rays as a therapeutic agent has received a great deal of attention by the lay press, and, incidentally, by the medical journals. Cases reported to have been cured by this agent include that class of ailments which, as a rule, are considered incurable. Consumption, cancer, heart disease, and some forms of blindness are mentioned. These cases have a sensational cast which bids for eager, suffering and emotional readers; the medical journals are waiting for more tangible facts with which to guide the ways of practice.

There can be no question about the ultra violet rays passing through the body, and that the effect of this agent creates a feeling of well-being not otherwise accounted for. This self-benignity has been observed by every x-ray operator. That the rays are bactericidal must yet be proven. It is thinkable, however, that the results obtained by radiant matter within the tissues of the body, may be due to a vital stimulus, as light to vegetation, capable of engendering greater power of cure already in operation in phagocytosis, and also the eliminative functions of glandular organs.

So effective have been the action of the rays upon some persons, that though not practitioners of medicine, they have observed the change. Prof. Nikola Tesla was troubled with a chronic cough, which he noticed rapidly disappeared and was cured while working with the x-ray. He gave mention of similar conditions in other persons.

Whether it is a cure effected with the x-rays, or merely a coincidence, the following case is instructive:

J. C. S., living at 3019 Laclede Ave., this city, became a patient in Aug., 1894. He was 58 years of age, unmarried, weighed 210 pounds, which was his usual weight. He stood erect, and his general appearance was healthy. He never had a venereal disease. He had never been sick except a few months the previous year, when he complained of pain similar to the present. At that time, too, he was sore in the right inguinal region. He now complained of severe pain in and about the shoulder, extending into the fingers. The arm was quite lame. He was habitually constipated, and recently suffered with a great deal of pyrosis. His life was active and he has always been a very large eater, and especially of meats. Soreness was acute in the lower left angle of the right hypocondriac, extending horizontally across the epigastric region. After six months treatment the patient lost 25 pounds and the physical symptoms were aggravated. He sought relief from other physicians in vain. He visited watering-places without avail. In August, 1895, he weighed 120 pounds, was sallow, and looked greatly distressed. Physical examination revealed a hardened and rough induration, very painful and tender, movable within the abdomen, and extending from the xiphoid appendix to the lower border of the umbilical region in the median line. It was fully 7 inches in length and 3 inches across. The case was variously diagnosed, but the consensus of opinion pointed to a case of surgery. In August, 1896, the patient weighed 95 pounds, was excessively weak, constipated, and suffered with continuous pain in the umbilical region. Paroxysmal attacks came almost weekly, at which times his life seemed hopeless. At this time the patient was examined with the x-ray, and although the diagnosis was not made clear, it was sufficient to nullify the claim of cancer, or other fleshy growths. The condition was pronounced benign, surgery was denied, and the patient encouraged. Three applications of the x-ray with 30 minutes duration was given within a week. The patient, after the first day, noted some immunity from pain, but its full effect was not evident for a month. This improved condition lasted for some sixty days. He then lapsed into a more critical condition, and reduced to 80 pounds in weight. In March and April of this year he was again bathed with the rays a few times. The x-rays were powerful enough to cast a clear shadow of the bony structure in the fluoroscope, and the duration was 20 to 30 minutes. Sixty days after the treatment the only change noticed was less pain and better sleep. Since last June the patient has gradually regained strength and weight



X-Ray Apparatus in use in the private office of Dr. Carl Beck, New York City.

—now, October, he weighs 115 pounds; he is tolerably free from pain, and eats "everything;" nothing abnormal is felt in the abdomen. Every indication points to full recovery.

X-ray therapy commands the closest investigation. It is an agent that can be used with perfect impunity to the tissues—very unlike medicinal products. It offers greater hope than any medicinal agent gave in its early use.

THE ROENTGEN RAYS IN SURGERY.

Read before the Surgical Section of the Second Pan-American Congress, City of Mexico, Nov. 9, 189[illegible], by Carl Beck, M.D., Professor of Surgery, New York School of Clinical Medicine; Consulting Surgeon to St. Mark's Hospital, Poliklinik, West Side German Dispensary; Surgeon H. S. G. S. Orphan Asylum; Honorary President Section of General Surgery, Second Pan-American Congress, Etc.

Bullet *in situ* above elbow. First Roentgen picture of a medical case taken in New York City. Duration of exposure, one and one-half hours. [A better picture can now be taken in 10 seconds.—ED.]

At the instance of Professor Beck the cuts were kindly sent to THE AMERICAN X RAY JOURNAL, by Henry W. Cattell, A. M., M.D., of Philadelphia, Pa., Editor of the International Magazine, in which magazine the cuts and article in full appeared.

The article is most interesting and instructive, and should be read by every physician and others interested in this subject. For lack of space we can only reproduce the half tones.

FRACTURE OF THE FOURTH METACARPAL BONE.

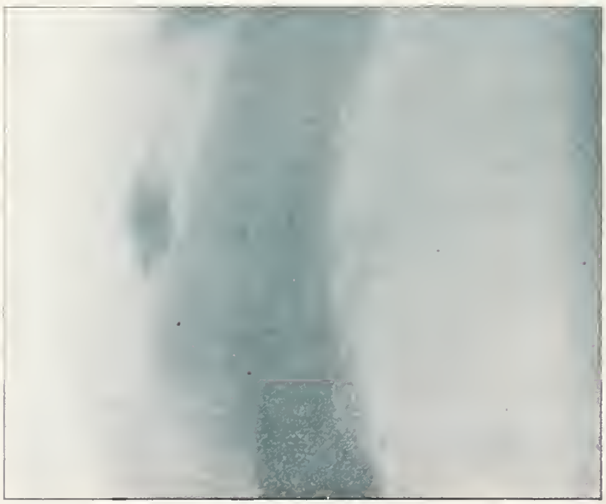
COLLES' FRACTURE. Accident five weeks ago.

COLLES' FRACTURE AND FRACTURE OF THE STYLOID PROCESS OF THE ULNA.
An enormous amount of callus has been thrown out, preventing pronation and supination.

COLLES' FRACTURE. Accident three hours ago; slight infraction of the ulna.

COLLES' FRACTURE. 24 days after the accident, the deformity being increased by extensive callus formation.

FRACTURE OF THE OLECRANON.



VICIOUS UNION OF FRACTURE OF FEMUR.
Nine weeks after the accident.

OSTEO-SARCOMA OF RIGHT RADIUS.

Partial resection of left ankle. Partial removal of right second, third, fourth and fifth metatarsi and of the os cuboideum.

Resection of knee-joint for tuberculosis.

THE X RAY PICTURE OF THE LIVING HUMAN HEAD.

BY WILLIAM JAMES MORTON, M. D., NEW YORK CITY.
(From *Items of Interest*, New York City.)

To those actually familiar, in practice, with the fluoroscopic and photographic revelations of the Roentgen ray, the exhibit is still a source of never failing wonder and admiration. But the public mind, fed by the sensationalism of the daily press, and satisfied to substitute its own imaginative processes of what might be, for what really is, expects of the x-ray, revelations of the human interior not yet nor probably ever attainable. We all recollect how during the period of the early announcement of Roentgen's discovery, statements were made and pictures exhibited purporting to show the structure of the brain, its veins and arteries, its convolutions, greater centers, etc.

These results I have never been able to repeat nor substantiate. And since negative evidence, on the basis of diagnosis by elimination, is often quite as valuable as affirmative, I reproduce in these pages an x-ray picture of the living human skull which, as I believe, represents the highest perfection of actual accomplishment yet recorded.

Compound fracture of the tibia, caused by the new army bullet. Shot from 50 yards at Governor's Island, New York.

This picture is chiefly remarkable, so far as it relates to the topographical and structural anatomy of the brain, for what it does not show. (Plate I.)

The subject was a boy of twelve and one-half years of age. I took the picture at the request of his parents, to see if any cause could be disclosed for

PLATE I.

frequent attacks of the epileptic *petit mal.* The usual focus tube was employed, and according to my usual custom was placed at a distance of two feet from the sensitive photographic plate. The duration of the exposure was fifteen minutes. An inspection of the print shows that the x-ray passed abundantly and freely through the head to the plate. The flesh and bones of the face indeed seem to have exerted scarcely an appreciable obstacle to its passage. In the present case a piece of depressed bone was suspected, but it is reasonably positive that no such depression exists. It is certain, however, that the convolutions of the brain, and their specific relation to their envelope of bone, have left behind them upon the plate a fairly definite record. This record I will not here attempt to interpret. Further similar pictures will be required to corroborate the localizations here evident. Fascinating as such a field of exploration may be to the neurologist, it is, however, as has been said, very different from the false x-ray pictures of the brain, heretofore represented, and I am not without hopes that the x-ray, still in its very infancy, may yet prove to be of inestimable value in brain as well as in other surgery.

If we turn from the skull contents to the facial region of the head, we find some points which may prove of real interest to dental surgery. These points are both affirmative and negative. Affirmatively, the existence and position of certain teeth not visible to the eye by ordinary inspection, are made clear, and their stage of development is disclosed. Negatively, we are assured (by comparison of this print with other prints of the normal skull) that no deviations, malformations or abnormal osseous growths, dental or otherwise exist.

Dr. Ottolengui, who was quick to appreciate the dental features of this x-ray picture, has kindly consented to make the interpretation, and to him I cheerfully leave this branch of the subject.

In conclusion I can hardly refrain from alluding to the great injustice which is now being done to legitimate x-ray work by those who cause severe burns and injuries to patients. This is wholly unnecessary and entirely due to lack of skill and knowledge. So great has been the impetus to investigate Roentgen's discovery that a mass of inefficient apparatus has been placed in inefficient hands. The burns, necrosis of the derma and depilation recorded are invariably due to long exposure, or nearness of the patient to the tube—because of a weak and inefficient x-ray. Never in my experience, and I have continuously taken x-ray pictures of every sort since the first announcement more than a year ago, have I seen the slightest injury to a tissue result. This I believe to be due to the fact that I have used a powerful x-ray and have thus been enabled to place my Crooke's tube at a considerable distance from the patient. My minimum distance for any work has been eighteen inches, my average distance, from two to three feet, and I have recently taken a picture of the entire adult figure, showing the skeleton bones, at a distance of four and one-half feet.

These remarks I make, not to take any credit to myself, but rather to aid others to seek the right path, and thus avoid casting an unnecessary and undeserved opprobrium upon this new and marvelous addition to our means of diagnosis.

Dr. Morton having very kindly presented this most interesting picture and article for publication, I am only too willing to interpret the dental aspect of the picture. Being desirous of presenting the whole skull, it was necessary to reduce the photograph in reproducing it, as the print was of life size. In order

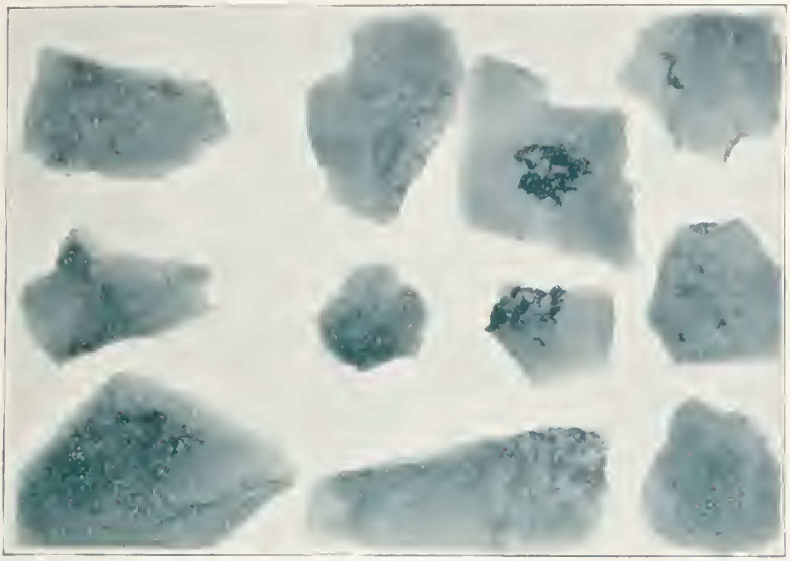
Fig. 1.

Fig. 2.

PLATE II

Fig. 3.

Fig. 4.



Solid quartz showing gold. Specimens from Randsburg, Cal., and Aurora, Lower California. Taken by x-rays July 20, 1887, by Dr. F. E. Yoakum, Los Angeles.

therefore to bring out more clearly the details of the mouth parts, a second picture has been made, showing that region in full size. (Plate II.)

The first features which will attract the attention of the dentist are the two triangular sharp pointed projections in the fore part of the jaws. At first one might imagine that we have here some one of the lower animals, heretofore unknown, armed with terribly powerful mandibles, which would place the creature half way between the elephant and man. But the subject was a very mild mannered human child, endowed with no oral armament beyond normal. The explanation of the triangular shadows is that the Crooke's tube being necessarily at the side of the head, we obtain a profile view. Consequently, remembering the curve of the jaws anteriorly, and the narrowing at that part, we find that the shadows of the teeth on both sides of the jaw, the hypotenuse of the triangle being made sharply distinct by the progressive absorption of the teeth posteriorly.

To be more explicit, the sharper part of the triangular shadow in the upper jaw includes the two central and the two lateral incisors, while the base of the shadow includes the cusp of the forming cuspid, plainly visible in the film, though not so distinct in the illusiration. In the lower jaw, the triangle is somewhat differently produced. We have a deeper shadow from the process because it is thrown by the bone of both sides, and the upper edge of the triangle is outlined because the thin roots of these young incisors, largely filled with pulp tissue, and not yet of full length, have not resisted the passage of the light, so that the crowns appear, with the roots almost unindicated. The cuspid is seen faintly rising from the shadow, but is not yet sufficiently calcified to cast a deep shadow. The bicuspids, however, which must appear at an earlier day are more developed, and are plainly outlined, the resorption of the roots of the temporary molars being beautifully shown, especially the posterior root of the second temporary molar, which, as usual, is more resistant. A point of great interest here is the distinct space shown between the erupting bicuspids and their predecessors, the temporary molars. This proves that the resorption of the roots of the

Radiograph of a Canadian penny in the esophagus of a child three years of age.
By Dr. Pitkin, Buffalo, N. Y.

temporary teeth is not due to an irritation caused by actual contact or abrasion, but rather that the resorption being a physiological expectation, a thick layer of odontoclasts are normally present and at work decalcifying the roots.

Another interesting feature of the picture is the condition of the twelfth year molars, still in the bone, but with scarcely any roots, the third molars casting no shadows at all, being at this age still a pulp mass.

The faint shadow below is the outline of the opposite inferior maxilla, which has been impressed upon the plate because the head was slightly tipped towards the x-ray which it must be remembered was on the side opposite to that which is distinctly shown—thus the jaw bone nearest the light is but slightly depicted. R. OTTOLENGUI.

[The radiographs were kindly loaned to the AMERICAN X-RAY JOURNAL by the editor of *Items of Interest*.]

Perhaps the strongest propensity manifested by a little child is to keep the alimentary canal replete with promiscuous material, digestible or otherwise, marbles, buttons, jackstones, pennies, nickels, etc., etc., are all consigned by the little one to the primæ vial. Pernicious and disastrous as the habit may prove to the juvenile's well-being it promises a fruitful field for research and profit to the expert Roentgenian.

On June 2d of the current year a three-year-old lad of Italian parentage was brought to The Buffalo Electrical Sanitarium with the following history:

One week prior to his admission to this institution a large Canadian penny had suddenly disappeared. Since that time he had complained of pain in the chest and was unable to deglutate solid aliment.

Fluoroscopic examination revealed the presence of the missing coin in the child's æsophagus two inches above the cardia (see accompanying skiagraph).

So securely was this semblance of her Royal Highness grasped by his gullet in the year of her jubilee that probes, bougies, brushes and forceps per ovum failed to effect its dislodgement.

An anterior meseal incision was therefore made in the cervical region at its junction with the body, the trachæ and great vessels were pressed to one side and an entrance to the chest effected beneath the sternum. The æsophagus was located between a sound passed through the mouth and the exploring index finger in the thorax. The tube was then raised and an incision made through which the penny was extracted.

During the operation no air was admitted to the pectus, hence touch was the only sense that could be utilized, the pulsating heart and great bloodvessels felt beneath the index finger served to warn me of their presence and told their exact location. The patient suffered but little from the loss of blood. Had it not been for the x-rays, with which we were able to determine the presence of the penny such an extreme procedure would hardly have been warranted. It is in this manner that we learn how much we owe to their discoverer, Professor Roentgen. Let us pay to him our everlasting tribute of respect. JOHN T. PITKIN, M.D.,
Buffalo, N. Y.

DIAGNOSIS WITH THE ROENTGEN RAY.

BY H. C. MCBRIAR, D. D. S., MIDDLETOWN, N. Y.

That the sciagraph, or photograph taken with the Roentgen ray is destined to be of service to the dentist as well as to the general surgeon, is amply proven by the following cases from my practice Both of these patients suffered with neuralgia, that ailment which converts so many into human shuttlecocks, to be referred from physician to dentist, and from dentist back to the doctor.

In the first case, the sciagraph gave a

negative result which, however, was of value because it was thus ascertained that the pains were not of dental origin. The teeth were all perfect and unquestionably in a healthy condition. But the origin of the pain seemed to indicate that there might be an impacted wisdom tooth. The sciagraph, however, dispelled this theory, no sign of a wisdom tooth being evident (Plate III. Fig. 1.)

In the second case the neuralgia was equally severe and mysterious. A sciagraph was made and disclosed the presence of pulp nodules, or secondary dentine formations, in the root of the lateral incisor, at the point marked in the picture (Plate III. Fig. 2), the upper half of the canal showing clear, and thus indicating the presence of live, soft tissue only. The canal of the cuspid is shown to be clear through, while a root filling in the molar shows a dark shadow. All of these details are much clearer in the films than in the photograph (or half tone reproduction) because in the former we have a chance to examine the picture with transmitted light.

The pulp of this tooth being removed the neuralgia disappeared. Without the sciagraph there would have been no more reason for opening the lateral incisor than for so treating either of the adjacent teeth.

THE ADVISABILITY OF X RAYS.

By S. H. Monell, M. D., Brooklyn, New York.
Chief Instructor of the Brooklyn Post-Graduate School of Clinical Electro-Therapeutics and Roentgen Photography; Fellow of New York Academy of Medicine, Kings County Medical Society, Etc.

Scattered through the East and West, all over these United States, are physicians who followed to its crest the first wave of popular x-ray enthusiasm, who spent time and money freely in breaking tubes and puzzling over apparatus they little understood, who recognize the value of Roentgen's discovery in many diagnostic examinations and still aspire to share its benefits, but who accept the verdict of certain medical journals that x-rays are not available for the general practitioner. While it may be more brilliant and startling to report in these pages some new discovery of the nature of luminiferous vibrations yet it seems to me that the greatest practical need now existing in regard to x-rays is to bring up the profession to the height of present development.

The value of high efficiency x-rays in surgical and even medical diagnosis cannot be disputed. If, however, none but a few specialists can procure reliable and adequate effects and x-rays are barred to the great mass of physicians the whole world must share in the disappointment, for millions of people live remote from these "few specialists." The belief that the average physician cannot employ an instrument which has revolutionized the examination of surgical affections in a single year is mischievous and prejudicial to medical progress. When a leading medical journal publishes the statement that, "the fact remains the same that x-ray photography, while frequently individually successful, has no success in the long run," we must stamp the statement with emphatic disapproval. On the contrary there is scarcely a practitioner who desires to produce the most brilliant and reliable x-ray effects, and who will devote a reasonable time to the technique who cannot soon equal the work of the leading specialists. This is as it should be, for no monopoly of so great a blessing as Roentgen's discovery is desirable. To make the fact known then, that a Crooke's tube will respond to the humblest as well as to the most "eminent" practitioner is one of the most important missions of The American X-Ray Journal at present.

What is required? Why, simply correct apparatus and the "know how" to use it.

Is the art of manipulating a superb Crooke's tube difficult and does it take long experience? On the contrary it is simplicity itself and full instruction in the best technique involves but a couple of hours' time. This fact may be reassuring to the thousands who have "tried and failed" or who have as yet no measure of real x-ray capabilities beyond the dim glow of some inferior tube they have seen poorly operated, by a non-expert. Ninety-nine out of every hundred physicians would to-day be astonished could they enjoy an actual demonstration of the powers of a fine Crooke's tube glowing with splendid radiance. Yet equal results are possible in their own offices. In two of my articles (referring to the improved tube developed by me) I have described effects which I easily demonstrate to those who come to me for instruction. They are easily obtained and any one can do the same, yet from all quarters I receive letters saying, "The results that you obtain are really marvelous," and followed by many inquiries as to methods and apparatus. I do not wish my reports to be considered "marvelous" but I wish it to be made generally known that all I am able to do with a Crooke's tube can be done by any one who cares to learn how. It takes but a couple of hours to give in a practical object lesson the whole art of tube management in which success depends. There is no excuse for disappointment, or disaster, x-rays are available for the general profession. Their use need not be confined to a few. The cost of apparatus is now less than formerly, and the cost of complete instruction is nominal. With the author's form of tube breakage rarely occurs and the average physician can readily produce x-rays which will afford, for instance, the following effects:

Metallic objects through a piece of half-inch board are visible in a completely darkened room at forty or more feet from the tube, while at fifteen feet they show clear and sharp definition. With volumes of books aggregating 3,600 pages, plus heavy board covers piled in front of the tube the rays render the same objects clearly visible, while through a double foot plate of sheet copper the hand is visible from twelve to twenty inches from the tube. The mechanism of the hand, wrist, arm, ankle and all small and thin parts appears upon the fluoroscope three feet from the tube. Between the distance of thirty-six and twelve inches from the tube all gradations of transparency, such as the surgeon may require for these parts, are secured. When the object is nearer than twelve inches the bones become sufficiently transparent to allow the ready detection of a broken needle embedded in the radius or ulna, or bones of the hand, one of the most difficult of foreign bodies to locate with the fluoroscope. The shoulder and knee joints are also quite distinctly shadowed at three feet from the tube and the increase in transparency up to six inches is adequate for full surgical examination.

These effects are usually produced on the instant with no tedious delay whatever.

Those who have spent hours over a tube requiring even the hand to be held within a few inches of it may compare the above with their experience.

But it is perfectly easy to go much beyond this. The thick bones of the skull yield to the penetrating effectiveness of rays which are within reach of all physicians who desire to employ them. The head of a grown person viewed through the fluoroscope from side to side at all distances from three feet down to four inches between the bulb and the ear shows increasing transparency, until not only the lighter portions—frontal sinus, antrum, nose, etc., are illuminated, but any metallic object placed opposite the thickest part is plainly seen wherever it is moved by the hand, showing that a bullet anywhere in the head could be quickly located with ease. At the maximum of radiance the transparency of the skull is about equal to the transparency of the hand with ordinary tubes and inferior apparatus.

The spinal column and the osseous detail of the trunk are visible in clear outline and may be studied in different degrees of transparency at various distances up to three feet. The detection of a bullet, fracture or dislocation is thus assured with the fluoroscope alone. While a photograph may, if desired, be secured in five minutes' exposure, instead of the half hour formerly required for the trunk of the body.

At between three and four feet from the tube the heart of an ordinary man is seen in nearly normal position and size. In a man of spare build the heart is as plainly seen, in as sharp detail and definition as is the hand held behind the fluoroscope. These practical test demonstrations prove an efficiency adequate for rapid surgical examinations in all parts of the body. My remarks here do not apply to occasional flashes of great radiance followed by days without again being able to produce a similar view but refer to effects which are reproduced at will at different times with different tubes and which may be equalled by all physicians who follow my teachings.

The ready recognition of functional derangements which may occur in any tube and the knowledge of how to correct them constitute the basis of satisfaction in x-ray work. It is a great economy of time as well as an unspeakable comfort to be able to step from guesswork to certainty in understanding the behavior of a Crooke's tube; to know at a glance or by a moment's test whether it is a good tube or a poor one; whether it can be coaxed into working form or is hopelessly impaired. The physician who has learned how to tell at once what is the matter with a refractory vacuum tube and how to correct the trouble has made a long step towards satisfactory x-ray work. It is the state of doubt as to the significance of phenomenon visible within a badly working tube which perplexes and distracts the uninstructed physician. Operative skill is not a vague, intangible chance "prize in a lottery," it is a definite, practical, easily acquired technique which almost any physician can obtain in a few hours. A judicious appreciation of this fact will put a different aspect upon the question of utilizing x-rays in the minds of the great majority of physicians.

ROENTGEN RAYS IN ANALYSES.

Dr. Ferdinand Ranwez gives the results of experiments with the x-rays to detect impurities in saffron. The plan adopted was to wrap a gelatinobromid plate in black paper, place the saffron on this on the same side as the sensitive film, and allow the rays to act for four minutes, afterwards developing and fixing in the usual manner. The presence of barium sulphate, potassium nitrate, and similar adulterants may be sharply indicated in the resulting radiograph. *Ann'ls de Phar.*

X-RAYS AND THE RETINA.

The Roentgen rays should be visible, Dr. Brades, of Halle, has assumed, to an eye from which the lens has been removed, as in the treatment of a cataract. He has succeed in finding a girl who can see the rays with her left eye, from which the lens have been taken. while her right eye, which is normal, sees nothing. He asserts that the rays affect the retina, and that the light can be seen by normal eyes if the head be enclosed in an opaque vessel near the source of the rays.—*Medical Times.*

WE WANT TO KNOW.

BY HOMER C. BENNETT, M.D., M.E.

If the Roentgen rays, that are way ahead,
Will show us in simple note,
How, when we ask our best girl to wed,
That lump will look in our throat.

If the cathode rays, that we hear all about,
When the burglar threatens to shoot,
Will they show us the picture without any doubt,
Of the heart that we feel in our boot.

If the new x-rays, that the papers do laud,
When the ghosts do walk at night,
Will show 'neath our hat to the world abroad
How our hair stands on end in our fright.

If the wonderful, new, electric rays,
Will do all the people have said,
And show us quite plainly, before many days,
Those wheels that we have in our head.

If the Roentgen, cathode, electric, x-light,
Invisible! Think of that!
Can ever be turned on the Congressman bright
And show him just where he is at.

Oh, if these rays should strike you and me,
Going through us without any pain,
Oh, what a fright they would give us to see
The mess which our stomachs contain!

Lima, Ohio.

LYNN, MASS., Sept. 3, 1897.

The X-Ray Journal No. 2914 Morgan St., St. Louis, Mo., Heber Robarts, M. D., Editor.

DEAR SIR: Dr. N. Stone Scott has undoubtedly done a great service in putting the results of his inquiries into the causes of x-ray injuries into such form as to be available to the general reader through the means of your valuable journal.

There are some remarks which he makes, however, which I must take exception to; for example, on page 58, he states that I advanced the theory that the burns are caused by ultra-violet light. I am not aware of ever having advanced any such theory, except in so as it has been my ideas that the x-rays themselves are extremely high-pitch rays, beyond the ultra-violet. On the contrary, from the first I discarded all theories as to the cause of x-ray burns for the one which was the most obvious to me, namely, that the injuries were caused by the rays themselves, or a certain set of rays, probably those of the lower wave lengths, emitted by the tube and known as x-rays, these lower wave lengths being included with the higher wave lengths.

I have seen no reason to change my original opinion that the injurious rays are the most easily absorbed of the Roentgen rays, or the lower wave lengths of the Roentgen order so to speak. My experiments, which Dr. Scott has alluded to, were made for the express purpose of showing that this was the correct view. The first experiment was made to find out, in the first place, if injury would follow what would be equivalent to a long exposure to the rays. It did follow. The extent of the injury and other circumstances showed to me that it was without question due to the radiation and not to electro-static, ozonic, or other effects. My second experiment proved, conclusively, that the rays and the rays alone were the cause. It is not worth while to discuss whether they act through thermal effects, electrical effects, or electro-chemical effects, or by purely mechanical effects, as nobody knows anything about that part of it. That injuries can be caused by electro-static streamers under the circumstances which produced injuries in my second experiment, namely, through aluminum foil, is impossible.

I have no doubt that the condition of the subject will have an influence on the extent and character of the injury, and I further have no doubt whatever that if a sufficiently long exposure be given and the tube be at the time evolving the apparently lower order of Roentgen rays in quantity, injury will follow, and that the injury will be due to the absorption of these lower pitch rays within the tissues. I feel sure, also, that we know nothing whatever of the manner in which these rays produce the injury, or how they act, and it is idle to assume that they act in any particular way unless we get more information upon which we may base our assumptions. I am also convinced that no examination, either by the fluoroscope or by photographic plates, need ever be prolonged, or be made under such conditions, as will involve any considerable risk of x-ray injury. Yours truly,

ELIHU THOMSON.

INTERNAL RAYS.

Prof. S. P. Thompson, in a letter to L'Eclairage Electrique, explains the distinctive properties of a new kind of rays, which he has discovered inside the x-ray tube, and which he calls "internal rays." These rays which we have already shortly described in our report of the British Association meeting at Liverpool, says the English Electrical Review, differ from the Roentgen rays in being deflectable by a magnet, and from the cathode ray, in being given off in every direction from the surface of the anti-cathode. Prof. Thompson's attention was first drawn to these rays by observing that the boundary line of the fluorescence in the focus tube was displaced by a magnet, while no displacement of the corresponding line on a fluorescent screen held outside the tube was observed. Evidently, then, there were some deflectable rays flowing along withthe Roentgen rays inside the tube,but unable to pass with the latter through the glass. These rays do not appear to us to be so different in kind from the Roentgen rays as to require to be characterized by a special name. If Lenard's theory of the difference between the cathode and the Roentgen ray be correct, the two kinds of rays regarded from the point of view of magnetic deflectability pass into each other by insensible gradations. Though Prof. Thompson says internal rays do not pass through the glass, they must be able to pass through the sides of an aluminum tube, in which case they would merely be a variety of our old friends, the Lenard rays. There appears to have been a great tendency lately among the X radiationists to mistake mere varieties for new species.

When you have a poorly nourished patient afflicted with a tape-worm, cause him to abstain from solid food for supper and eat no breakfast. At 10 o'clock in the morning give him a two-ounce emulsion holding four drams of Merck's essential oil of male fern and one-half dram of chloroform. In 50 minutes administer two ounces of castor oil containing one drop of croton oil. Now direct the patient to lay upon the table convenient for x-ray examination. With the fluoroscope the intestinal movements are recognizable and the study facilitated by aid of the instantaneous cut-off. Within 20 minutes following the second dose of medicine the worm will pass in one mass.

HAIRY NÆVUS TREATED BY THE X-RAYS

Leopold Freund (Wien. Med. Woch., March 6, 1897) reports the results he has obtained from the treatment of a pigmented and hairy nævus reaching from the nape of the neck down almost to the folds of the nates, and extending over the whole back, the sides of the thorax, the shoulders, and the upper half of the right arm. The back was exposed to the rays for two hours every morning at a distance of four inches from the tube, the cathode rays being employed. For ten days no effect was produced, but on the eleventh the hairs began to fall out in bundles, and this continued to an increasing extent for eight days, when a slight dermatitis appeared, which soon yielded under the use of ichthyol. By this time the neck and interscapular space had become quite bald. The actual cause of the falling out of the hairs appears to have been a slight inflammatory change, followed by atrophy of the follicles. No attempt at regeneration had taken place within six weeks.—*British Medical Journal, May 8, 1897.*

THE ROENTGEN RAY.

Dr. E. Bock suggests in Memorabilien for February that if letters are painted on a sheet of cardboard, afterward varnished and dusted with powdered metal, or if the leters are made as gold leaf is applied, the Roentgen rays will throw their shadow through the opaque cornea of the blind; and if the optic nerve is still sound, the blind person will see the shadowgraph thrown on the retina. He urges experts to experiment in this line with persons who have lost their sight from opacity of the cornea, etc., and quotes Professor Eder, of Vienna, as authority for its feasibility.

THE TRUE PLACE OF THE X-RAYS IN THE DIAGNOSIS OF ABNORMAL CONDITIONS.

Dr. Nicholas Senn, in his presiddential address before the American Medical Association, said: "Translumination of the body by the wonderful Roentgen ray is the last and most important addition to our diagnostic resources in medicine and surgery." These words from so eminent and honest authority as Senn, can not otherwise than meet with the serious consideration of every thoughtful worker in the domain of science. And while the advantages in diagnosis by means of this agent are marvelous indeed, we must study to ascertain the true scope of its utility and the evils that sometimes arise from its employment. Indeed, we have no agent, however good, that is of universal utility, and we have no instrument, however important, that can not have its true function so perverted as to accomplish harm. The scalpel, which has brought relief to so many thousands of suffering human beings, has sometimes wondered into regions that would have been better off without it. Anæsthetics, that have taken away the pain of surgery, have gathered at least a few prematurely to their reward in the great unknown. In fact, those remedies which have served us best have sometimes made us sorrow most. And the way in which we can know the true value of the Rœntgen ray is by a study of the reports of all observers. And I must confess that in ophthalmic and laryngological practice, so far as my experience has extended, the value of the x-ray is confined to the locating of certain foreign bodies and the determination of certain pathological states of the bone. As to the evil results I have had no experience whatever, and out of a few hundred cases that I have examined with this agent I have failed to discover any unpleasant effects. But other observers have reported some very interesting morbid changes that have been produced by the influence of this weird and mysterious force.

THE BLIND AND SENSITIVE ELEMENTS.

A story hails from Russia about a new instrument for making the blind to see, said to be the invention of Dr. Noishewski. The principle of the instrument is the sensitiveness to light of selenium and tellurium, both of which change their quality as conductors of electricity with a variation in the light to which they are exposed. In stating that the blind can "see'. by this instrument, a relative meaning, only, is indicated. While their actual vision will be unaffected, they will feel the various effects of changing light by its action. It is claimed that Dr. Noishewski has enabled a totally blind man to find the windows in a room, and after a little practice, to distinguish approaching men from approaching animals. It is further stated that the inventor is at work upon improvements to his device, which he hopes to make so efficient that the blind will be able to tell almost to a certainty when they are approaching opaque or transparent objects.

X-RAYS AND CANCELLATED DISEASE.

French surgeons have succeeded, with the aid of x-rays, in producing photographs of the bones of a living person which reveal the existence of disease in the center of the bones, while the outer portions are sound.—*Ex.*

Every railroad corporation should be in possession of an x-ray apparatus. X-ray machines are exceedingly simple. They reveal every portion of the interior of the body; they can be worked by any railway surgeon; they furnish the most important diagnostic means of the nineteenth century.

Fluoroscopy, and, if possible, radiography should be made of every injury received upon the road. Immediately after the dressing of the injured person a picture should be taken, and again when the patient is discharged. These are unerring records for the benefit of all parties concerned, and of vital worth in case of litigation.

The name or actual existence of a medical staff of railroad surgeons will be insufficient evidence, even when arrayed, to shield a corporation against the conquering evidence of an x-ray picture. Radiographs will be had by the prosecution when it is too late for the defence to correct their mistake. The trend of legal thought is to individualize culpability in these cases, and managers must awaken to the responsibility. The time has arrived when courts of equity, or courts passing upon unwritten law, will instruct severely against corporations or managers failing to provide reasonably for their injured—the possession of an x-ray apparatus.

CAUTION.

With the advancement in science, construction rapidly progresses. At the present time, and in the field of x-ray apparatus and appliances, the physician is confronted with a knowledge, accumulation of data and facts that is likely to set his brain whirling in order to clearly make a selection of goods suited to his use. He is likely to correspond with various manufacturers of such wares, receiving from each descriptive matter illustrating their particular form of construction and the merits of their goods. While he may be peacefully contemplating a selection, believing so far as his knowledge of the science will permit, that he is making a wise choice and securing goods exactly suited to his purpose, his attention is called to circular matter received through the mail upon the very goods he is contemplating a purchase. Carefully opening the circulars, his eye is attracted to the prices.

He looks with amazement to the cost of the goods as revealed by the circulars, and the prices quoted from some reputable house. Instantly he resolves to delay the purchase, and make further inquiry. He corresponds with his new formed acquaintance as to the grade of wares, and in due time receives an answer that they are all that could be wished for—the apparatus the best manufactured, the outfit the most perfect possible, and the definition far superior to an apparatus of eight or ten times the value. Like human nature, he glories in the fact that he can save unto himself an amount of no little value, and hastily proceeds to order the outfit from his new formed acquaintances.

In due time the goods will arrive. They are placed in shape, according to directions. The apparatus may have a capacity to glow a small tube; it may, also have the capacity to penetrate a small dense mass, so as to just glow the screen of the fluoroscope. This is what the maker calls a perfect outfit. To have the screen of the fluoroscope illuminated slightly by the x-ray is anything but satisfactory to the definition sought for in practical work. The physician at once is dissatisfied, denounces the maker of the outfit in measured terms, but to no purpose. The circular matter has been so carefully prepared as to leave beyond a question no part for redress. It is the same old story of the desire to save a little in the original cost, and the purchase of unsatisfactory apparatus. It can hardly be expected that a physician should be required to have complete technical knowledge of all the sciences, and therefore it would prove greatly to his advantage, greatly to his saving of money, and greatly to his success if he would clearly outline to any ordinary manufacturer what his wishes are as to the goods he desires to secure. He would then in turn receive the information and cost of an outfit suitable for his conditions. What would suit one operator would be wholly inadequate for another. Thus it would be useless to force one to the purchase of the exceedingly expensive outfit when the use would not demand. In the line of x-ray work, the definition of the outfit is one of great importance. To have a screen show the effect of the illumination, and to be unable to define the shape of the image or parts under examination, clearly reveals that the outfit is an impractical one, yet it produces x-rays beyond all questions of doubt. On the other hand, the ordinary practitioner when possessed of an outfit designed for ordinary surgical diagnosis would have within his range an outfit that would clearly define the extremities of the body, such as the arms, hands, and the lower extremities. The apparatus which would clearly define the parts, as enumerated, would by no means be of service in making definition through the chest and abdomen. An outfit that would produce good definition through the larger sections of the body cannot be secured for little money. The various parts must be made perfect and thoroughly tested. For surgical diagnosis, such as ordinary accidental cases of the extremities, dislocations of the extremities, a small outfit of much less cost would prove equally as satisfactory in the hands of the regular practitioner. It would give him the opportunity of making a record by photographs of the surgical work upon the case or the setting of the limb and filing same as against a suit in the future for malpractice. Strange as it may seem, circular matter has been distributed to the profession, and most boldly announcing complete x-ray outfits for the sum of $15.00! If we stop to consider a little, and sum up the various parts that are necessary to make an outfit simple and complete, we would have a value in a poor tube, a cheap tube holder and a cheap fluoroscope, exceeding in cost the price asked for the complete outfit. Now what becomes of the cost of the more expensive part, which is the device for generating the high potential energy? The circulation of such literature is wholly misleading, and is simply done to catch the money of the profession, regardless of any merit that may be attached to the outfit. The class of wares that the profession desire have long passed the era of toys, and let us hope that the science may not retrograde to the age of mechanical toys. A science so noble and captivating, so instructive and revealing to the advanced mind, must progress upon the pure lines of science, and should demand the highest type of wares. To be exact and perfect in our doings we should have such instruments of application or measure as to carry us as far as possible beyond the range of error, and into the units of perfection. To be of service to mankind is to be of service to the world. Do not let us fall into the habit of securing that which is cheap, because cheap goods are purchased for exactly for what they are. They never prove satisfactory; they can never reap the benefits as would accrue from the use of higher class wares. With good instruments we accomplish much. With poor instruments we accomplish but little. The reputation of a practitioner may many times be at stake, simply through the use of inferior goods. Let us not encourage such. Let us, in making purchases, select goods of known value and honor, not at exhorbitant or fabulous prices, but at legitimate values. All reliable manufacturers are only too pleased to give their years of experience and knowledge in the line of their specialties for the benefit of the profession, as against the many misstatements of those constructing goods and making sales, seeking simply the money from the profession in exchange for wares that prove useless. Let us affix upon our minds the facts that we should first consider, not what the original cost may be, but what is the cost to maintain.

THOMAS F. LIVINGSTON,
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New York, N. Y.

IMPROVEMENTS IN INDUCTION COILS.

The study of Roentgen-ray phenomena has caused a diligent study on the part of many experimenters for the improvement of the familiar Ruhmkorff induction coil. The suggestions made by Mr. George T. Hanchett in another column, seem so eminently and sensibly practical that it is to be hoped that the directions indicated by him will be closely followed by experimenters interested in this subject. The induction coil, as it has been constructed, is a highly inefficient piece of apparatus. While many improvements have been made upon it recently, there still remains much room for further progress.—*Electrical World.*

LIFE AT WASHINGTON.

The inauguration of a President, the selection of his Cabinet and the seating of a new Congress give especial timeliness to the remarkable series of articles on various phases of the government by Secretary Herbert, Postmaster-General Wilson, Attorney-General Harmon, Senator Lodge and Speaker Reed, to be printed in THE YOUTH'S COMPANION during 1897. This series of articles and the many other brilliant features promised for 1897, show that now, on the eve of its seventy-first birthday THE COMPANION is as wide-awake and as progressive as ever. THE COMPANION'S Art Calendar, lithographed in twelve colors, is given to each subscriber for the year '97. It is the most costly gift of its kind THE COMPANION has ever offered. An Illustrated Prospectus may be had free by addressing

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X-RAY NOTES.

Aortic Ectasy. M. Beclere presented a radiographic photograph, which verified the existence of a double center of pulsations.

Researches with Uranium Rays. Becquerel. *Jour. Inst. Elec. Eng.*, June; abstracted briefly from the *Comptes Rendus*, March and April. Two papers, one on reseaches on uranium waves, and the other on the law of discharge of electrified uranium in air.

X-Ray Burns. Sharpsteen. *Elec. Eng.*, July 8. A detailed description of two serious cases, from which he concludes that the harmful effect is due to the pulsating current; that if proper treatment had been pursued at once the skin would have become sound again; and that the health of a person has something to do with the effect produced.

X-Rays in 1708. Cosmos, June 12. Under this heading a translation is made of an article in the *Philosophical Transactions* of 1708, by Hawksbee, describing some experiments in which opaque objects were to a certain extent made transparent by means of what appears to have been a static charge effect; the matter seems to have no connection with x-rays.

Application of Roentgen Rays to Surgery. *Am. Jour. of Sc.*, July; abstracted briefly from the *Comptes Rendus*, May 17. Ollier describes his researches on the osseous regeneration after surgical operations; observations heretofore been very difficult, but x-rays now enable one to study the development exactly, rendering unnecessary, in certain cases, the amputation of diseased limbs, since the diseased portions can now be accurately located and removed.

Penetrative Power of X-Rays for the Alkaline Metals. Marangoni. *Proc. Lond. Phys. Soc.*, June; abstracted briefly from the *Rend. Acc. Linc.*, 5, p. 403. He found that the thickness of sodium was double, and of lithium twenty times that of potassium to produce the same depth of shadow; lithium is, therefore, the most transparent of any of the metals; the alkali metals are, therefore, exceptions to the general rule that the transparency is inversely proportional to the density; it seems rather a function of the atomic weight.

Nature of Roentgen and Other Rays. Precht. Lond. *Elec.*, July 2; abstracted from the *Wied. Ann.* 61, p. 2. An elaborate paper on the comparison of Roentgen and other types of radiation. He described photographs showing that the bending of cathode rays in a magnetic field is strictly in accordance with the Biot-Savart law, and the theory of electrodynamic tension; the canal rays are not deflected by a magnet and have no power of exciting fluorescence or photographic action; Roentgen rays can alter the resistance of the selenium cell 32 per cent.; the amount of absorption by paper subjected to Roentgen rays depends upon the time during which the radiation lasts; he thinks a portion of the action is purely electrical; experiments were made with interference, and some data were obtained corresponding to a frequency of light, pointing to the fact that the radiations may be longitudinal rays.

Luminescence by Various Rays. Arnold. *Wied. Ann.*, 61, p. 313; abstracted in the Lond. *Elec.*, July 2. A systematic investigation of luminescence produced by all sorts and conditions of rays, including light, cathode, Roentgen, Becquerel, canal and discharge rays; a number of substances were also examined; among the results was a proof that the effects obtained with solid solutions cannot be obtained by a mere intimate mechanical mixture of the two substances; there is a more decided difference in the luminescence of various bodies under the influence of cathode and x-rays respectively. Most brilliant solid solutions fail to produce Becquerel rays; the canal rays obtained by Goldstein from the red cathode rays by perforating the cathode, are not deflected by a magnet, but have the property of producing an intense luminescence which is only temporary, as the bodies rapidly lose this property under their influence; there is no photographic action; their energy is very great; it is thought that luminescence may offer a valuable test for distinguishing between the various types of rays.

X-RAYS AND BIRTH RATE.

The Vermont Medical Monthly says that over 500,000 French women have had their ovaries removed in the past fourteen years. It is small wonder, then, that the government officials of France have become seriously alarmed at the rapid decrease of the birth-rate in that country. It would be instructive to be told how many thousands of these women were spared with the sole object of preventing conception.—*American Journal of Surgery and Gynæcology.*

Statutory enactment requiring x-ray examinations by legalized experts of all ovaries, prior to operative interference, may save the French republic. It would prevent asexualization, an operation only resorted to by the authorities of Michigan to do away with the feeble-minded, epileptic, triple convicts and ravishers.

HUMAN LORGNETTE.

This is an apparatus, so styled by Gaston Seguy, of Paris, France, with which, it is claimed, the organs of the interior of the human body can be examined with minute detail. The Human Lorgnette is used by the Department of Customs of France to examine sealed packages. The contrivance is of small compass, not being larger than a parlor stereopticon, and contains all the essentials of the x-rays. Prof. Segue was the first man in France to take up the experiments of Roentgen, and has spent most of his time since in this line of research in the laboratory of Le Roux.

X-RAYS AND TRANSPLANTED BONE.

Northwestern Lancet (St. Paul) is authority for the statement that a case of bone grafting is reported from Buffalo, N. Y., in which a five-inch piece of bone from the femur of a sheep was transplanted into the tibia of a man suffering from comminuted fracture. The case is chiefly interesting because of the use of the x-rays during the process of repair, by which it was shown very early that union was taking place between the ends of the transplanted bone and the fragments of the tibia.

The x-rays were recently employed to locate a piece of steel in the eyeball, which was found in the vitreous above the ciliary body. Hirschberg magnet failed to dislodge the missile, necessitating an incision at the sclero-corneal junction.

RADIOGRAPHY APPLIED TO THE SURGERY OF THE NERVOUS SYSTEM.

M. M Chipault and Loude prosented radiographic proofs relative to the surgery of the cranium, brain, vertebrœ, medulla and the peripherial nervous system, which show what valuable information can be furnished by the x-rays, provided always that the apparatus employed shall possess great power, and the period of application shall continue for twenty or thirty seconds.

Now-a-days a surgeon will rarely be satisfied that a bone is properly set, until verified by the x-rays.—*Dr. W. F. Estes in the International Journal of Surgery.*

As Editor of this journal I desire to express my grateful acknowledgement for the hundreds of encouraging letters received throughout the land. It will be my purpose to ever keep the columns up to the standard, and act as such that the announcement in the first number of the JOURNAL will not be infringed upon.

The success of the AMERICAN X-RAY JOURNAL is an assured fact. The business outlook is most promising. Between the last and present issue of the JOURNAL the advertisements have increased 14 new pages. Subscription has increased throughout the States at a gratifying rate, and in the last month letters containing subscription price for the JOURNAL have come from Germany. France, Cuba, South Africa, Chili, Mexico, Liberia and China.

Manufacturing phamacists and wholesale drug houses, makers of mechanical appliances, electrical apparatus, x-ray marhines and all those inventions calculated for the physical improvement of man, find the unique pages of this journal a profitable medium in which to present their wares.

It is with a great deal of pride we are able to give to the world this increased and greatly improved issue of the AMERICAN X-RAY JOURNAL. The expense is very great, but the lessons taught in its pages demand that no expense should be spared.

The day has passed when illustrated articles on the surgery of bones and joints will be appreciated without radiographs to prove the case.

There is not a surgeon living that could now successfully place a work on surgery upon the market without the salient features of the x-ray.

Pictures made by the Roentgen rays are variously called radiographs, shadowgraphs, x-ray photographs, cathode photographs, cathography, electro-photographs, skiagraphs, skotographs, ultra-actinographs, caloragraphs and Roentographs.

The phenomena of electricity and light depend upon the same principles. Both consist in vibrations of ether that fills the whole universe. Wilhelm Hertz, the renowned Professor of the University of Bonn, showed that electric induction obeys exactly the same laws as those governing the diffusion of the light waves.

X-Ray plants advertised in this journal are worthy of patronage, and can be relied upon in every way. Physicians and other prospective operators should be careful that the manufacturers of x-ray goods are reliable, and come well recommended. Cheap and inefficient apparatus, notwithstanding the boastful praise of some houses making them, bring failure and discredit upon the most useful boon to this century.

HEALTHY HUMOR.

They turned the x-rays on her
(It really was a shame),
And the lovely living picture
Was nothing but a frame.

—*Puck.*

Doctor—Now, what did your father and mother die of?

Applicant—Well, sir, I can't say as I do 'zactly remember, but 'twan't nothin' serious.—*Punch*

Doctor (on second visit to see a boy who had swallowed a copper cent)—How is the boy this time?

Anxious Mother—No change yet.—*Life and Health.*

No surgeon or x-ray operator can be properly equipped for diagnostic work without the Dennis Fluorometer. Bullets and other foreign matter can be accurately located within any portion of the body by this device, and it is the only safe and reliable method known. Surgeons and hospitals purchasing useful x-ray machines, should not overlook this most essential diagnostic feature.

We are in receipt of an article from Doctor Francisco de P. Astudillo, Professor and Scientist of Habana, Cuba. The subject matter deals almost exclusively with specific pathology in a special line of cases in which the x-ray is the sole remedial agent. The results obtained are very wonderful, and calculated to awaken greater interest in x-ray work in its entirity.

Since the AMERICAN X-RAY JOURNAL has a large circulation in all Spanish America, we will reproduce the original in the November number of this journal, together with the translation.

BOOK REVIEW.

MANUAL OF STATIC ELECTRICITY IN X-RAY AND THERAPEUTIC USES. By S. H. Monell, M. D., Founder and Chief Instructor of the Brooklyn Post-Graduate School of Clinical Electro-Therapeutics and Roentgen Photography; Fellow of the New York Academy of Medicine; Member of the New York County Medical Society; Kings County Medical Society; Editor of the Electro-Therapeutic Department Department of the *Medical Times and Register;* Author of the Treatment of Diseases by Electric Currents. A Hand Book of Plain Instruction for the General Practitioner, Etc. Second Edition. William Beverly Harrison, N. Y. 670 Pages. Octavo, Cloth, Gilt. Price, $6.00 Net.

This volume is just recently from the press. It is attractively printed in small pica on good heavy paper, is well bound and capable of withstanding severe use.

The general scope of the book is broad and comprehensive, new and original. The contents are arranged into parts and chapters, the latter into explanatory headlines, full and explicit. The index affords an easy guide to the book's contents.

The work is written in a most attractive style. It is scholarly, vigorous and confident. It picks up the reader, raw and untutored, and conveys to his understanding in convincing language the essentials of static electricity, divested of mask, myth and mystery. It is the only book written in any language exclusively upon the subject of static electricity, and the inventive genius of the author has slipped the cog of time, making the world his debtor.

Two essential features mark the volume: First, its historic interest for purposes of reference of the reports of Addison, Golding-Bird, Sir William Gull, and others, and the "collected opinions as to the value of static electricity in medicine." Secondly, the practical method of using static electricity in all morbid conditions, and also the superior attainment of x-radiance. The book contains about twenty illustrations.

Part I. is divided into 40 distinctive chapters, each under entitled captions, the subject matter of which contains all the knowledge known upon the subject, together with the more interesting personal experience of the author. Chapter III., details the "Care of the Holtz Machines." Chapter VI., "How to Regulate the Strength of a Static Machine." Chapter VII., "X-Ray Apparatus and Static Methods." Chapter XII., "Electro-Physiology." Chapter XIV., "Neuralgias and Neuritis." Chapter XVIII., "Chronic Functional Nervous Diseases." Chapter XX., "Pain." Chapter XXI., "Brain-Fag and Insomnia." Chapter XXIV., "Heart Diseases, Chronic Grief and Weather Neuroses." Chapter XXVIII., "Diseases of the Skin." Chapter XXXIV., "Impaired Voice of Surgeons, Debility of the Age." Chapter XL., "Static Electricity in Gynæcology."

Part II., contains 17 chapters. A few examples of the subjects are: Chapter I., "Historical Therapeutics." Chapter III., "Clinical Cases Treated by Static Electricity." Chapter XVII., "The Moral Effect of the Static Machine Considered as a Medical Apparatus.' On page 91 Monell says: "I am not wedded to any hobbies, and at all times approve of the best means which will produce the best results." Again, on page 4: "Electricity is not hostile to any other mode of cure. All that electricity and drugs, massage and heat, and cold and hydropathy, and climate, food, mental therapeutics and surgery combined, can do for suffering humanity, is yet utterly inadequate to supply the demand for relief from pain and disease. The united forces of medicine need more help not less. With this fact in view, the author commends the fuller study of static electricity." Again: "The physician instructed in its technique can operate it successfully every day in the year. It is no longer a creature of atmospheric variability." As an example of the charms of style of the author, I quote from page 201, in Rheumatic Stiffness and Partial Paralysis: "Apply the spark slowly for several minutes with intervals of rest to avoid fatigue. The sense of lightness, buoyancy, endurance and general well being imparted to heavy, stiff and inactive limbs by this method is far more appreciable to the patient than the results of any other form of treatment known to medicine."

The book commends itself to every practitioner of medicine, and to every x-ray worker. No person can be informed without this book, for its contents can nowhere else be found.

IMPERIAL GRANUM.

A prominent Vermont physician writing to thank The Imperial Granum Company for copies of their famous clinical record, adds the following convincing words as to the merits of their product as a food for children: "I can show a baby that has been reared on—IMPERIAL GRANUM—after trying numerous other foods until he was reduced to a mere skeleton—that is now as tough and strong a boy of fourteen months as can be found anywhere."

Physicians cannot afford to be without an X-Ray apparatus. It furnishes a diagnostic means in importance equal to light and sound. How can a deaf and blind man practice the science and art of medicine? The x-ray is revolutionizing practice. It is causing the knife to be laid aside, except for useful reasons—no more "exploratory incisions." Percussion and Auscultation is less needed as the use of the Roentgen rays increase.

Colleges, medical and scholastic, without an x-ray apparatus, have justly a lagging existence. Failing to be informed upon the most useful invention of this century invites retrogression.

DOCTOR:

Your library is not complete without the ***Hypnotic Magazine,*** which publishes each month a report of the work done at the daily clinics of four or five schools of Suggestive Therapeutics in America, with full detail of cases treated. Cost of this handsome monthly, including premium book on SUGGESTIVE THERAPEUTICS, written by Dr. Parkyr and Sydney Flower, LL.D., is only $1.00 a year; with the AMERICAN X-RAY JOURNAL, $1.50.

FOR SALE CHEAP.

Our Static High Grade X-Ray Apparatus, worth $125.00, for $100.00 cash. This apparatus is new and does beautiful x-ray work, and can be used for therapeutic purposes. Address C, AM. X-RAY JOURNAL. Enclose stamp for reply.

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A PREMIUM OFFER.

We will send this JOURNAL for one year and the following named books pertaining to x-rays prepaid, at the prices annexed:

"A B C of the X-Rays" (price 75 cents) and the JOURNAL for $1.50.

"The X-Ray of Photography of the Invisible" (price 75 cents) and the JOURNAL for $1.50.

Both of the above books and the JOURNAL for $2.00.

"Manual of Static Electricity in X-Ray and Therapeutic Uses." Just out. (Price, net, $6 00) and the JOURNAL for $6.00.

"Roentgen Rays and Phenomena of the Anode and Cathode" (price $1.50) and the JOURNAL for $2.10.

These three books are richly illustrated, beautifully printed on coated paper, and handsomely bound in cloth.

One-half dozen Solid Silver After Dinner Coffee Spoons, with gold washed bowles. These spoons retail for $1.00 each, or $5.00 per one-half dozen.

For a short time these spoons are offered as premium to solicitors for subscribers to the AMERICAN X-RAY JOURNAL. These spoons are very beautiful and valuable, and make a handsome present.

Any one sending two cash subscribers will receive one of the above described spoons. For eight cash subscribers, ½ dozen spoons, and for 12 cash subscribers, one dozen of these spoons.

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AMERICAN X-RAY JOURNAL,
St, Louis, Mo.

THE AMERICAN X-RAY JOURNAL.

A Monthly Journal devoted to Practical X-Ray Work and Allied Arts and Sciences.

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THE AMERICAN X-RAY JOURNAL.

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HEBER ROBARTS, M. D., EDITOR,
2914 MORGAN STREET, ST. LOUIS, MO.

Entered at the postoffice at St. Louis, Mo., as second-class matter.

Six months have passed since the appearance of the first number of the American X-Ray Journal. Eighteen months previous—it was in December, 1895, when William Konrad Roentgen read his preliminary communication entitled: "A New Form of Radiation" to the Würzburg Physico-Medical Society.

The character of the discovery and the nature of the announcement was of such plainness and simplicity that the world instantly appreciated something of its worth. The knowledge reached every home and won votaries to its cause.

At the inception of this journal the intensity of interest had reached a degree which was revolutionizing and conquering. Every nature of publication was devoting some space to the subject and the matter was sought with the greatest interest. No agency for the benefit of man had ever before so quickly won approval. It was evident from the repetition of notices, daily appearing, that the facts already announced were confirmed and that also a lull in the excitement must soon ensue. It is a matter of history that the fame of great and useful discoveries bound rapidly to the zenith and by a law of compensation relax with shameful retreat. A retaliation spirit seems to arise which retards the progress of science and art; possibly an emergency-check in nature to prevent one faculty from disproportionately out-stripping another.

In this instance, however, no retrogression has occured. There are less lay press accounts, but a deeper and firmer hold is being taken by the advanced element of the medical profession. This is evidenced by the cordial support given this journal all over the world. Scarcely a land upon the earth has failed to learn of and subscribe for this Journal. The problems which first confronted x-radiations and diffusions are now eliminated and no possible "erroneous impressions" or "distortions" can now occur. X-ray apparatus are perfected to the degree that no portion of the human body can escape scrutiny. None but the best apparatus should be purchased by physicians, and a full supply of accessories, including the fluorometer, should be with every purchase.

While the Journal has met with cordial support we can see why it should be in the office of every physician.

We believe there is a closer relationship existing between physicians than formerly. The more we associate together the greater the mutual understanding. This relationship should be encouraged between doctors in country towns. One of the best means to this end is to establish a business which will be mutual and which will greatly encourage patients to be doctored at home.

Any physician owning a useful x-ray apparatus will find his business increased. Physicians in the neighborhood should encourage the use of the apparatus and make their own diagnosis. By this means the public, having greater confidence in local physicians, diagnosing and surgery can be done at home where it rightly belongs. Never was error more grossly committed than flight from the country to the city for physical relief. The most practical men of the profession are the town physicians and they only need fraternal unity at home to do any surgery. The possession of an x-ray apparatus will assist in establishing that fraternity and bring together all classes of the profession. The public will hail such consummation with delight and the profit to all the physicians will be enhanced. The Journal will assist in this matter to the fullest extent. The blight and witherings of the past should only encourage us to grasp hold of the tidings before us. This Journal will hope to give more in the future than the past.

LOS RAYOS ROENTGEN Y LOS CIEGOS.

HABANA, Setiembre 22 de 1897.

SOR. HEBER ROBARTS, M. D., EDITOR DEL X-RAY JOURNAL, ST. LOUIS, MO.

Muy Sor. mio y de mi mayor consideración: he recibido su apreciable del 9 del actual, la que tengo el gusto de contestar, dándole las gracias por el honor que me hace ofreciéndome su ilustrado periódico para publicar mis experiencias.

Aunque sea algo largo voy á decirle todo lo que he hecho para que Vd. con su talento estracte lo que crea útil.

Dedicado desde joven ál estudio de las Ciencias Físico-Químicas, cuya carrera seguí, y amigo de la experimentación, he seguido hasta donde mi limitada inteligencia me lo ha permitido, el vertiginoso vuelo que en pocos años han emprendido, llenándonos á cada paso de asombro y admiración los pasmosos resultados que los sabios dedicados á su estudia obtienen.

Desde que se dieron á conocer los rayos X se despertó en mí el deseo de conocerlos y estudiarlos para lo cual pedí por medio de corresponsal á la casa de Anthony un aparato completo. Me remitieron una cosa que ni honra al pais que lo produce ni á la casa que lo vende; una bobina pequeña en mal estado y un tubo de juguete, teniendo en cuenta que yo no habia limitado precio.

Comprendiendo que era necesario escoger personalmente lo que yo deseaba fuí hace un año á New York y despues de buscar lo que en dicha po blación hubiera fuí á visitar al Sor. W. H. Meadowcroft, Sec'y de la Edison Decorative &, en Harrison, con una recomendación del Scientific American, y tuve el gusto de encontrar en dicho Sor. Secretario una persona bellísima que me estuvo enseñando lo mejor que respecto á rayos X habia y le encargué me construyera un aparato que pudiera corresponder á mi deseo.

Efectivamente: en dicha renombrada fábrica me construyeron un inductorium soberbio, y un interruptor rotatorio así como tubos de doble foco, y con él me dediqué á estudiar esa nueva rama de la Física que está llamada á representar un papel importantísimo en las Ciencias.

Yo, que siempre he tenido gran compasión á los ciegos, pensé que por medio de los rayos X podris el oculista saber si el nervio óptico de un paciente estaba ó no muerto; pues por notables que sean los conocimientos de los médicos dedicados á la curación de las enfermedades de la vista, no pueden llegar esos conocimientos á penetrar á través de tantas causas como pueden velar el camino para investigar si el nervió óptico está en eondiciones de apreciar las vibraciones luminosas.

Penetrando, me dije, los rayos X todos los tegidos, es natural que penetren todas las sustancias que están ante el nervio y con la ayuda de ellos y de sustancias fluorescentes tal vez pueda apreciar los objetos; pero por lo menos ha de percibir la luz.

Persiguiendo el estudio de esta teoria me fijé un dia en un ciego que tenia sus ojos claros y que hacia 12 años no veia, habiendo sido asistido por los principales oculistas de Madrid, Barcelona y Paris, y cuyo oiego habia gastado todo su capital en su curación, que no pudo conseguir, y declarado ciego totalmente por esas eminencias, tuvo que pedir limosna para vivir.

El diagnóstico de todos los oculistas que le asistieron era caida total de la retina del ojo izquierdo y casi total de la del derecho.

Dicho ciego no percibia ni aun los rayos ni pequeña claridad con el sol al medio dia.

Le invité á someterse á una observación y se me presentó el dia 13 de Agosto.

Colocado delante del tubo Crokes pudo ver objetos con èl fluoroscopo y lo demás que Vd. conoce por haberlo publicado el Sun copiado de la carta que le remití al Sor Meadowcroft, debiendole añadir que hoy está trabajando en escritorio y puede considerarse totalmente curado; pue aunque vé a corta distancia es cuestión de lentes toda vez que le he hecho mirar con gemelos de teatro y percibe claramente los objetos á la distancia que nosotros los vemos.

Ahora bién: en la observación hecha por mí se presentan dos fenómenos importantísimos.

Dicho ciego pudo ver los colores del espectro y leer claramente con los rayos aplicados sobre una mesa con una inclinación de 45°, es decir que los rayos caian sobre la mesa y despues se dirigian á sus ojos.

¿Es efecto de refleccion de dichos rayos, ó de iluminación particular?

El otro fenómeno es la influencia que dichos rayos han podido tener para que obrando sobre la materia haya esta podido volver á su estado normal.

Y que ha habido en esa modificación de la materia un fenómeno mecánico es indudable, pues el enfermo notaba sensación de calor, apesar de que con un termómetro sensible no pude observar calor alguno en los rayos á la distancia en que el dicho enfermo se encontraba.

Ahora bién: yo creo, y perdone Vd. si digo un disparate, y reservelo en ese caso, que lo que se ha verificado es lo que mecánicamente pudieramos llamar un *bombeo electrico.*

Los rayos han robado á la materia expuesta á su acción la electricidad que posee y al cesar la acción de los rayos X esa misma materia ha recibido de la atmófera la cantidad de electrlcidad que se le habia quitado. Repetida la experiencia se repitió el fenómeno y durante ese trabajo mecánico á que la deselectrización de las moléculas dió lugar se produjo el fenómeno del calor, fenómeno que indica una suma de trabajo.

No somos los físicos y electricistas los que hemos de decir como han obrado las moléculas en esa caso; cual era el estado de ellas en la enfermedad que padecia el ciego: como podian volver á su estado normal. Ese es trabajo de los Médicos y hombres pertenecientes á otra rama de las Ciencias. Nosotros le procuramos el medio: ellos deben aplicarlo.

Y lo mas notable es que hoy tengo en tratamiento mas de 20 casos, cada uno de distinta enfermedad y todos han experimentado alguna modificación, lo cual indica que no ha sido una casualidad lo operado con el primero, habiendo entre esos casos algunos tan notables que han de llamar la atención del mundo cientifico cuando se conozca.

Y por si Vd. quiere hacer de ellos algún uso y sinó como pura curiosidad le copio la hoja experimental de cada uno.

D. MANUEL BORDAS.

Hace dos años perdió la vista poco á poco primero del ojo izquierdo y luego del derecho.

Diagnóstico: unos debilidad del nervio óptico y otros debilidad general. Vé la claridad del dia y sombras.

Agosto 20.—Ha percibido la claridad de los rayos X.

Sbre. 1°—Ha visto claramente la luz con el fluoroscopo, una tigera y una llave.

" 11.—Manifiesta que vé mas claridad y con el fluoroscopo vió un martillo.

" 14.—Percibe mejor los objetos y durante el dia ha visto sus manos al lavarselas en la palangana.

Da. LUCRECIA PALACIOS.

Hace 6 meses perdió la vista. Primero veia los objetos dobles y le jos con el ojo izquierdo; con el derecho veia bien y ha perdido poco á poco la vista.

Diagnóstico: Atrofia de la papila.

Agosto 27.—No vé nada con el fluoroscopo ni con los rayos directos.

" 31.—Después de sometida al tratamiento rayos directos, ha percibido con el fluoroscopo una tigera. Con el derecho las vé claramente.

Sbre. 18.—Manifiesta que durante los dias que ha dejado de asistir á la experiencia, por estar enferma, vé con el ojo izquierdo los bultos, la sombra de su mano cuando la pasa ante los ojos, y discos luminosos de dostintos colores.

D. ERNESTO ARAZOZA. (Notable caso.)

Hace 18 años que perdió la vista de un susto, teniendo 8 años de edad. No vé absolutamente nada.

Diagnóstico: Tuberculos en el cerebro. Meningitis y parálisis del nervio óptico. Congestión á la retina. Lo han visto tres oculistas que son los que han dado cada diagnóstico.

Agosto 21.—Percibe algo la claridad á los rayos X directos y la sombra con el Fluoroscopo.

" 23.—Ha notado la claridad del dia y precisa mas los rayos X.

" 25.—Vé lo mismo y dice que siente en los ojos una sensación agrable que en su concepto indica mejoria.

" 31.—Siente un poco de dolor en los ojos. Ha visto durante el dia á las 2 de la tarde viniendo en el vapor de Regla, la claridad y movimiento de la espuma de las ruedas del vapor y tuvo mareo Se encuentra mas aliviado. Con el Fluoroscopo dibujó la forma de la tigera sobre la mesa por no conocerla—No tiene noción de colores ni de objetos.

Sbre. 4.—Manifiesta que siente mejoria porque vé con mas intensidad la claridad del sol.

" 9.—Despues del tratamiento vió la claridad de la luna en la calle.

" 10.—Ha visto de 12 á 12½ de la mañana una gran intensidad de luz y vió objetos sin poderlos precisar. Siente mucho ardor en los ojos y dice que siente en ellos algo que le circula, fenómeno que no ha sentido antes. Durante un fuerte aguacero ha visto correr el agua por la calle. Ha percibido con mass intensidad la luz del tubo.

" 11.—Lo mismo.

" 14.—Le causa doloray ardor la influencia de la luz del sol sobre los ojos. Al Fluoroscopo vé la sombra de su mano.

Da. EMILIA QUINTANA.

En Junior de 1889 empezó á perder la vista, nublándosele los ojos, es decir, los objetos. y se sometió al tratamiento de un oculista perdiendo completamente la vista en Agosto de 1889. Vé solamente claridad.

Diagnóstico: Amaurosis sifilitica. Fué operada de ambos ojos.

Agosto 21.—Percibe el color de los rayos X y siente cansancio á los 3'.

" 24.—Despues del tratamiento vé mas intensa la luz del tubo.

" 31.—Despues del tratamiento vé mejor la luz del tubo con el ojo derecho. Con los rayos reflejados vió una tigera. (Llamo rayos reflejados á los que despues de caer sobre el objeto van á loss ojos en un ángulo de 45°.

A la claridad de la luz eléctrica ha percibido el tamaño y distancia de los óvalos del género de su vestido.

Sbre. 7.—Ha visto conclaridad la luz verdosa del tubo. Crokes.

" 17.—Ha visto durante los dias anteriores mucha claridad y ha distinguido la forma de un barril. Vé la luz de los faroles de los coches. Percibe claramente la luz del tubo.

D. MIGUEL LLORENTE Y TORRADO.

Es natural de la Habana, de 30 años de edad, hace 20 que perdió la vista del ojo derecho á consecuencia de un golpe ligero.

Diagnóstico: Catarata traumática y caida de la retina.

Cinco años después, hace 15, perdiú la vista del ojo izquierdo.

Diagnóstico: caida de la retina y catarata.

Ha sido asistido por los oculistas notables de esta Ciudad y médicos eminentes. Ha consultado además al Doctor Knapp y dos mas de Newyork.

Percibe un poco de claridad con el ojo inquierdo y nada con el derecho.

Agosto 21.—No vé nada con los rayos X directos ni reflejados ni con el F.

" 23.—Lo mismo.

" 31.—Lo mismo.

Sbre. 2.—Lo mismo.

" 5.—Distinguió los faroles del alumbrado público, por la noche, y al dia siguiente notó que veia con mas intensidad la claridad del dia y las luces artificiales que tenia algo próximas.

" 7.—Lo mismo.

Sbre. 9.—Lo mismo.

" 11.—Lo mismo.

" 16.—Distingnió un estremecimiento de la claridad estando bajo la acción de los rayos X.

Antes de someterse á la experiencia de los rayos X veia con el ojo izquierdo, aun estando en una habitación oscura, como unos circulitos y arcos y sombras luminosas blancos y amarillos y medio rojos.

Muchos de los circulos arcos y sombros han variado de forma y de manera de presentarse: algunos han casi desaparecido y ninguno se presenta nunca cuando está bajo la acción de los rayos X.

La mancha blanca ó catarata del ojo ojo izquierdo ha sufrido alteración en su forma.

Este es un caso digno de estudio toda vez que los rayos X no parece haber penetrado hasta el nervió óptico, pues no vé su luz y sinembargo ha sufrido modificación su enfermedad hasta el estremo de ver ya la luz de gas de los faroles.

Da. MERCED MORA.

Hace dos años perdió la vista y la operó un oculista la catarata viendo despues de la operación hasta los 6 meses que perdió de nuevo la visión. Vé claridad pero no percibe objetos.

Agosto 16.—Vé la claridad del tubo Crokes.

" 18.—El dia 17 ha esperimentado alguna mejoria. Vé la luz natural mas clara que antes, fenómeno que la ha llamado la atención. Ardor en los ojos y algún lacrimeo. Despues del tratamiento ha visto claramente la luz verdosa del tubo y con los rayos directos ha percidido la sombra de su mano.

Manifiesta que durante el dia ha percibido la sombra de su mano mas distante de lo que la veia antes

" 20.—Dice que ha visto una cuchara y el color rojo de una cinta con la luz natural.

Da. VALENTINA PEREZ.

Hace 17 años está ciega. Se dió un golpe en el ojo derecho y fué operada en Marzo de 1881, manifestándole el oculista que su vista estaba completamente perdida. Fué operada por otro oculista del ojo izquierdo y perdió la vista.

Agosto 22.—Percobió la claridad de los rayos X.

" 24.—Durante el dia ha percibido el movimiento de sus manos al lavar un pañuelo.

Despues del tratamiento vió con los dos ojos la luz del tubo. Con el izquierdo principió á ver la luz blanca y seguidamente fué cambiando al amarillo hasta precisar el verdoso caracteristico.

Con el derecho veia la oscilación de la luz.

Percibió con rayos reflejados las sombras de las letras negras sobre papel blanco.

" 29.—Con la luz natural ha distinguido los colores.

Sbre. 4.—Percibe claramente la luz verdosa del tubo y distingue á la claridad de él todos los colores. Manifiesta que vé á un metro de distancia los objetos y su contorno.

" 11.—Vé mejor durante el dia hasta el estremo de andar sola. Despues del tratamiento vió mas claro y brilliante el color de la luz.

" 13.—Vé con mas precisión la claridad y no titubea al andar.

Percibe la sombra con el fluoroscopo.

" 16.—Ha visto durante todo el dia la claridad y ha distinguido el color de su mano y una sortija en la mano dè una negra. Distingue con claridad los objetos.

D. TOMAS TARNOS.

Hace dos años se quedó ciego despues de un traumatismo. En la actualidad vé reflejos con el ojo derecho. No distingue ningún objeto.

Agosto 31.—Con el Fluoroscopo distingnió la sombra de la mano.

Sbre. 2.—Ha visto con mas claridad la luz del dia.

" 6.—Vé mucho mas.

" 7.—Vió claramente la mano con el F.

" 11.—Vé los rayos X con mas claridad. Experimenta pequeño ardor.

" 15.—Nota mas intensidad de luz y le molesta mucho al medio dia la claridad del sol. aliviandose con los vidrios oscuros. Ha visto el martillo con el F,

" 18.—Ha esperimentado grandes resplandores durante el dia y vé los objetos sin precisarlos.

D. JUAN NAVAS GARCIA.

Al salir de la cama á la azotea al aire libre cayó al suelo como atontado y despues siguió su trabajo sin novedad hasta la noche que empezó á perder la vista.

Fué operado de ambos ojos.

Agosto 26.—No vió nada.
Sbre. 2.—Percibe la claridad.
" 7.—Vió con el F. una llave y una tigera.
" 15.—Lo mismo.

Da. CONCEPCIÓN BENITEZ.

Hace un año perdió la vista é ignora la causa.

Diagnóstico: Glaucoma crónico en ambos ojos con brotes agudos.

Agosto 24.—No ha visto nada.
" 31.—Lo mismo.
Sbre. 2.—Despues del tratamiento ha visto la claridad de la luz eléctrica.
" 4.—Ha percibido por primera vez el color verde de los rayos X.
" 6.—Ha visto durante el dia un poco de claridad constante por primera vez desde que se enfermó. Vé el color verde de los rayos.
" 9.—Ha visto durante el dia claridad y ha distinguido por primera vez la claridad debil de la pantalla del fluoroscopo.
" 11.—Ha visto durante el dia mas luz y vé sombras á manera de listas y cuadros. Ha percibido con el F. la sombra de un martillo pero no lo precisa.
" 14.—El dia 12 vió un gran resplandor amarillo intenso como oro brillante y la han repetido unas vegigas en los ojos que padecia las cuales le han supurado mucho.
" 16.—Ha visto claridad.
" 18.—El 17 tuvo nuevamente las vegigas y despues de la supuración ha visto un solo cuadro de color verde. Vé la sombra del martillo en el F.

D. PABLO SUAREZ.

Hace 9 meses perdió la vista en un mes.

Diagnóstico: debilidad en los nervios ópticos. Vé la claridad y no precisa los objetos.

Sbre. 7.—Vé rayos amarillos con el tubo Crokes.
" 9.—Mas amplio el campo visual y ha visto la mano con el F.
" 11.—Ha percibido un martillo y una llave con el F.
" 14.—Lo mismo.

Estos son los casos que tengo en tratamiento y por el resultado que se obtiene podrá Vd. comprender que no se trata de una casualidad sino que efectivamente tienen una poderosa acción los rayos X sobre los organos de los ojos.

Es de notar que no hay entre esos casos dos de igual enfermedad, y sin embargo á todos les ha producido efecto.

Tan luego reciba unos acumuladores que he pedido á Newyork citaré á los médicos y oculistas de esta Ciudad para que examinen dichos casos y que ellos con su competencia expliquen el fenómeno.

No quiero cansar mas su atención; pero he querido dar á Vd. todos estos detalles para que pueda juzgar del resultado que se obtiene.

Le remito una fotografia tomada por mí del ciego D. Ignacio Marquéz con quiem hice la primera experiencia, antes de la experimentación y otra del mismo ante el aparato en la forma en que coloqué el tubo iluminando la primer palabra que él pudo leer.

Adjunto remito á Vd. $1 para que se sirva remitirme la colección de su periódico del año corriente y le ruego me diga cuantos años tiene de publicación para remitirle su importe y me los mande,

Aprovecho esta oportunidad para ofrecerme de Vd atto. S. S. Q. S. M. B.

DR. FRANCIS DE ASTUDILLO.

THE ROENTGEN RAYS AND THE BLIND.

HABANA, Sept. 22, 1897.

HEBER ROBARTS, M. D., EDITOR AMERICAN X-RAY JOURNAL, ST. LOUIS, MO.

DEAR SIR: I have received your esteemed favor of the 9th inst., to which I reply with pleasure, thanking you at the same time for space in your periodical for the publication of my experience.

Notwithstanding that what I am about to say is rather lengthy, I will endeavor to tell you all I have done, and you may, in your judgment, extract from it whatever you may find profitable and useful.

From my youth I dedicated myself to the study of Physical Chemistry, which course I followed to this day, being devoted to its practice. The last few years have filled those dedicated to its study with admiration and wonder and into the flights of the marvelous.

From the time the x-rays became known I had a desire to study them. To accomplish this I obtained through a correspondent in New York a complete outfit. They sent me something that is neither a credit to the country that produced it nor the house that sells it—a small pump in very bad condition and a tube which was nothing but a toy. Taking into consideration the fact that I was not at all particular as to the price, I came to the conclusion that in order to obtain what I wanted it would be necessary to go in person and get it. For that purpose I went to New York, and looked for everything in that line that I could find in the big city.

I called on Mr. Wm. H. Meadowcroft, Secretary of the Edison Decorative Co., with a recommendation I had from the *Scientific American*. I had the pleasure to find in him a very courteous gentleman, who took the trouble to show me everything in the line of x-ray apparatus that could be found. I gave him an order for an apparatus which suited my purpose. Really, in that renowned factory they made me a magnificent Inductorium with an automatic interruptor, with tube of double focus. With this I devoted myself to the new branch in physics which will be called to play an important part in the branch of science.

I have always had a great sympathy for the blind. It occurred to me that through the medium of the x-rays an oculist could find out whether or not the optic nerve of patient was dead. It matters not how great may be the knowledge of the doctor who makes a specialty of treating the eyesight, their knowledge can not encompass all cases. How can they fathom the way to investigate the luminous vibrations of the optic nerve?

It occurred to me, that if the x-rays could penetrate the tissues it is natural that they penetrate all of the substances that are before the nerve. With the aid of the x-rays and fluorescent screen it seemed certain that objects could be estimated, or at least the patient could perceive the light.

Following the course of this theory: I noticed one day a blind man who had his eyes clear, but for 12 years had been unable to see, and had been treated by the best oculists in Madrid, Barcelona and Paris. This man had spent his entire fortune trying to get cured, but was unable to succeed, and finally he was declared to be irreparably blind by these learned men. At last, after spending all, had to go begging. All the oculists diagnosticated the case "falling of the retina of the left eye and nearly all of the right." This man could not distinguish the brightest light, even the meridian sun.

I invited him to my office for treatment, and he responded on the 13th of August.

Seating him before the Crookes tube, he could see the objects with the assistance of the fluoroscope. More of this case you already know from a letter sent to Mr. Meadowcroft, which was published in the *Sun*. I can say that this man is to-day working at the desk, and can be considered as entirely cured, although he wears glasses. With opera glasses he can see objects at the same distance with us.

Now, then, the observations made by me bring forth two important phenomena. Said blind man could see the colors of the spectrum and read clearly with the rays applied over a table with an incline of 45°—that is, the rays fell over the table and afterwards were directed to his eyes. Is it a fact that there is reflection of the rays, or is it self-illumination?

The other phenomenon is, after working with the x-rays, a return to the normal state.

That there has been in that modification of the matter, a mechanical phenomenon, there is no doubt, as the patient noticed a heated sensation, notwithstanding that with a delicate thermometer I could not observe any heat in the rays at the distance I had the patient. Now, then, I believe (and I beg you to pardon me if I have made a blunder, and if such is the case, correct it), that which has been verified is what would be called mechanically electric bombarding (Bombeo electrico.)

The rays have robbed the power possessed by the matter exposed to its action, and as the action of the x-rays cease that same matter has received from the atmosphere the quantity of electricity which was taken from it. The experience being repeated, as was the phenomenon, and during this mechanical work to which the dielectrization and electrization of the molecules gave place, the phenomenon was produced by heat, an occurrence which shows a great deal of labor.

It is not for us to say, Professors of physics and electricians, how the molecules have worked in these cases of the blind, or how they could return to their normal state. This belongs to another branch of science claimed by medical men. We procure the way, and they ought to apply the remedy.

The most notable thing is that I have now more than twenty patients which I am treating, each with a different malady, and all of them have experienced some kind of modification, which indicates that the case cured was not a casualty. Other cases which I have, if once known, would call the attention of the scientific world to them.

Should you wish to make these facts known, or if not, only for pure curiosity, I give you a copy of the experiences of each of them:

MR. MANUEL BORDAS.

It is two years since he lost his eyesight, which occurred slowly; first the left and then the right. Diagnostic: Some weakness of the optic nerve, other weakness general. Sees shadows and the light of day.

Aug. 20.—He has perceived the light of the x-rays.

Sept. —He has clearly seen the light with the fluoroscope—a pair of scissors and a key.

" 11.—He states that he can see more clearly, and with the assistance of the fluoroscope he saw a hammer.

" 14.—Can see objects better. and during the day he has seen his hands as he washed them over the bowl.

MRS. LUCRECIA PALACIOS.

It is six months since she lost her eyesight. At first objects appeared double, and, with the left eye, far away. Soon the right eye began to fail, and by degrees she lost her sight altogether. Diagnostic: Atrophy of the papillæ.

Aug. 31.—Cannot see anything with the fluoroscope and the x-rays. After being put under the treatment of the direct rays she has seen a pair of scissors with the assistance of the fluoroscope. With the right eye she can see them clealy.

Sept. 18.—States that during the days in which she has failed to take treatment, on account of illness, she can see objects with her left eye, also the shadow of her hand as she passes it before her eyes, and also an illuminated discus of different colors.

MR. ERNESTO ARAZOZA. Notable Case.

He lost his eyesight suddenly 18 years ago, when 8 years of age. Cannot see anything. Diagnostic: Tubercles in the cerebrum, meningitis, paralysis of the optic nerve and congestion of the retina. Three oculists have treated him, and they are those who gave the diagnosis.

Aug. 21.—He can see clearly the light and shadows through the assistance of the fluoroscope.

" 23.—He can see more clearly the light of day and also the x-rays.

" 25.—He can see the same; says he feels a very agreeable sensation, which he thinks indicates his improvement.

" 31.—He feels pain in the eyes: has seen throughout the day. While coming in on the boat from Regla the brightness of the foam, and the motion of the wheels of the boat he thinks has helped him. With the aid of the fluoroscope he drew the shape of a pair of scissors over the table, not having formerly known their shape. Has no notion of objects or colors.

Sept. 4.—He states he feels much better because he can see with more intensity the light of the sun.

" 9.—After the treatment he could clearly see the light of the moon in the street.

" 10.—He has seen from 12 to half past 12 in the morning a great intensity of light, and could distinguish objects without knowing what they were. He feels burning sensations in the eyes, and says that he feels in them something that circulates, a phenomenon which he has not felt before. During a heavy rainfall he has seen the water run through the street. Has perceived with more intensity the light of the tube.

Sept. 11.—The same.

" 14.—He feels a burning pain through the influence of the light of the sun over the eyes. Through the assistance of the fluoroscope he can see the shadow of his hand.

MRS. EMILIA QUINTANA.

In June, 1889, she began to lose her eyesight. Her eyes began to get cloudy, that is to say, the objects. She put herself under the treatment of an oculist--losing completely her eyesight in August, 1889. Can only see light. Diagnostic: Amaurosis Sifilitica. She was operated on both eyes.

Aug. 21.—She perceives the colors of the x-rays, and distinguishes to the 3°.

" 24.—After the treatment she sees more intense the light of the tube.

" 31.—After the treatment she sees better the light of the tube with the right eye. With the reflected rays she saw a pair of scissors. (I call reflected rays to those who after fallen upon the object go up to the eyes at an angle of 45 degrees.) To the brightness of the electric light she has perceived the size and distance of the folds in the cloth of the dress.

Sept. 7.—She has seen clearly the green light of Crookes tube.

" 17.—During the last few days she has seen a great deal of light, and distinguished the form of a barrel. She sees the light in the lanterns of the carriages. She perceives clearly the light of the tube.

MR. MIGUEL LLORENTE Y TORRADO.

He is a native of Habana, 30 years of age. It is 20 years since he lost the sight of the right eye through a light fall. Diagnostic: Traumatic cataract and falling of the retina (y caida de la retina). Five years afterwards, and 15 years ago, he lost the sight of the left eye. Diagnostic: Falling of the retina and cataract. He has been treated by the most prominent oculist of this city, and physicians as well. He has consulted, besides, Dr. Knapp and two others of New YorK City. He can perceive some light with the left eye, but none with the right.

Aug. 21.—Cannot see anything with the x-rays direct, nor reflected rays, nor with the fluoroscope.

" 23.—The same.

" 31.—The same.

Sept. 2.—The same.

" 5.—He distinguishes the light of the public street lamps by night. The following day he could see with more intensity the light of the day and the artificial lights which were near him.

" 7.—The same.

" 9.—The same.

" 11.—The same.

" 16.—He distinguished an overpowering sensation of light while under the action of the x-rays. Before submitting himself to the x-rays he had a sensation with the left eye, even though he was in a dark room, and could see circles, arches and luminous shadows, white, yellow and red. Many of the circles, arches and shadows have varied in form since the use of the x-rays. Some have almost disappeared, and none ever appear while under the action of the x-rays. Now the cataract of the left eye has suffered some alteration in its form.

This is a case worthy of study, since at no time does it appear that the x-rays penetrated to the optic nerve, as it cannot see the x-radiance, notwithstanding the cataract has suffered some modification even to the extent of being able to see the gaslight.

MRS. MERCED MORA.

It is two years since she lost her sight, and an oculist removed the cataract, enabling her to see after the operation for six months, when she again lost her vision. She can see the light, but perceives no objects.

Aug. 16.—Can see the light of Crookes tube.

" 18.—The 17th day she experienced some improvement. Sees the natural light more clearly than before. A phenomenon that has called her attention (fenómeno que le he llamado la atención); burning sensation of the eyes and flowing tears. After the treatment she has seen clearly the green light of the tube, and with the rays direct has seen the shadow of her hand. She states that during the day she sees the shadow of the hand more clearly than before.

" 20.—She says she has seen a spoon and the red color of a ribbon with the natural light.

MRS. VALENTINA PEREZ.

She has been blind 17 years. She struck herself in the right eye, and was operated on in March in 1881. The oculist stated that her eyesight was completely lost. Another oculist operated upon the left eye, and she lost her eyesight entirely.

Aug. 22.—She perceived the light of the x-ray.

" 24.—During the day she has seen the movements of her hand while washing a handkerchief. After the treatment she saw with both eyes the light of the tube. With the left she began to see the white light, and following it began to change to yellow until she perceived the characteristic green. With the right she could see the oscillation of the light. With the direct rays she saw the shadows of the black letters upon white paper.

" 29.—With the natural light she has distinguished colors.

Sept. 4.—She perceives clearly the green light of the tube, and distinguishes through its light all the colors. She states that at a distance of three feet she sees objects and surroundings.

" 11.—She sees better during the day to the extent of being able to walk alone. After the treatment she could see more clearly and brilliant the light.

" 13.—She can see with more precision and does walk with confidence. She sees the shadow with the fluoroscope.

" 16.—She has seen during the day the light, and has distinguished the color of her hand, and the ring in the hand of a negress. She clearly distinguishes the objects.

MR. TOMAS TARNOS.

Two years ago he became blind after traumatism. Now he can see shifting lights with the right eye. Cannot distinguish any objects.

Aug. 31.—With the fluoroscope he distinguishes the shadow of the hand.

Sept. 2.—Has seen with more clearness the light of day.

" 6.—He sees much more.

" 7.—He clearly saw the hand with the fluoroscope.

" 11.—Can see the x-rays with more clearness. He experiences a light sensation of burning.

" 15.—He notices with more intensity the light, and is much bothered by the light of the midday sun. He is relieved by the use of green glasses. Has seen a hammer with the fluoroscope.

" 18.—He has experienced excessive flashes during the day, and can see the objects without being able to know them.

MR. JUAN NAVAS GARCIA.

After leaving his bed he ascended to the roof, and the free air falling upon him, he fell to the floor as if stunned, and afterwards he proceeded to his work without any trouble until night, when he began to lose his eyesight. Both eyes were operated upon.

Aug. 26.—Cannot see anything.

Sept. 2.—He perceives the light.

" 7.—He saw with the fluoroscope the keys and a pair of scissors.

" 15.—Same.

MRS. CONCEPTION BENITEZ.

It is a year since she lost her sight, without knowing the cause. Diagnostic: Chronic glaucoma of both eyes, with sharp eruptions (brotes agudos).

Aug. 24.—She has not seen anything.

" 31.—Same.

Sept. 2.—After treatment has seen clearly the electric light.

Aug. 4.—He has seen for the first time the green color of the x-rays.

" 6.—Has seen constantly the light during the day for the first time since he became blind. Can now see the green colors of the x-rays.

" 9.—Has seen clearly during the day, and has distinguished for the first time the dim light of the shade of the fluoroscope.

" 11.—Has seen the light more during the day, and sees in the form of squares and stripes. He has perceived in the fluoroscope the shadow of a hammer, but cannot distinguish it.

" 14.—The 12th day of September he saw a great intense yellow flash like shining gold, and some blisters (vegigas) in the eyes of which he previously suffered, and which now are full of pus.

" 16.—He has seen the light. The 17th day he had again the blisters, and after suppuration he has seen only a green colored frame. He sees the shadow of the frame of the fluoroscope.

MR. PABLO SUAREZ.

He lost his sight in one month, nine months ago. Diagnostic: Debility in the optic nerve. He sees the light, but does not know the objects. He sees yellow rays with the Crookes tube.

Sept. 9.--There is more space in the visual field, and he has seen the hand with the fluoroscope.

" 11.--He has seen the hammer and keys with the fluoroscope.

" 14.--Same.

These are the cases I have under treatment, and by the results obtained you can understand that the cases treated are not accidental ones, but that the x-rays have effectually a powerful action upon the organs of the eyes. It is to be noted that of these cases there are no two of them alike, and, notwithstanding, some effect has been produced in all of them.

As soon as I receive some accumulators, which I have ordered in New York, I will engage the doctors and oculists of this city, in order that they may examine these cases, and that they with their competency explain the phenomenon.

I do not wish to tire you any longer, but I wish to give you all of these details in order that you may be able to judge the results thereto obtained. I send you photograph taken by me from the blind Mr. Ignacio Marquez, with whom I had the first experience, and before the experiment, and another of same before the apparatus, in the form in which I placed the tube illuminating the first word he was able to read.

Inclosed please find $1.00 to pay for one annual subscription for the Journal. Please tell me how long the Journal has been in publication, in order that I may send the money for all subsequent issues. I take advantage of this opportunity to offer myself

Yours very truly, DR. FRANCISCO DE P. ASTUDILLO.

Literal translation from the Spanish by Professor J. Claudio Martinez, 2808 Washington Avenue, St. Louis, Mo.

THE DYNAMO IN THERAPEUTICS.

By John T. Pitkin, M. D., Buffalo, N. Y.

In this, the electrical age, it seems to me that it behooves us as Physicians (if we desire to be progressive) to keep in touch with the rapid developments in that branch of science which has stamped its name not only upon this city (Buffalo), but also upon the epoch in which we live.

The extreme value of electricity in its various forms or degrees of tension, i. e., (1) Galvanic, (2) Faradic, (3) Franklinetic, as a remedial agent, either alone or in conjunction with ponderable agencies for the alleviation of lithæmic, neurotic and asthenic disorders, is too well known to require from me at present any more than a laudatory comment. But the physician who desires to avail himself of the utility of this subtle variety of force finds himself confronted on every hand with manifold difficulties and perplexities.

The knowledge of this important branch of science acquired in the average University medical course is extremely meagre and utterly inadequate to form for him a proper working foundation and the man of any science who endeavors to build a superstructure on other than the rocks of knowledge is thereby doomed sooner or later to failure and remorse.

Many manufacturers of electrical apparatus take undue advantage of us by making instruments which are very complicated and correspondingly expensive. Once in our possession they seldom work satisfactorily for any considerable period of time, usually on account of impairment or exhaustion of the source of electrical supply.

The purpose of this communication is to offer a simple plan whereby this complication can be obviated.

Some of us now have, and all of us can have from the dynamo, a constant supply of electricity which is essentially galvanic. How can it be utilized?

A first-class Faradic coil with complete accompaniment of electrodes should cost not to exceed ten dollars. The primary of such a coil can be connected directly to any street lighting current in the following manner:

Supposing your office to be wired, as the electrician would express it, in multiple, that is, the current has the choice of following several lines through as many lamps, which it will do, always selecting the channel or channels of least resistance.

Unscrew from the wall fixture or electrical chandelier the sixteen or twenty candle power lamp (as the case may be) in the place of which insert a screw socket; from this two wires should lead to a Faradic instrument, but before reaching same, one of the wires must pass through an electrical lamp which must always be turned on. The purpose of the lamp is to act as a safety valve, protecting the house wires on the one hand and the instruments on the other, for in its use the surplus of electricity is transformed into light and heat; thus it allows only such a portion of the electrical current to reach the instruments as they can safely utilize, it also becomes an index to the operator, showing him when the current is passing onward. By this arrangement your wall bracket lamp and and coil will be wired in series. The apparatus is always ready upon turning the button for electro-therapeutic purposes (always on tap).

The current so obtained, if from a 110 volt dynamo, will have a strength at coil, of about 52 volts and half an ampere, this, after induction, can be safely employed for Faradization of the patient's extremities for muscle, nerve and joint affections.

To electrify the great nerve centers, less voltage is recommended. This can be obtained by interposing in the primary circuit between the lamp and coil a water Rheostat, i. e., a jar of acidulated water into which the current is lead to two copper plates.

The greater the distance between these immersed plates the more will the electrical force be converted into chemical energy and thereby reduced.*

The galvanic current may be obtained from the same apparatus by disconnecting the Faradic instrument and attaching proper electrodes to the wires which formerly supplied it.

Should a street service not be obtainable, you can procure a small dynamo and propel the same by a water motor, a small gas or steam engine. Small dynamos can be built by the makers, so wound as to give any number of volts

*The water rheostat may be replaced by extra lamps wired in simple series.

Reduced copy of a composite X-Ray portrait of a man thirty-one years old. The picture was made on nine plates; three 11x14 inches for the head and feet, and six plates 18x22 inches for the two arms, the two legs, the chest and shoulders and the trunk. Exposures varied from three to tweuty minutes, with the tube about three feet distant.

By courtesy of Dayton C. Miller, Cleveland, Ohio.

desired,† as already intimated. A dynamo giving 40 to 50 volts and one-half to one ampere for ordinary Faradic and galvanic work, is the quality and quantity most desirable.

By introducing resistance coils into the galvanic current amperage will be raised at the expense of voltage, and with proper electrodes you are prepared for cautery work.

By the means suggested in this article you have at your disposal not only a constant source of electrical supply, but also currents of some power capable of doing some good. The two or three cell fluid chemical battery‡ with its filthiness, uncertainty of action, requiring constant care and expense, giving only about one volt per cell, even when freshly charged has, in my humble opinion, outlived its usefulness, except, perhaps, as a plaything or faith cure, and should be relegated to the realms of innocuous disusage.

Again history repeats itself, for the dynamo is only the outgrowth of the magnetic-electrical machine with which our medical forefathers ground out electricity for the alleviation of the suffering of their fellowmen.

In closing, let me suggest that electricity be employed like other powerful remedial agencies in definite doses, i. e., as many volts and amperes as may be required to overcome a given pathological condition. Then will both you and your clientage marvel at its efficacy.

†Large wire for quantity, long fine wire for tension is used in winding the armature and field magnets.

‡The fluid battery has been largely replaced in the arts and telegraph service by the dynamo.

THE LIMITATIONS OF THE ROENTGEN ENERGY.

By JOHN DENNIS.

These conclusions have now forced themselves on the minds of every conscientious and skillful Roentgen-ray operator on surgical lines:

First. The energy cannot be utilized in diagnosis of foreign substances in the human organism, with exactness, or in presenting undistorted views of the anatomy, without scientific and positive appliances which will reveal the location of any such object with geometrical precision, or present a relatively correct shadow of the bones of the skeleton. It is now known that the Roentgen energy, unaided, is an unsafe and, indeed, dangerous guide; that it will reveal the presence of an object more permeable to the ray than its surroundings, but will not disclose its position with the accuracy necessary to insure successful exploration. It is unnecessary to enlarge upon this proposition. If it has not impressed itself on the mind of an experimenter, he has yet much to learn regarding the practical application of the force.

Second. That observations by means of the Roentgen engergy, for the diagnosis of the location of foreign substances in the living human organism, can no longer properly be made as experiments; scientific means having been provided by which all elements of experiment and uncertainty have been eliminated. In other words, prolonged and repeated exposures, with tubes in close proximity to the subject, are not warranted in the present condition of the art, that art having advanced to the point where any object which can be discovered on the field of the fluoroscope, can be located with geometrical exactness with reference to exploration, only a few minutes exposure, with the source of energy outside of the known danger line, and with the subject sufficiently remote to insure against untoward effects being necessary. In case the object is not discernable on the field of the fluoroscope, and is still susceptible of being revealed on the sensitive plate, scientific means have been provided by which the distortion can be eliminated and the position of the object fixed, without exposing the subject to danger from the energy. The fluorograph provides for the correction of all distortion, and the results are exact, as in the case of a fluorometric observation with the fluoroscope. This is done without the long, tedious and repeated chance exposures which so often result in final failure in exploration, even at the hands of the skillful surgeon.

Third. That the probe, with all of its potentiality of good and evil, is no longer an experimental instrument, but is guided to its destination with unerring precision; that a line of travel is mapped out for the probe which eliminates the elements of uncertainty and hope, and guides it direct to its mark.

Fourth. That the Roentgen energy is absolutely safe and certain in its results, in a surgical endeavor, if in the hands of competent operators, and if aided by the latest scientific appliances.

Fifth. That the usefulness of the Roentgen energy has suffered, as an aid to the surgeon, by reason of its failures in the hands of unskilled operators, who have endeavored to utilize it without sufficient knowledge of its limitations, and without the additional aid in the way of appliances which science has provided.

One of the many readable journals of the country is the *Medical Review of Reviews*, edited by Daniel Lewis, A.M., M.D., New York City. A novel and useful feature adopted by this publication is the "Key to Medical Periodicals," and the title of the "Month's Leading Articles."

This is the third year of publication of the *South African Journal of Engineering, Mining and Science*, printed in Johannesburg, S. A., and edited by Robert Dives. It is an exceedingly interesting monthly, and the advertisement pages are full—a proof of good times in that interesting country. The September number contains an editorial "The History of Our Times," which should be read by every one interested in history, and South Africa particularly. The price named on the journal is sixpence monthly.

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ELECTROCUTION, AND WHAT CAUSES ELECTRICAL DEATH.

BY HOMER C. BENNETT, M.D., M. E. LIMA, OHIO.

A Lecture before the Class of the National College of Electro-Therapeutics, Re-arranged and Written for The American X-Ray Journal.

The infliction of the death penalty as a means of capital punishment by means of electricity, is now the only legal method in but two States, viz: New York and Ohio.

This method has been in vogue in New York for a number of years, and was first used there on William Kemmler (alias John Hart), in the Auburn prison, August 6, 1890. It has but recently been introduced into Ohio, where the idea first originated some fifteen years ago, and the first time it was used in Ohio was at the Ohio Penitentiary on the morning of the 21st day of April, 1897, at about half-past 12 o'clock.

It does not fall within the province of this paper to enter into the discussion of the subject of capital punishment as a deterring agent for the prevention of crime, at all but as we are confronted by a condition instead of a theory, we will endeavor to show that if the death penalty is to be inflicted at all as a capital punishment, that the method commonly and officially known as electrocution, is the most humane, painless, bloodless and best method known.

In the legislative history of Ohio electrocution and the name of Jones will always be associated, because about fifteen years ago, the subject was first brought before the General Assembly of Ohio by Representative Jones, of Jackson county. It was at first treated as a jest, but later it was decried by certain sentimentalists, who were horrified at the idea. But like "Banquo's ghost," it would not "down," for after awhile the matter was again brought up, this time by Representative Jones, of Trumbull Co., only to meet with opposition and failure of recognition. The idea had come to stay, however, and after it had been tried in the State of New York the matter was for the third time brought up, and again by a man of the same name as before, this time Senator Jones, of Madison county, who in the seventy-second General Assembly of Ohio introduced Senate Bill No. 216, which with but slight change became the law as it now exists in Ohio.

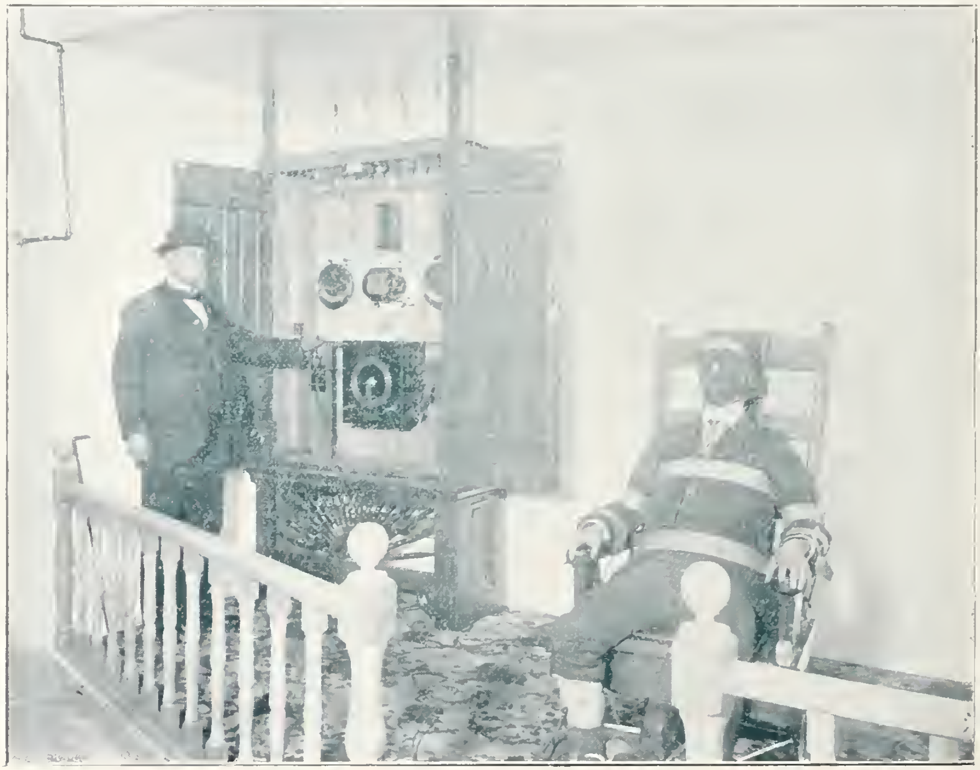
Thus we see that there were three periods in the history of this method in Ohio, viz: inception, struggle and failure, and at last success; and, as we have seen, there was a Jones at the helm in each.

In the meantime, however, New York had taken the matter in hand, and it was cussed and discussed for a long time, but it finally prevailed, on the ground of being more humane. There, however, it had its hardest fight to live after it was upon the statute books, for the most extraordinary methods were resorted to to prevent its execution, case after case being taken to the Supreme Conrt of Appeals, and even to the Supreme Court of the United States, on the ground that it was "cruel and unusual."

The Supreme Courts sustained the law, and then appeals were made to electricians and manufacturers and dealers in electrical goods and supplies, because they said that to use electricity, the greatest discovery of the age, for the ignoble purpose of capital punishment, would be to bring disgrace and shame and reproach upon the most wonderful thing of modern science, and that it would not do to convert so valuable an agent to the furthering of "legal murder."

The makers of knives, axes, swords, guns and ropes which have all been used for the execution of criminals at different times, have always been respected and honorable men, notwithstanding, and it seemed strange that electrical workers should have been influenced by such statements, but such was the fact, though by what the wire, armature and electrode could be any more disgraced than any other instrument, was not clearly demonstrated.

The result was that the State authorities were unable to secure the proper appliances and apparatus with which to properly carry out the law, as no reputable manufacturer could be induced to install the plant, nor any experienced



THE OHIO STATE "ELECTROCUTION CHAIR," USED AT COLUMBUS, OHIO.
Showing how capital criminals are now executed by electricity. Hon. C. G. Coffin, Warden of the Ohio Penitentiary, at the switch.

electrician would risk his reputation by being in any way connected with the thing.

Consequently they were compelled to depend on inexperienced men, and to use defective apparatus, and in the absence of any precedent it is a wonder that the earlier electrocutions in New York were not as barbarous as the abandoned method of hanging.

It was also said, and probably with good grounds for it, that at the time of the earlier executions by this means that the apparatus was tampered with, in order to cause just such horrors as would lead to such a popular outcry and create such a prejudice in the minds of the people that would lead to the repeal of the law. At any rate there were attempts made to have the law rescinded, and the strong argument used was that the flesh was burned where the electrodes came in contact with the skin.

But the law stood as it was, and after a time the feeling died out, and there was the usual revulsion, and with more complete understanding of the subject and with the perfected machinery and appliances at their command, there was nothing more heard of the frightful tortures and the burning of the flesh, and time, science and common sense finally triumphed in the Empire State, and after a lapse of so long a time the idea which originated in Ohio, where so many great ideas and men have started, returned to its home, and was put into execution most successfully, and the Joneses were at last vindicated.

Such, in substance, is the history of the introduction and establishment of electrocution up to the present time, and its practical demonstration so far as shown by actual use, where this method has been once used, has doomed any older method to oblivion.

It was through the courtesy of Hon. E. G. Coffin. Warden of the Ohio State Penitentiary, that I was permitted to see the condemned men, Wm. Haas and Wm. Wiley, the afternoon before the execution, and also to examine the apparatus used, and then, later, to witness the first and second legal electrocution occurring in the State of Ohio.

The chair used in this instance was designed by and built under the personal supervision of Mr. H. L. Canfield for the State, and is a handsome and substantial piece of furniture, but not such as one would want to ornament a parlor. It is made of oak, about three feet wide, and about two and a half

Showing the construction of the "death chair," the method of applying the current through the hands in the case of McElvaine, and the attitude of the subject before receiving the contact.

feet deep, and from the bottom of the seat to the top of the head rest is about 3 and a half feet. The seat is of perforated wood and the head-rest is so adjusted, somewhat after the manner of a dentist's chair, so as to be raised or lowered, and it has a padded front which can be forced forward by means of a thumb screw after the face strap is adjusted, thus making the head immovable without being painful.

The subject is seated in the chair and

held there firmly by means of thick straps of yellow leather, about three inches wide, one around each wrist, one around each arm just above the elbow, one around the body just below the arms, one around the body just above the hips, one around each ankle and one across the whole face and around the head. This last one is made of soft black calfskin, and consists of two pieces, each about four inches wide at the widest part, just meeting at the middle, but lapping over each other at the sides of the head, thus making a sort of diamond-shaped bandage with a concave surface which fits over the face, leaving a small opening for the tip of the nose to project, thus allowing the subject to breath. This strap answers the double purpose of a strap with which to secure the head and also as a mask.

Each ankle fits into a semi-circular notch in each side of a cross-piece at the bottom of the chair. These notches are covered with russet leather and studded with brass tacks to which the ankle straps are attached. When a man is strapped in this chair he can move nothing but his knees, and them only from side to side.

The contacts are made by means of two electrodes, one of which is applied to the outer side of the right leg at about the junction of the upper and middle third, and is held in place by means of a light strap around the calf.

The other electrode is applied to the vertex by means of a long black strap which passes down over the temples and cheeks and under the chin.

Right here I will call attention to these electrodes. Everything used was in first-class shape, and was neat and artistic, except the electrodes, which are the most important part from an esthetic standpoint, as they do the work, and when they were shown to me I could not repress a smile, because they were so crude and rough. I would not have such ugly things seen about my office and have it known that they were to be used by me. The one for the leg was about two by four inches, and the one for the head was about fonr inches square, and they consisted of nothing but pieces of common rough galvanized iron wire screening, having about a quarter-inch mesh, and they looked as if they had been just cut from the piece. To one side of each was soldered a binding post to which to attach the conducting wire, and to the other side was roughly stitched a common coarse sponge without any attempt at finish or insulation on the side of the binding post, and although they were no doubt efficient, they were ugly and dangerous to handle, and were not in keeping with the rest of the paraphernalia, the majesty of the law and the dignity of the State, but they did the work, and probably there was no one there who was enough interested in the details except myself who would make any note of their defects. It is to be hoped that they have been replaced, or will be, by others more artistic and safe.

In my practice, when I apply an electrode to a patient, I am accustomed to having them neat, if not pretty, and made of brass, either polished or nickeled, and properly insulated on the back.

As far as I was able to learn, I was the only electro-therapeutic specialist in attendance, although there were present twelve physicians, who through the thoughtfulness of Dr. F. S. Wagenhals, the prison physician, and the courtesy of Warden Coffin, were admitted to the execution room and invited inside the railing before the rest of the spectators were admitted, and in view of the smallness of the room and large number of witnesses, there being about ninety, was quite an advantage, and was appreciated by the doctors.

Everything being in readiness, the condemned men were led in, one at a time, and strapped securely to the chair, and the electrodes adjusted after being well wetted with a solution of sal-ammoniac, and the current was turned on.

When the switch was thrown by the Warden, which completed the circuit through the body, there was a sudden tetanic contraction of every muscle in the body, so that every strap was put under strong tension until they creaked with the strain. With the contraction of the diaphragm there was a short, spasmodic, inhalatory gasp, which was undoubtedly entirely involuntary and automatic, otherwise there was not a sound audible except the creaking of the straps to show that a human being was being put to death.

As soon as the current was turned off there was, of course, a relaxation of the tetanus of the entire muscular system. This was repeated again and again, about three seconds duration each time, till three such shocks had been given, when the man was pronounced "dead," although death had probably occurred before the first charge had been turned off, and the subsequent contractions and relaxations and gasps, were but such as were known to follow the application of electricity to dead muscle, as was previously tried on the bodies of a horse and dog.

The current used was the alternating dynamic form, with a tension of 1,700 volts in the first case, and 2,000 volts in the second, an amperage in both cases of 7½ amperes, and alternations of 16,000 per minute, and the apparatus used was that of the famous "Wood" system, made at Fort Wayne, Ind., than which there is none better.

It has been decided by the authorities of New York State that about this number of volts do the work most effectually, although I have personal knowledge here at home, where persons have met with accidents, where they received a much smaller dose, and with very poor contacts, and only one, which was instantly fatal, in spite of all attempts at resuscitation, persisted in for hours.

The only visible sign of the deadly work of the current were slight blisters on the legs of both men, due to the current heating the water in the sponge, and the hair of the head where the wet sponge rested was hot for the same reason, but not burned or singed at all.

The sensational newspaper accounts which were circulated and written by unscientific and inexperienced men, one of whom to my certain knowledge was badly rattled and half drunk, were all nonsense. The various noises described by them as snapping, buzzing, purring, etc., were only due to the stretching of the new leather straps, as the muscles contracted, and the "small puff of smoke" which one imaginative writer saw, was an almost invisible vapor that arose from the head electrode when the current heated the water in the sponge, and was so slight as to be seen by but a very few who were quite close. I was only six feet from it, and although I expected, and looked for it, I did not see it.

As all electro-therapeutists know, the greatest resistance to the passage of the electricity, resides in the skin, which, next to the hair and nails, is the poorest conductor in the body, and that after the skin is penetrated, the soft moist tissues of the body, on account of the large percentage of water which they contain, and which is an excellent conductor, offer but slight resistance to the passage of the current.

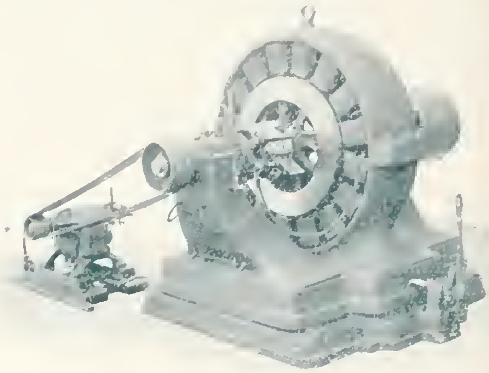
The part of the skin chosen also determines the amount of the current required, as the skin varies in the amount of resistance offered, in different parts of the body. For instance, very much more voltage, or electro-motive force, will be required to force the same amount of current strength, or amperes, through the body, from one hand to the other, than will be required to force the same number of amperes through the body, from the abdomen to the sacrum. It is estimated that the resistance of the body from one hand to the other, is about twice the amount of resistance encountered in the entire Atlantic cable.

A shock of 1,700 volts, passing through the body, will force through it a current strength of from seven to fourteen amperes, according to the conditions, where the electrodes are placed, the size of the electrodes, and individuals, and the state of the health of the person. For instance, a man who is large, anæmic, and sickly, with a dry skin, will require more voltage to kill him than one who is small, full-blooded, healthy and with a moist skin.

This was demonstrated in these two cases. In each case there were 7½ amperes passed through them, but the man Haas, who was short, well built and apparently strong, it took only 1,700 volts to do the work, while in the case of the man Wiley, who was tall, slender, pale and sickly looking it required a voltage of 2,000 to force the 7½ amperes through his body, with the same contacts.

It is claimed, but with how much truth I do not know, that it is impossible because the measuring apparatus is in a room separate from the execution room, to tell the exact amount of electricity used in the New York prisons in any individual case, but with the apparatus used in Ohio this can be accurately found out, and this record if kept will be of value to the electrical scientists of the future.

The dynamo generating the current used at Columbus, Ohio, is located in the power house which is about a thousand feet from the Annex where the electrocutions take place, and the current is conveyed to the Annex by means of overhead wires across the intervening space. This dynamo is a "Wood" system, thirty kilowatt alternator, with a one and one-half kilowatt exciter, and is capable of carrying a load of six hundred sixteen candle power lamps. The armature is of the ten pole iron clad ring type with ventilating air chambers, and an initial potential of 2,000 volts, with a speed or 1,680 revolutions per minute, making 16,000 alternations per minute. By the courtesy or Mr. F. S. Hunting of the engineering department of the Fort Wayne Electric Corporation, we are able to present a cut of the alternator and exciter.



When this 2,000 volt alternating current is thrown into the Annex circuit that circuit can be controlled or cut down from this full power to that of 100 volts by means of a separate set of lead wires which are connected up in series with the alternator and a rheostat composed of German silver wires in the Annex switch-board, and with a direct reading, primary current voltmeter reading from 1,000 to 3,000 volts, so that the operator can easily control the voltage required to do the work of electrocution, which is, as has been stated, about 1,700 volts.

The Annex switch-board contains the following, viz:

A primary voltmeter, reading from zero to 3,000 volts; an ammeter, reading from zero to 25 amperes; one rheostat controlling the primary voltage from zero to 3,000 volts; one two-pole single-throw knife switch to throw the current through the chair; one double-pole double-throw knife-switch to open the alternator or field-coil in connection with the single-throw knife-switch, so that before the main current switch is thrown off the subject, the handle of this switch will open the alternator field switch before the contacts of the main switch are opened, this devise being necessary to avoid the formation of a spark, or as it is called, an arc, and the grounding of the operator.

The time taken by the two electrocutions is as follows, viz:

12,31:00—Haas takes the chair.

12,31:30—The current switched on, 1,700 volts, 7½ amperes.

12,32:00—Haas pronounced "dead,"

12,34;00—Wiley takes the chair.

12,34:45—The current switched on, 2,000 volts, 7½ amperes.

12,35:00—Wiley pronounced "dead."

This record shows that in the short space of less than one minute, net, two men were legally executed in a painless and bloodless manner.

Formerly it took a much longer time to accomplish this end, as some have been known to struggle for life as long as twenty-seven minutes when being hanged, and it is a common thing for them to linger for half this length of time before being pronounced as "dead." The object sought after in hanging is that the sudden drop will break the neck and cause death suddenly by paralysis, but this often fails, and the victims of defective apparatus have to suffer death by slow strangulation, and they are conscious for some time, and sometimes they are frightfully mutilated by the rope cutting into the flesh of the neck.

A case of this kind was detailed to me by my friend, Dr. Harry S. Jones, of Columbus, Ohio, who was for fourteen months the prison physician, under Governor McKinley, where the rope cut the throat of a man who was being hanged, so that the doctor was forced to support the body in order to prevent entire decapitation, for abont nine minutes, while the man slowly bled to death, and in the mean time the doctor was drenched from head to foot with the blood of the dying man.

After going through with such an experience is it any wonder that after witnessing the quick, painless and bloodless electrocution, that he was much impressed with the many benefits of the new method?

It was the opinion of every one who witnessed these two executions that the men never knew what had happened, and that they were killed quicker than they could think, and therefore felt no pain whatever.

It is a well established fact that it requires an appreciable length of time to think, and it has been estimated by eminent scientists that the ordinary sensory impressions travel along the nerves at the rate of about 155 feet per second of time, and that painful impulses do not travel that fast, and when we know that a current of electricity will travel the circumference of the earth eleven and a half times in a minute, or at the rate of over 25,000,000 feet per second, it is almost inconceivable to reckon the time required for so strong a current to pass from a man's head to his foot, at most only five feet, or for it to pass through the skull and reach the sensorium and paralyze consciousness. At most, the slow going thought or pain impulse is left far behind in the race, and the man is dead, or at least unconscious, long before he knows it.

Evidence has been adduced from experience in past electrocutions, both legal and accidental, that a current strength of 8 amperes forced through the body by a pressure of 1,700 volts and representing a power (1,700 x 8) of 13,500 watts, or about 18 horse power, will produce instantaneous, painless and absolute death.

On July 7, 1891, there were four murderers electrocuted at Sing Sing prison, New York, on whom was used a strength of about 1,600 volts, and was the first and only time that four prisoners were electrocuted in one and the same day, but since then there have occurred three double electrocutions when two men were electrocuted in the same day. These occurred as follows, viz:

Clinton prison, Dannemora, N. Y., Oct. 29, 1895.

Sing Sing prison, Sing Sing, N. Y., on April 23, 1896.

Ohio penitentiary, Columbus, O.. on April 21, 1897.

There are but four electrocution chairs in the world which are used for the infliction of the legal death penalty, and they are at Sing Sing, N. Y., where Warden Sage has had charge of 21 electrocutions; at Auburn, N. Y., where Warden Stout has had charge of 10; at Clinton prison, Dannemora, where Warden Thayer has had charge of 9 electrocutions; and at the Ohio penitentiary, Columbus, O., where Warden Coffin has had charge of 4 electrocutions.

(Continued in January Number.)

WHAT CAUSED ELECTRICAL DEATH?

Since electricity has come into general use, as a therapeutic agent, and especially since numerous lethal doses have been given, either by accident, or, as, in electrocution, by design, there has been much theorizing as to what actually causes the death.

Some aver that the death is caused by the tetanic contraction of every muscle in the body suspending the functions of the heart and lungs. This same condition of suspension exists in persons who have been apparently drowned, when both the heart and lungs have ceased their work for some time, yet such persons have been resuscitated, The same may be said of asphyxiation by gasses, and of narcotic poisoning.

Another theory is that death is caused by paralysis of either the central or peripheral nervous systems, which seems to be plausible, yet there are cases on record where persons have received non-lethal shocks, and were paralyzed, who recovered, showing, that up to the extent of the paralysis, there was no change made which could not be repaired.

There are other theories advanced, but these two have the most advocates, and are the most generally accepted.

After a careful study of the action of electricity on the human system, both in disease and health, there occurs to me another theory. as to the cause of electric death, which, until it is controverted, and another, and more scientific one is advanced, will seem to me to be the best one yet proposed.

It is a well-known fact, among electricians and scientists, that a bar of iron, can be permanently magnetized, It is also a fact that if such a magnet be cut into two parts, that each part will partake of all the properties of the parent magnet, and in itself be as complete a magnet as before division, that is, each divided part will have two poles, which will attract their opposites, and repel their likes.

This division can be carried on indefinitely, with the same result, till we know that every atom of the magnet, will itself be a perfect magnet. We know that if a magnet is free to move, that it wlll assume an approximately north and south direction.

We also know that if we heat a permanent magnet very hot, that the magnetism will be destroyed.

We also know that if we pass a high tension alternating current, either through or around a permanent magnet, that the magnetism will be destroyed. It is this principle that is employed to demagnetize watches, when they become accidentally magnetized.

We know that the air above us is positively electrified, and that the earth beneath us is the great negative electric reservoir, and that there is a constant effort, like water running down hill, to establish an electric equilibrium, between the so-called positive and negative poles, which designations are merely relative, and are made by electricians only for convenience.

As we are usually standing erect, and it is a property of electricity to always follow the best conductor, and as the body is a better conductor than the air, we are constantly acting as electric conductors, from the air to the earth.

As like poles repel and unlike poles attract, it is only right that we assume that, since, as shown above, every atom in the magnet, is itself a perfect magnet, that every atom in the magnet is arranged accordingly, the positive pole of one toward the negative pole of its neighbor, in order to make the perfect magnet.

If this is true of an iron magnet, it must be equally true of the human body, and such a condition existing in the human body constitutes perfect health, and any deviation from this condition constitutes disease, and the nature and extent to which this equilibrium is disturbed, determines the nature and extent of the disease.

Upon no other theory can we account for the action of electricity, as a therapeutic agent for the amelioration and cure of disease, than that the passage of the mild current through the diseased part will so act as to rearrange the atoms of the body in their normal relations, from which they have been moved.

This theory will also account for the effects of climate, and altitude upon the body. If a person living in a climate or altitude where the air is always highly electrified positively, goes to a place where the opposite condition exists, there will be a disturbance of the atomic electric equilibrium of the body, which will sooner or later be manifested in some way, either for or against his health.

Every physician knows that to send certain persons to the mountains will benefit them, whereas to send them to the coast would kill them. Some live in Colorado and New Mexico, who would soon die if sent to southern California, or Florida, and vice-versa, and we can account for this fact on no other theory than that of the disturbance or restoration of the body atomic electric equilibrium. Many will contradict this statement, and say that the presence or absence of oxygen or ozone in the air is the reason, for the help or harm received in these cases. When they say that, they state only a part of the proposition, for what is oxygen but an oxidizing agent which produces heat, which is one of the forces correlated to electricity.

There is a correlation between electricity, heat, light, motion, chemism, magnetism, gravity, levity, etc., and why not nerve force, intellectual action, and life or vital principle, or whatever you choose to call it, which actuates the body, both animal and vegetable. The U. S. Government agricultural experiments prove that the growth of vegetables is stimulated by electricity, and all of these correlated forces can be converted into each other.

The eminent Dr. J. Inglis Parsons, of England, has reported numerous cures of cancer, by the passage of strong alternated currents of electricity through the growths, and he thinks that the current breaks up the affiliations and affinities of the particles of the foreign body, giving them a chance to once more resume their normal relations, and return to health.

Every electro-therapeutist knows that he can relieve or cure diseased conditions with electricity, but how it is done, we do not positively know, but we can account for the many seemingly wonderful results obtained, on no other grounds than the above theory.

From the above reasoning we assume that disease is more or less fatal, according to the extent with which the electrical equilibrium of the component atoms of the body is disturbed, and if it progresses to a certain extent, death will result, and we know that we can either wholly restore the equilibrium, or arrest the progress of the disturbance, and cure or relieve the disease, as the case may be.

As stated above, we do not know how the electricity acts, to arrest and cure the disease, but we can reasonably assume that it follows the law which governs the correlation of force, and the conservation of energy, that it does elsewhere.

It will be conceded by all that whatever is a power for good when rightly used, is just as strong a factor for evil when wrongly used, in proportion to its potential.

Therefore, if with a mild current of electricity, rightly applied we can arrest disease, in a sick person, we can by a too strong current cause disease, and even death, in a well person.

If we can, according to Dr. Parsons, above referred to, with a therapeutic dose, cause a rearrangement of the atoms of a cancer, and bring about a return of the normal equilibrium, the lack of which would cause death, we can with a lethal dose, as given in electrocution, so disturb the normal atomic equilibrium as to cause in a well man, complete, instantaneous disease, and death.

As shown by the results of the autopsies of electrocuted men, there are no evidences, either macroscopical or microscopical, which would be pathognomonic of the cause of death, therefore, in the absence of some of the more exact reasons, we can, following the above line of argument, accept the theory that electric death is caused by a violent, rapid and excessive disturbance of the normal atomic electrical equilibrium of the body, to such an extent as to cause complete and instantaneous. disease and death.

The author invites discussion of his theory here set forth, which as far as he knows is entirely new, and original with him.

HOMER C. BENNETT, M.D., M.E.
Electro-Therapeutic Sanitarium, and X-ray Studio, Nos. 2, 4, 6, 8 and 10, Collins Block, Public Square, Lima, O.
Dec. 1, 1897.

COAL ANALYSIS BY ROENTGEN RAYS.

The density of the shadow of a coal sample viewed through a fluoroscope is dependent upon the percentage of ash, and by matching the shadow of sample under investigation with that of a sample of coal of similar size and thickness, and with a known percentage of ash, speedy and probably quite accurate results may be obtained.—*Caryl D. Haskins.*

VICTIM NOT A GOOD WITNESS.

In the United States Circuit Court, Judge Elmer B. Adams caused some surprise on the 12th inst. at St. Louis, by sustaining a demurrer to an indictment charging "Professor" I. C. Fay, a medium of that city, with using the mails to defraud. The evidence against Fay was conclusive, but he was discharged by Judge Adams, who held that any man who was so mentally dwarfed as to be swindled by representations such as "Professor" Fay made should not be a competent prosecuting witness in the criminal prosecution of the man who made them.—*Chicago Legal Journal.*

X-RAY TUBE. ROLLINS. *Elec. Rev.*, Dec. 1.—An illustrated description of his tube, in which the anode is kept cool by a stream of water behind it.

TREATMENT OF BURNS.

The most painful burns are assuaged in a few minutes by an application of cocainized Campho-Phenique, after the following formula:

℞ Cocaine hydrochlorate, 5 gr.
Campho-Phenique .... ½ oz.
Olive Oil .... ½ oz.
M.

Rub up the cocaine and Campho-Phenique and add the olive oil. A man whose hand had been torn and badly burned by an electrical discharge, the pain of which was so severe that he fainted twice before the dressing could be applied, expressed himself as absolutely without pain in less than one minute after the application.

In the first number of this journal we produce a photograph and a radiograph of a mummified hand of an Egyptian princess, believed to be more than 3,000 years old, obtained near the tombs of the King's Thebes, in 1892.

The accompanying radiograph is the mummified foot of an Egyptian princess and from the same body as the hand.

The deformity noticed in the big toe or joint is evidently from the sandal strap. Dr. Keen, of Philadelphia, estimates that the age of the young lady was about 15 years, as shown by lack of ossification in the joints.

M. Contremoulins of the laboratory of Micro-Photography of the faculty of medicine in Paris, has invented an apparatus called "le chercheur de projectiles" or "searcher for projectiles," which he claims is capable of revealing with the absolute precision of a demimillimetre, the exact location of a ball within the brain. The invention dates about November 25th, this year.

The Dennis Fluorometer was invented by John Dennis, of Rochester, N. Y., about August, 1896. It was used successfully October 23d, 1896, to locate a bullet in a human skull in the city of Rochester, and is now used in some of the American hospitals as an indispensable adjunct to the Roentgen rays. The

instrument locates bullets, etc., with mathematical accuracy.

The American's invention antedates the Frenchman's about fifteen months.

CONDENSED X-RAY INFORMATION.

ABSORPTION OF ROENTGEN RADIATION. HUMPHREYS. (Univ. of Va.) *Phil. Mag.*, Nov.—A short article describing researches made to determine whether the absorption of these rays depends on the kind of elements and amounts, or to some extent on the manner in which the elements are combined, that is, whether it depends at all on the grouping of the atoms in the molecule; he found that the absorption is chiefly, if not entirely, an atomic phenomena, and therefore the absorption due to a compound differs but little, if at all, from the sum of those of its constituents. In the experiments the rays were passed through compounds, and also through "equivalent thicknesses" of the constituent elements; from the small number of substances examined he believes that possibly the Rontgen ray absorption is an atomic one, and he concludes that, if so, all compounds none of whose elements were highly absorptive would transmit the rays, while all those containing one or more elements which in the free state were opaque would themselves be opaque; about forty compounds of a varied nature were examined: it also seems that the absorption is a function, though probably not a linear one, of the atomic weight.

DISCHARGE RAYS. HOFFMAN. *Wied. Ann.*, No. 2; abstracted in the *Elektrochem Zeit.*, Nov. 1.—He made researches to determine the properties of these rays; the conclusions are given in the abstract but are too numerous to be given here; among others he states that some substances have the property of changing these into Rœntgen rays.

MAGNETIC DEFLECTION OF CATHODE AND X-RAYS. METZ. *L'Eclairage Elec.*, Oct. 30.—A reprint of an Academy note describing experiments. The only difference in the results between this and his previous experiments is that the fluorescent spot was always diffused, even when the vacuum was very high. Several other Academy papers on Rontgen rays (already noticed in the *Digit*) are also abstracted in that issue.

ROENTGEN RAY TUBE. J. W. HOWELL, Newark, N. J. App. filed Aug. 26, 1897. The art of regulating a vacuum in a Roentgen ray tube, which consists in passing a current proportional to the resistance of the tube through a suitable salt in a vacuous inclosure, and thereby volatilizing the salt in accordance with the degree of vacuum desired.

CHARLES A. LEONARD, A. M., M. D., in the *Journal of the American Medical Association*. In reference to x-ray "burns," the author does not believe that they are the x-ray *per se*, but that they are due to the results of induced electric currents in the tissues of the patient. The x-ray depends for its production on the physical phenomena of electric induction, and it is certain that any conductor of electricity, as the patient's tissues, if approached sufficiently near to the x-ray tube, *i. e.*, within the field of electric induction, will have a current of electricity induced in it which may be capable of destroying its vitality. A substantiation of this theory is seen in the fact recently made known, that a sheet of aluminum if grounded and placed between the tube and patient, will prevent the burn, while interfering in no way with the x-ray phenomena. The induced currents are formed in the aluminum and carried by the wire to earth without injury to the patient.

THE CONTRACTIONS of the Stomach studied with the Roentgen ray have resulted in establishing the fact that the human stomach, like that of the frog and the dog, the larger part serves as the receptacle for the food, while the smaller prepyloric part is the motor organ of the stomach.—*Semaine Med.*, July 28.

ACTION OF X-RAYS ON CUTANEOUS EVAPORATION. LECERCLE. *L'Eclairage Elec.*, Nov. 6—reprint in *Electrical Review* —A brief abstract of an Academy paper giving the results of experiments in which he measured the amount of water evaporated from the skin before it is exposed to the rays, immediately after, and an hour and a half or two hours afterwards; he found that it produced a diminution of the evaporation which persists for a long time afterwards, and can even result in the complete suppression of the evaporation. This is followed by an abstract of another paper in which he describes similar experiments made on the heat radiation: they show that there is always an increase in the heat radiation which persists for a long time after the exposure: he also observed in some cases a temporary diminution of the heat radiation.

RADIOGRAPHS. SEGUY. *L'Eclairage Elec.*, Nov. 6—reprint in *Electrical Review.*—A brief abstract of an Academy paper. In a recent paper Porcher claimed that there was nothing gained by photographing fluorescent image; the present author, however, obtained different results; he made a radiograph of the thorax in 30 seconds; it appears that he used two fluorescent screens, one on each side of the very thin glass plate containing the sensitive film; the image was complete and very sharp. This is followed by a brief abstract of another paper by the same author; he made the bulb of glass which contained powdered albumen and carbonate of calcium, or, better, the chloride of didyme; this has the property that the fluorescent image is red and not green; it emits twice as many x-rays as the ordinary glasses; the image on the fluorescent screen is more brilliant, and is of a greenish yellow with a red tint.

CASES EXPOSED TO ROENTGEN RAYS. RUTHERFORD. *Phil., Mag.*, Nov.—A long article on the velocity and rate of recombination of the ion of gases exposed to Rœntgen rays; he investigated the duration of the "afterconductivity" of air and other gases exposed to these rays, and determined the velocity of the ions from this data. No general conclusions are drawn.

CATHODE RAY COLORATIONS. ABEGG. *Wied. Ann.*, No 11, noticed briefly in the Lond, *Elec.*, Nov. 12.—He made experiments which invalidated the chemical hypothesis concerning the colorations of salts by cathode rays, noticed by Goldstein.

RŒNTGEN RAY TUBE. H. L. SAYEN, Philadelphia, Pa. App. filed April 26, 1897. As a means for varying the pressure in a high-vacuum tube, a main circuit for operating the tube and a shut circuit for varying the pressure.

DEFLECTION OF CATHODE RAYS BY ELECTRIC OSCILLATION. SCHMIDT. *Elek, Zeit.*, Nov. 6—reprint in *Electrical Review.* — An abstract of recent paper describing experiments. A very long tube was used with a fluorescent screen in the interior of one end and a diaphragm in the middle of the tube. Deflections were produced in the beam by merely touching the tube on the outside, the bright spot on the screen becoming oblong; similar results were produced with strips of tin foil on the outside of the tube, or with a metal ball connected with the cathode terminal, when the spot became a bright band. He is convinced that the repulsion is due to the oscillations rather than to the electrostatic charging.

MUTUAL INFLUENCE OF CATHODE RAYS. BERNSTEIN. *Wied. Ann.*, No. 11—reprint in *Electrical Review.*—abstracted briefly with some illustrations in the Lond. *Elec.*, Nov. 12.—He made experiments with the apparent repulsion of cathode rays and obtained results which do not agree with Crookes' interpretation; he favors some kind of wave hypothesis; two opposite beams running parallel, side by side in the same tube, did not affect each other, but when the cathodes were placed side by side and the beams went off in opposite directions they were bent; the direction of the emerging waves is therefore of no account; the action is probably exerted by one cathode on the beam of the other at its origin.

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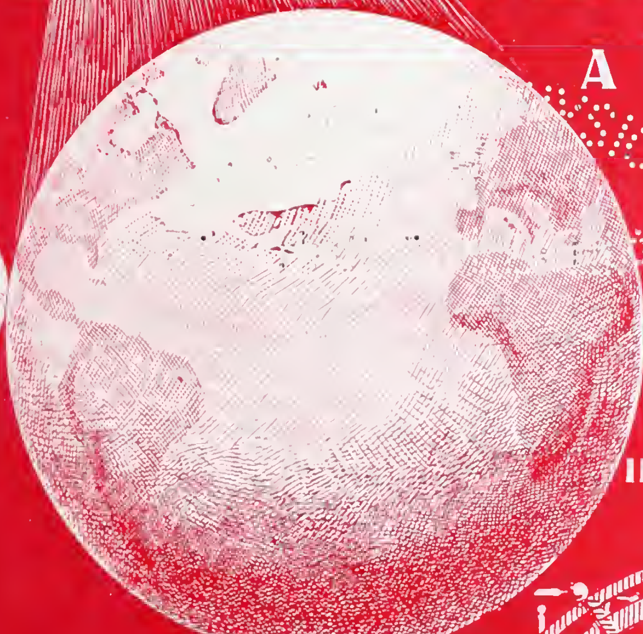

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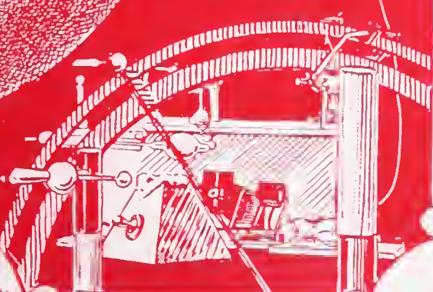

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ELECTROCUTION, AND WHAT CAUSES ELECTRICAL DEATH.

BY HOMER C. BENNETT, M. D., M. E., LIMA, OHIO.

A Lecture before the Class of the Normal College of Electro Therapeutics, Re-arranged and Written for The American X-Ray Journal.

[CONTINUED FROM PAGE 134.]

There are but four electrocution chairs in the world which are used for the infliction of the legal death penalty, and they are at Sing Sing, N. Y., where Warden Sage has had charge of 21 electrocutions; at Auburn, N. Y., where Warden Stout has had charge of 10; at Clinton prison, Dannemora, where Warden Thayer has had charge of 9 electrocutions; and at the Ohio penitentiary, Columbus, O., where Warden Coffin has had charge of four electrocutions, which makes a total of 44 electrocutions in the two States where it is in vogue, up to the present date, December 1, 1897, as far as known to the writer, but there are prospects of more to take place soon, so that by the time this is published, this total will have been increased.

The following is a complete list, up to this date, of all electrocutions which have been inflicted, which list from New York was kindly furnished by the Hon. Walter N. Thayer, Agent and Warden of the Clinton prison, at Dannemora, N. Y.

AUBURN PRISON.

(Auburn, N. Y.)

Name.	County.	Date.
Wm. Kemmler, (alias, John Hart.)	Erie,	May 18, '92
Joseph Tice,	Monroe,	May 18, '92
John Fitzhum,	Buffalo,	June 26, '93
Wm. G. Taylor,	Saratoga,	July 27, '93
John Johnson,	Cayuga,	Nov. 14, '93
Lucius Wilson, (alias "Drik.")	Syracuse,	May 14, '94
Wm. Luke,	Albion,	April 4, '95
John Hoch,	Lewis,	Jan. 20, '97
Guiseppe Constantino,		June 22, '97
Robert J. Powley,		June 29, '97

CLINTON PRISON.

(Dannemora, New York.)

Name.	County.	Date.
Jos. Wood,	Warren,	Aug. 2, '92
Kornell Loth,	Schenectady,	Jan. 16, '92
James Martel,	Saratoga,	June 6, '93
Martin Foy, Jr.,	"	Oct. 23, '93

Geo. H. Smith. Albany. Oct. 29, '95
Chas. N. Davis. " Oct. 29, '95
Bartholomew Shea, Rensselaer, Feb. 11, '96
Joseph Zlamel, Fulton. April 14, '96
Frank Conroy (alias, Charles), St. Lawrence, Aug. 10, '97

SING SING PRISON.

(Sing Sing, N. Y.)

Name.	County.	Date.
James S. Slocum,	N. York,	July 7. '91
Harris A. Smiler,	N. York,	July 7, '92
Joseph Wood (col.).	N. Y.,	July 7, '91
Schichiok Jugigo,	New York,	July 7, '91
Martin D Loppy,	New York,	Dec. 7, '91
Charles McElvaine,	Kings,	Feb. 8, '92
Jeremiah Cotto,	"	Mar. 28, '92
Fred McGuire,	Orange,	Dec. 19, '92
James L. Hamilton (col.),	L. I. City,	April 3, '93
Carlyle W. Harris,	New York,	May 8, '93
John L. Osmond,	New York City,	June 12, '93
John Delfino,	Brooklyn,	Dec. 4, '93
Matthew Johnson,	New York,	Feb. 26, '94
David Hampton (col.),	New York,	Jan. 28, '95
Dr. Buchanan,	New York,	July 1, '95
Richard Leach,	New York,	Aug. 5, '95
Louis P. Hermann,	New York,	April 23, '96
Charles Pustolka,	N. York,	April 23, '96
Carl Feigenbaum,	N. York,	April 27, '96
Arthur Mayhew (col.),	Queens,	Mar. 12, '97
John H. Barker (col),	Westchester,	July 6, 97

OHIO PENITENTIARY.

(Columbus, Ohio.)

Name.	County.	Date.
Wm. Haas,	Cincinnati,	April 21, '97
Wm. Wiley,	"	April 21, '97
Frank Mueller,	Columbus,	Sep. 3, '97
Albert J. Frantz,	Dayton,	Nov. 19, '97

The literature on the subject of electrocution is remarkably conspicuous for its scarcity, as the only thing of the kind which I have been able to secure, outside of the sensational newspaper reports, is an able paper by Dr. Carlos McDonald, of New York.

Dr. McDonald was requested by the then governor of New York to make a special report to him on the subject and to attend the first seven electrocutions, which he did, and he has embodied a part of his official report in an article whice was published in the *New York Medical Journal*, of May 7 and 14, 1892, the subject of which is: "The Infliction of the Death Penalty by means of Electricity, being a report of seven cases with remarks on the Method of Application, and the Gross and Microscopical Effects of Electrical Currents of Lethal Energy on the Human Subject."

This is a careful and able paper of 37 pages, with cuts of the chair showing the method of applying the current from one hand to the other, as applied to McElvain, and also the microscopical effects of the current as observed in the autopsy of Jugigo.

The cuts, through the courtesy of Dr. R. B. Granger, editor of the journal mentioned, we are able to reproduce herewith.

From him we learn that when the first man, Kemmler, was killed, the current was applied to the vertex and sacrum and that in the next five cases it was applied to the vertex and the calf of the leg, and that in the seventh case (McElvain), it was first applied from one hand to the other, as shown in the above cut, and then a second application was made from the vertex to the calf, and that all the cases since then have been applied the same way, viz: from vertex to calf.

In these seven cases the time consumed, from the time when the men entered the room, till they were dead, varied from eight minutes in the longest, to three and a half minutes in the shortest instance, and the voltage varied from 1,450 to 1,700 volts, and the ampereage varied from two to seven amperes strength.

I have the complete reports of the seven autopsies by Dr. Mac Donald, also one from Dr. Conant Sawyer, physician to the Auburn prison, in the case of Powley, also the one held on Haas by Dr. F. S. Wagenhals, physician to the Ohio Penitentiary, and they all correspond to the statement made by Dr. MacDonald, when he says that, "The practical results of the microscopical examinations are that the passage of the electric current through the body is attended with no recognizable changes in its tissue organs, excepting the local thermic changes in the skin at the points of application of the electrodes and some minute petechial spots on several of the organs, and it is doubtful if these are not some indirect or secondary consequences of the current.

Of the hundreds of physicians who have witnessed the different electrocutions, there are none but what are of the opinion that consciousness to pain is entirely and almost instantaneously obliterated by the first application of the current, and there are but very few but what think that death results almost if not as soon as the consciousness is lost.

It is the unanimous opinion of every one who has any knowledge of the workings of the method, either practically or theoretically, whether they are professional or non-professional, that electrocution is the surest, quickest, most efficient and least painful method of inflicting the death penalty that has yet been devised.

The only exception which can be taken to this method is on account of the vesecation which sometimes occurs at the points of contact with the electrodes, because the passage of such a powerful current for any length of time will heat the water in the sponges to the boiling point, and scald the skin. This only occurs when the application is prolonged and as there is no doubt but that death occurs at the first contact when it is properly made, there is no necessity at all for any prolonged application to such an extent as to boil the water in the sponges, as is now practiced.

If the sponges should be not wet enough or applied to the head where the hair is not well wetted, or to the dry hair, as was the case of Frantz, then there might be the formation of an arc, which would burn the hair and skin, but with care such accidents should not occur.

The application of the current of 1,700 volts, and $7\frac{1}{2}$ amperes for three seconds is amply long enough to cause death if the contacts are perfect, and is not long enough to cause scalding, and if this plan was adopted there would be then nothing to detract from the method, and nothing to offend the sensibilities of the most asthetic, and would make the ideal method.

After a man is dead from the first shock he cannot be made any deader by further shocks, and only one should be given, unless some unforseen accident should render it absolutely necessary.

As far as known to the writer, there have never been any attempts made at resuscitation after legal execution, for it is not desired that the subject live, but where slight non-lethal doses of electricity have been given, and in some cases of accidental shocks, attempts have been made at resuscitation usually by means of artificial respiration, and it may not be out of order to call attention here to an ingenious yet simple apparatus devised and used by Dr. P. J. Gibbons, of Syracuse, N. Y., for this purpose.

Dr. Gibbons kindly furnished me with a reprint of an article, which he wrote, and which was publised in the *New York Medical Journal* for April 20, 1895, entitled, "A Method for Resuscitation from Electric Shocks," with cuts of his apparatus for practicing artificial respiration, which through the courtesy of Dr. R. B. Granger, the editor, we are able to reproduce herewith.

As will be readily seen the two bellows act as a set of lungs. one to pump air into the lungs and the other to suck it out, and anyone who has tried the usual methods of artificial respiration for several hours on some drowned, or asphyxiated, or narcotized person will appreciate the convenience of this apparatus of Dr. Gibbons in such cases.

FIG. I.

The doctor in his article does not cite any cases, and it is reasonable to suppose that it is more useful in resuscitating drowned, poisoned or suffocated persons than those suffering from electric shock, which are usually fatal. I mention this fact and show this apparatus, not to advocate its use, but to show the scant literature on the subject, and the simplicity yet ingenuity of the device.

As the late electrocution of Frantz at the Ohio penitentiary on November 19, 1897, is still fresh in the papers, and has been exploited as a failure and Frantz proclaimed as a "martyr to science," it will not be out of order to go a little in to detail of this case. I quote the following from one of the sensational newspaper accounts which appeared the next day. "As the body sank there were three distinct agonizing efforts at inspiration—not expiration. How the scientists will reconcile this fact with their claim that muscular contraction causes all the apparent struggles for breath is a serious question."

The above question only goes to show what erroneous ideas the laiety get about scientific subjects.

How a non-professional person in such a time of suspense and excitement could tell whether certain efforts were of inspiration or expiration, when there were straps all over the body, and a thick black leather mask covering the whole face, is one of the still unexplained mysteries. And then, if there were such efforts, it would be just what we would expect under the circumstances, viz., inspiration, due to the spasmodic contraction of the diaphragm causing a vacuum in the lungs, into which the air rushed, which would seem to the uninitiated as an effort to breathe, and not expiration, as the reporter seems to infer that we claim.

FIG. 11.

Such mistaken ideas, while they may be harmless in the individual, are, when published in a paper of large circulation and widely distributed, productive of much harm to a worthy thing, and goes to show that metropolitan papers should employ professional men to report scientific things, if they want to get the truth.

I have been a reporter myself and know something whereof I speak, and know that reporters, as a rule, do the best they can, but oftentimes too much is expected of them.

Relative to the reports in various papers, in which the true facts of the electrocution are grossly misrepresented, Dr. F. S. Wagenhals, Chief Physician of the Ohio Penitentiary; Dr. W. B. Bassell, the Assistant Physician; Dr. C. Ferrell, Night Assistant, who assisted Drs. Wagenhals and Bassell at the electrocution, have made the following statements, which were published in the Columbus *Daily Press* on Sunday, Nov. 21, 1897:

HERE ARE THE FACTS ABOUT FRANTZ'S ELECTROCUTION.

"As a great amount of sensational matter has been published, and some criticism of the manner of the elctrocution of Albert J. Frantz has been indulged in by some, we deem it proper to make the following statement:

"In our opinion, the death of Albert J. Frantz was painless, and he was dead to all sensibility after the first contact of the current. The heart not ceasing to beat after the first contact, the second, third, fourth and fifth currents were applied until all indications of life were extinct, in strict compliance with the law, which reads as follows: 'The application of the current must be applied until such convict is dead.' The sounds which emanated from the body were caused by the forcible expulsion of the air and gases produced by the violent contraction of the muscles of the chest and abdomen and the sudden relaxation of the same following the application of the current. The odor and smoke which arose from the electrode upon the head was due to the chemical decomposition which took place when the current passed through the sponge, it being saturated with a strong solution of common salt and sal-almoniac. The hair of the scalp under the electrode was not scorched or burned. The time consumed from the first contact of the current until he was pronounced dead, was three minutes, two and one-half minutes of which was taken up by examinations in the absence of the current, leaving but one-half minute in which the current was applied to the body five times.

"In regard to the comparison of this mode of death to that of hanging (from a humanitarian standpoint), we are decidedly in favor of electrocution, it being swift and painless, while death by hanging in many instances is prolonged to 15 or 20 minutes before life is extinct, as death is caused by strangulation in the majority of cases.

(Signed) F. S. WAGENHALS,
Prison Physician.
C. B. FERRELL, M. D.,
Prison Physician."

"I was present at the electrocution of Albert J. Frantz, and examined his body after death. Will say that there was no burning of the flesh, and the only indication of the entrance and exit of the current was a slight hyperæmia or reddening of the skin at the point of contact of the electrodes. The expression on his face was perfectly natural and showed absolutely no signs of pain.

Very respectfully,
WM. BENEDICT BASSELL,
Asst. Physician (Night.)"

The following letter, which speaks for itself, I repeat in its entirety.

COLUMBUS, OHIO, Nov. 24, 1897.
H. C. Bennett, M. D., M. E., Lima, O.

DEAR SIR: Your letter of the 20th inst. has not been answered sooner on account of pressure of other duties.

In regard to the Frantz execution, will say that it was not a "failure," as reported by some sensational papers. The incident which gave rise to this re-

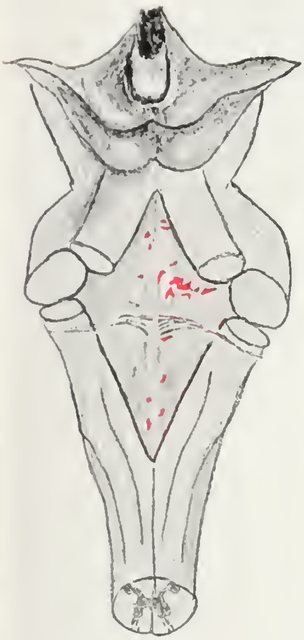

FIG. 1.

FIG. 2.

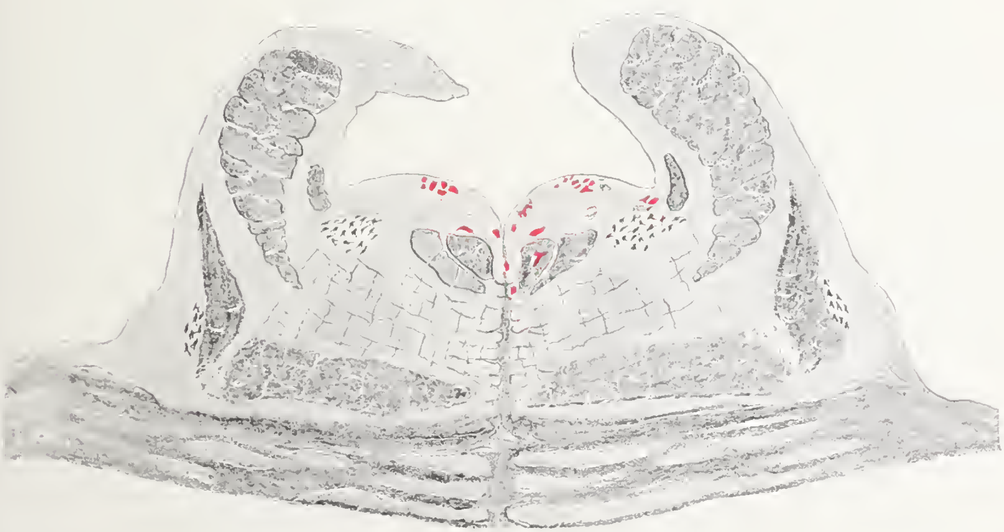

FIG. 3.

Figs. 1, 2 and 3 show the character and distribution of the petechial spots in the floor of the fourth ventricle in the case of Schichiok Jugigo.

port was the appearance of steam which was mistaken by some for smoke, during the first and second and third applications of current. This was caused by the displacement of the electrode on the head, probably by the placing of the hood over the eyes after I had examined the strapping and position of electrodes, found them all right, and turned to the cabinet to prepare for the immediate throwing on of the current as soon as the prisoner should have answered the question as to whether he had aught to say. Owing to the number of people standing between myself and the prisoner I did not notice the displacement of the electrode, and consequently the contact at the top of the head, owing to the slipping of the electrode, and also owing to the fact that the crop of hair on the top of the prisoner's head was unusually thick, was not so close as should have been, and this fact caused the steaming to take place. There positively was no burning, even of the hair, as was found by examination afterwards, and there is no question in my mind, nor I think in the mind of the physician in charge, that the first application of the current did the work. However, after the first current was turned off, an examination was made, and a noticeable beating of the heart discovered, no doubt reactionary, which decided the physician not to take chances, and a second application was ordered. The statement has been vouchsafed. by a number of physicians since, and even made by the physician in charge, that had they waited a few seconds, this apparent beating of the heart would have ceased and the man would never have revived. But as I said, no chances could be taken, and the current was ordered on again. I then threw the current on twice in succession, with the same result of steam rising from the top of the head. Another examination was made, and the physicians decided for the sake of being on the safe side, to have the current again applied. Then it was that I chanced to get a view of the prisoner, and at once noticed the displacement of the electrode. I sent a guard over to re-arrange it, and turned the current on twice successively, this time without evidence of steam or smoke, because the contact was perfect.

My own opinion is that the man received the force of the current the first time, and would never have revived no further application had been made. I am decidedly of the opinion that but one application is necessary, and think that future tests will prove it. It would have undoubtedly have been proven in this case had it not been for the slipping of the electrode, which caused the steam to rise and create so much misapprehension and distrust as to the efficacy of the first application. It was very unfortunate that such a thing should have happened to have given the slighest ground for sensational newspapers and the enemies of this mode of execution to base a cry of "failure" or bungling on. I am working out a plan now which I will certainly perfect before another electrocution takes place, which will make the strapping and placement of electrodes a much simpler affair, and render impossible the displacement of any portion of the appliances after once put into position; also doing away with the necessity of so many persons taking part in the operations.

If I have failed to state clearly the information you desire, I will be glad to answer any further question you may ask. I thank you for your kindly expressions of good will, and will be interested in reading your forthcoming article on the subject under discussion.

Very truly yours, R. P. GREEN,
Supt. Gas Wks & Elec. Lt. Plant, O. P.

I have to make special mention of and tender my thanks for assistance, statistics, and courtesies which I have received in preparing this paper, to the following persons, viz:

Hon. Asa S. Bushnell, Governor of Ohio, Columbus, O.

Hon. E. G. Coffin, Warden Ohio Penitentiary, Columbus, Ohio.

F. S. Wagenhals, M. D., Physician Ohio Penitentiary, Columbus, Ohio.

Harry S. Jones, M. D., ex-Physician Ohio Penitentiary, Columbus, Ohio.

Mr. R. P. Green, Electrician Ohio Penitentiary, Columbus, Ohio.

Ohio State Journal and Columbus Daily Press, Columbus, Ohio.

Mr. F. S. Hunting, Electrician, Fort Wayne, Ind.

Mr. Thomas Duncan, Electrician, Fort Wayne, Ind.

Hon. O. V. Sage, Warden Sing Sing Prison. Sing Sing, N. Y.

Robert T. Irvine, M. D., Physician Sing Sing Prison, Sing Sing, N. Y.

Hon. Walter N. Thayer, Warden Clinton Prison. Dannemora, N. Y.

J. B. Ransom. M. D., Physician Clinton Prison, Dannemora, N, Y.

Hon. James C. Stout, Warden Auburn Prison, Auburn, N. Y.

Conant Sawyer, M. D., Physician Auburn Prison, Auburn, N. Y.

Carlos MacDonald, M. D., Pleasantville, N. Y.

P. J. Gibbons. M. A., M. D., Syracuse, N. Y.

S. B. Granger. M. D., Ed. N. Y. Medical Jour., New York.

Cincinnati Enquirer and Commercial Tribune, Cincinnati. O.

Urlin & Pfeiffer, Photographers, Columbus, Ohio.

WEIGHT OF A HYDROGEN MOLECULE.—The weight of a molecule of hydrogen, as given by an eminent authority, is approximately 0.000,000,000,000,000,000-000,04 gram; by multiplying this inconceivably small number by 55, the atomic weight of iron, we get the weight of a molecule of iron—0.000,000,000,000,-000,000,002,20 gram. In the sulphocyanide test we are enabled to detect the presence of thirty three ten-millionths of a gram of iron; dividing this number by the weight of one molecule of iron, we find that this apparently delicate test is unable to indicate a less number of molecules than 1,500,000.000,000,000.

RADIOGRAPH, by Dr. William Mair, Calcutta, India, showing point of a

needle imbedded in fifth metacarpal bone, where it had been lost for seventeen years.

X OR ROENTGEN RAY RESULTS IN AMAUROSIS.

FREDERICK STRANGE KOLLE, M. D.

The statement that the Roentgen rays were to a certain extent valuable in their power to enable the blind to see, has caused considerable excitement and interest, and has made the blind patient look forward to the renewal of his sight with hope and longing.

These poor, unduly misled individuals arrive at our offices and demand treatment with the x-rays, feeling assured that they may be made to see at once, or in due time be able to move about without the aid of an attendant—perhaps to even write or read. That this feeling has been aroused in these unfortunate individuals is not to be wondered at, and the question arises, what can be done with this class of patients?

When I first read or heard of the fact that the blind were able to distinguish shadows and light, when brought near a Crookes or vacuum tube, it did not arouse much interest in me, until the patients began to present themselves for treatment. For the last three weeks I have been experimenting faithfully with several patients, and beg to submit their histories in condensed form, which I think most important, and a brief description of the results obtained, when subject to the x-rays.

First. I might state, that the results, at least a great number of them mentioned in current literature and the daily press, were due to light, and not to the action of the x-rays upon the retina, optic nerve or brain center.

Many blind persons are able to distinguish night from day; can locate the position of the sun in the heavens; an ordinary 16 c. p. electric light, and even the flame of an ordinary lamp. Again, the majority of patients could distinguish the light and location of a vacuum tube, while charged.

In all, or most all, of the experiments recorded, the patients were brought into a dark room, near to the uncovered tube in action. It is quite evident that the patient would experience the so-called sensation of light, because *light* came from the tube.

Let us admit that the light is very little and of an apple-green color: but its softness of color makes it very agreeable to the eyes of the blind. If, now, an object be passed between the tube and the eyes of the patient, they excitedly exclaim that they can see the object, but when closely questioned, they can only make out a difference in the light going to the eye corresponding, more or less, to the density of the object.

A finger held near to the eye or slowly passed by the eyes of the patient can be made out as a shadow, and in such a way can the fingers of the hand be counted.

At a distance of eight inches neither of my three patients could tell how large or small the object was—again proving the sensation to be due to the action of light, which, being diffused, does not throw the shadow of the finger upon the eye as when near to it.

When the fluoroscope is used, light is again observed, but of a much weaker character. I say light, because the sensation perceived by the eye, when looking through a fluoroscope is *one of light*, due to the convertion or absorbtion of the rays by the chemical compound employed for the screen. The light varies as to the normal eye, according to the tube efficiency and the chemical used to make up the screen.

If any object i. e., the hand, be placed against the screen and held within the radius of the x-ray emanation, the patient, unless unable to see any light of whatever nature, will be able to make out a shadow, taking away the little light previously perceived.

The best results in this way are obtained with a screen heavily coated with Potassium-platino-cyanide.

All this, however, does not prove that the x-rays have any of the property credited to them.

To enable the physician or radiographer to know whether or not, the patients' eyes are susceptible or acted upon by the rays, I have devised the following described instrument. (Nov. 27, '96.)* The radioscope is entirely reliable, easily made, light and readily applied to the eyes, excluding *all light*, from any source, except that which may be due to the action of the rays upon the eyes. It consists of the ordinary light-proof fluoroscopic box. See N. Y. Med. Jour., Jan'y 16, '97 with its lower or screen end replaced with a sheet of aluminium 1-2 of an inch in thickness, this excludes all light and appears perfectly dark when held before the eyes yet permitting the passage of the Roentgen rays, which are to us yet, invisible. If this instrument be applied to the eyes of a blind person, a certain phenomenon or sensation will be observed varying with the susceptibility or excitability, of their optic nerves or centers. The sensation may be said to be due to the action of the x-rays. If an object, dense and impervious to the rays be interposed between tube and radio scope, the patient may be enabled to tell its presence.

Case I. A boy aged 17, gives a history of scarlatina early in life, with blindness resulting. He is unable to count fingers held close to the eyes and can not decide one color from another, when disks of colored glass were used, but states that one appears darker than the other according to the density of their colors.

He can locate an electric light at a distance of 10 ft., with the right eye—the left being much poorer.

When using a charged vacuum tube. he can locate the tube as a large area of light, does not give it any color, but says that it appeared lighter than the red, emerald green or orange disks. He could count the fingers when slowly passed before the eyes, but was unable to tell their length or breadth.

By the use of the radioscope, held within the x ray emanations, he claimed to see a light or something resembling light—especially appreciated by the right eye. He was unable to say whether it was very light or dark and thought it resembled many twinkling stars. (Stern-Shuppen licht). If an object was held between the scope and tube, the star-like sensation ceased to a certain extent, but he could not make out the fingers of the hand or the width of 1, 2 or 3 fingers.

If the finger was brought on a line directly in front of the eye, entirely covering the area corresponding to the size of the globe, no sensation was perceived. The left eye did not respond to any of the experiments.

I found it advisable to proceed slowly with the experiments, as the patients have a tendency to become excited or very nervous indeed.

A curved sheet of lead 12 inches wide and 1-16 inch thick was allowed to enclose the head with its concavity, the patient facing the tube; but no further results were noted.

By turning the patient around so that the back of his head was presented to the tube, nothing definite was noted, although he claimed at times, he could feel something pass between his head and the tube, when the hand was interposed, but failed to notice the same at a later sitting.

Case II. Miss A. R., aged 28, by occupation a cook, gives the following history: Had always been well until about 14 months ago when she noticed a pimple developing on the right side of her lower lip. No attention was paid to same until in a few weeks, the tissues surrounding it became exceedingly painful. She consulted a physician who diagnozed the affliction as cancer and treated her for several months without success.

About six months ago the sight in her left eye began to fail (July 17, 1896). She then consulted another physician, who recommended her to an eye infirmary in New York City. Sight soon disappeared in the eye and one month thereafter the sight of the right eye also began to wane, and eventually became useless. During all this time the patient was under treatment and received increasing doses of the Iodide of Potash and continued treatment until the week she presented herself at my office, (Nov. 27, 1896).

Upon examination I found that she could distinguish daylight from darkness with the right eye and at certain times be able to locate the light of a lamp at a distance of several feet. She could not tell the color of the glass disks in daylight or the color of the light coming from a lamp, but described it as red. When subjected to a tube in action she could tell the following colors, using the colored glass disk arrangement; ruby red appeared as very dark red, scarlet as light red, orange as dark yellow, yellow as white, green (emerald), as bluish green, and the color of the active vacuum tube as white.

She was able to locate the tube and to count the fingers, when passed before the eyes, but unable to make out their size and shape. With the radioscope she at once observed the star-like sensation, especially with the right eye, and could really tell if an opaque object was passed between the tube and radioscope by immediately announcing, light and darkness. She could not make out the object, even a small copper disk 1¼ inches in diameter, appeared as a large shadow to her, although several of the stars, as she called them, remained.

To be convinced that she really saw them, I asked her to count them, if not too many; after a few moments she stated that there were 28, then 22, 27 and at a later sitting 32. By looking downward the sensation was most marked in the right eye.

The glass disks, independent of color, appeared only as shadows and obliterated the sensation.

Minute letters cut out of sheet lead could not be made out, except that the patient appreciated that something was held in front of the screen or eye.

Being a very intelligent patient I gave her a number of sittings and the above is a concise statement of the results obtained.

Case III. O. G, ae. 23, had lost his eyesight about three years ago, by the accidental discharge from a gun. His right eye was removed at the time and there is total blindness in the remaining eye. He was unable to see any light when brought near to the tube and did not observe any sensation like that in the other patients when looking through the radioscope, but at a second sitting thought that there was something inside of his head, but could not call it light, and was unable to distinguish anything passed in front of the radioscope.

From the above I conclude that owing to the nature of the x-rays, accepting the theories of Roentgen, Lodge, Tesla, Rood and others, the crystalline lens of the eye are impervious to the rays to a great extent; that the rays may, however, penetrate the globe immediately around the lens; that they cause a certain excitation of the retina, containing healthy or partly diseased nerve endings; that the rays do not allow of refraction, deflection or convexion and therefore can not create a focussed image upon the retina, nerve or optic center when an impervious object is held between the eye and the tube.

It is possible that minute bodies may be appreciated by the blind patient, but the shadow resulting, will be of the same proportion as the object itself, covering that area of the eye or other sensitive portion acted upon by the rays, causing an obliteration, of even that excitation, when a larger and impervious or opaque body be interposed.

The shadows posing before the eye, can be observed and counted: but the dimensions of that body--although of varying width, will appear the same, except in the case of the very small ones mentioned. I have been unable to obtain a patient with the lens of the eye or eyes removed and therefore am unable to verify the results obtained by Dr. Brandes of Germany.

PHENOMENA AND ACTIVE SPIRITS.

Spiritualism, in its full meaning, is the basis of the phenomena, instead of resting on them. Phenomena are shadows, not the reality. They are expressions, not the thing or person making the expression. They are pointers, directing us to the power producing them The falling apple seen by Newton was not the force of gravitation, but it pointed him to the infinite energy operating through universal being. But it took something more than the mere fall of an apple to evolve and demonstrate the law of gravitation. And it requires more than a rap, tip or slate-writing to prove the agency of decarnate spirits.—J. S. Loveland in the Philosophical Journal.

X-Ray of Hand and Wrist, by W. O. Horner, Cleveland, Tenn. After exposure a transparency was made from the negative.

MASTER AND SERVANT.

ACTION FOR INJURIES TO EMPLOYEE—X-RAY PHOTOGRAPHS AS EVIDENCE—EXPERT WITNESSES.

W. S. Bruce et al v. F. J. Beall. } Error to Circuit Court, Shelby County. Estes, L. H., Judge.

(Supreme Court of Tennessee. June 16, 1897.)

J. R. Flippin and E. E. Wright, Attorneys for Plaintiffs in Error.

Percy & Watkins, Attorneys for Defendants in Error.

In the process of the trial, one Dr. Galtman was introduced as a witness, and he was permitted to submit to the jury an x-ray photograph taken by him, showing the overlapping bones of one of the plaintiff's legs, at the point where it was broken by this fall. This was objected to by the defendants' counsel. This picture was taken by the witness, who was a physician and surgeon, not only familiar with fractures, but with the new and interesting process by which this particular impression was secured. He testified that this photograph accurately represented the condition of the leg at the point of the fracture in question, and, as a fact, that by the aid of x-rays he was enabled to see the broken and overlapping bones with his own eyes, exactly as if, stripped of the skin and tissues, they were uncovered to the sight. We might, if we so desire, rest our conclusions on the general character of the exceptions taken to this testimony, but we prefer to place it on the ground that, verified by this picture, it was altogether competent for the purpose for which it was offered. New as this process is, experiments made by scientific men, as shown by this record, have demonstrated its power to reveal to the natural eye the entire structure of the human body, and that its various parts can be photographed as its exterior surface has been and now is. And no sound reason was assigned at the Bar why a civil court should not avail itself of this invention, when it was apparent that it would serve to throw light on the matter in controversy. Maps and diagrams of the locus in quo drawn by hand are often used to aid a Judge or a Jury to an intelligent conception of the matters to be determined, and no one would think of questioning the competency of the testimony of a witness who stated that he knew the map or diagram to be entirely accurate, and who then used it to illustrate or make plain his statement. The pictorial representation of the condition of the broken leg of the plaintiff gave to the jury a much more intelligent idea of that particular injury than they would have obtained from any verbal description of it by a surgeon, even if he had used for the purpose the simplest terms of his art. We have not had our attention called to any case bearing on this question, save that of Smith v. Grant, tried in the First District Court of Colorado and reported in the Chicago Legal News of December, 1896; but photographs showing exterior surfaces have been admissible in numerous cases. They have been held competent on the question of identity of person (Udderzook v. Com., 79 Pa. St., 340; Cowley v. People, 83 N. Y., 464; Luke v. Calhoon Co., 52 Ala., 118; Ruloff v. People, 45 N. Y. 213), and to identify premises (Church v. City of Milwaukee, 31 Wis., 512; Blair v. Pelham, 118 Mass., 421), and in cases of handwriting (Marcy v. Barnes, 16 Gray, 161). It is not to be understood, however, that every photograph offered as taken by the cathode or x-ray process would be admissible. Its competency, to be first determined by the Trial Judge, depend upon the science, skill, experience, and intelligence of the party taking the picture and testifying with regard to it, and, lacking these important qualifications, it should not be admitted, and again, even when it is not conclusive upon the Triors of fact, it is to be weighed like other competent evidence.

The rulings in this case are in line with the greatest medico-legal jurists.

X-RAY OPERATOR REWARDED.

Very early following the discovery by Prof. Roentgen of the x-rays, W. O.

PROF. W. O. HORNER, CLEVELAND, TENN.

Horner, a prominent optician of Tennessee, equipped his office with the best x-ray apparatus then made. The machine was purchased for the purpose of such aid as it might give him in the specific line of optical work.

As Dr. C. J. B. Stephens, the progressive dentist of Great Falls, Mont., has recently said: "There are conditions in dentistry which may be positively diagnosed by use of the x-ray which could be known by no other means except by sacrificing the teeth." So Prof. Horner has discovered advantages for the x-rays in optical work. The interest he took in the new science broadened him beyond that of an optician. The surgeons at his home in Cleveland and those of neighboring cities grasped the opportunities offered by his learning and now employ him to radiograph their surgical cases.

When a man takes a step forward to his own advantage, every move of which benefits humanity, the people are substantially appreciative. The maxim has proven true in this case, for Prof. Horner's business has so increased that he has been compelled to re-equip his office with the latest x-ray devices including the Dennis Fluorometer.

Prof. Horner is now employed by railroad surgeons to radiograph injuries as soon as possible following their occurrence and again after surgical apposition.

INTERIOR VIEW OF PROF. HORNER'S OFFICE.

Roentgen Rays a Detective.—According to the Journal de Medicine de Bordeaux, a man by the name of Ferdinand, placed under arrest for illegal practice of medicine, claiming to be a graduate of an American college, presented a diploma which excited the suspicion of the magistrate. Calling in the services of an expert, the document was submitted to the action of a Crookes tube, and the result showed distinctly the outlines in the substance of the paper, of a name which had been erased from the surface to make room for that of "Dr. Ferdinand," who was held upon the evidence.—*Popular Science News.*

X-RAY TRAUMATISM.

Capt. W. P. Bannister, Medical Dept., U. S. A. Transaction of the Medical Society of the District of Columbia :

"A constant and critical observation of the effect of the x-ray in this case for six months, forces me to the conclusion that the lesion is not due to the luminous x-ray *per se*, but to some other factor not yet isolated. Considering the intensity and degree of the irritation to the integument, it is not possible that, if the x-ray caused it *per se*, it could pass through such a delicate membrane as the peritoneum, or such delicate organs as the kidney and liver, all of which it traversed in this case without producing signs of irritation in them, inflammation or death. If by any chance it specialized its effects on the skin, it should have ininflamed the integument where it emerged at the back of the patient, certainly to some proportional extent to the severe injury it inflicted on the integument at the front of the patient, where it first impinged. In my first report, written last October, I invited attention to the fact that the intensity of the irritation was greatest where the rays struck the surface perpendicularly, and noted the resemblance in that particular to the effect of heat rays, and I believe future investigations along that line will discover the real agent in the production of these lesions."

FIRST RADIOGRAPH IN EVIDENCE.

For the first time in the history of murder trials an x-ray photograph was offered in evidence, which occurred in the Haynes murder trial, in Watertown, N. Y. Oct. 21, 1897. In this case the prosecution claims that a 32-caliber bullet struck Allen on his jaw, that it split and one piece was deflected into the chin and that the other piece is in the back of Allen's head. The defense claims that the substance at the base of Allen's skull is not a fragment of the 32 caliber bullet, but is a complete 32-caliber bullet. To prove this claim the defense produced an x-ray photograph of Allen's neck, showing the substance which resembles a bullet near the second vertebra at the base of the skull. Dr. Gilbert Cannon, of this city, made the photograph, and from experiments says that the bullet is not a 32-caliber bullet.

Both sides argued for several hours that afternoon over the offer in evidence of the photograph by the defense. Justice Wright finally allowed it, and it was examined carefully by the jury.

A MECHANICAL HORROR.

Machinery, is a monthly journal published at Johannesberg, South Africa. In the October number just received is an account of a most remarkable clock belonging to a Hindu prince, which the editor thinks the strangest piece of machinery in India. Near the dial of an ordinary-looking clock is a large gong hung on poles, while underneath, scattered on the ground, is a pile of artificial human skulls, ribs, legs and arms, the whole number of bones in the pile being equal to the number of bones in twelve human skeletons. When the hands in the clock indicate the hour 1, the number of bones needed to form a complete human skeleton come together with a snap; by some mechanical contrivance the skeleton springs up, seizes a mallet, and walking up to the gong, strikes one blow. This finished, it returns to the pile and again falls to pieces. When 2 o'clock, two skeletons get up and strike, while at the hours of noon and midnight the entire heap springs up in the shape of twelve skeletons and strikes, each one after the other, a blow on the gong, and then fall to pieces, as before.—*Prognostic Star-Gazer.*

ACROMYGALIA.

BY JOHN T. PITKIN, M. D., BUFFALO, N. Y.

Acromyglia, or Acromegaly, is a strange, and fortunately a very rare disease, the ostensible manifestations of which are an apparent reversion from the human toward the animal type, a variety of atavism, e. g.

A lady of refined appearance afflicted with this ailment, who forms the context of this article, underwent the following distortion :

In consequence of a markéd osseous hypertrophy and hyperplasia of the entire bony framework, her features gradually changed from their usual fineness or attractive look to one of coarseness and repulsion. Her slender, graceful, tapering hands and feet became gross, awkward, paw-like in formation. The spine became crooked, the body bent, the limbs and head slowly enlarged in contour.

As a result of a general constructive fibrous metamorphosis the vital organs became increased in size and added their quota to her unsightliness. A voice once soft and melodious was harsh and baritone. Eyes that were bright and normally sensitive to light, became dim and lusterless.

JOHN T. PITKIN, A. M., M. D., BUFFALO, N. Y.
Surgeon, Electro-Therapeutist and x-ray Specialist, who testified as an x-ray expert for the defence in the great Orme murder trial, resulting in an acquittal.

Pathologists inform us that the essential and primary lesion of this disease consists in a destructive involvement of the pituitary body situated at the cerebral base, lodged in the fossa of the sella Turcica Therapeutically. My highly esteemed colleague, Dr. George T. Mosley, of this city, under whose care the lady was placed, is administering an animal extract which he made of ceed three months, the doctor reports that very marked improvement in his patient's condition has followed its exhibition.

RADIOGRAPH OF ACROMYGALIA BY JONH T. PITKIN, M. D.

the bovine pituitary bodies procured from the shambles of East Buffalo. Although this line of treatment has been followed for a period of time, not to ex-

Can you tell me, Johnnie, which travels the faster, heat or cold? "Heat, of course. Anybody can catch cold easily."

CONDENSED X-RAY INFORMATION.

New Application of the Roentgen Ray. Fluorescent Screen. An important advance in the application of the Roentgen ray to medicine is described in the *Semaine Med.* Instead of taking photographs, it is now possible to look directly into the body and see the skeleton with our own eyes. This is accomplished by means of a screen made by gluing a piece of cardboard ½mm. thick on a pane of glass. A square piece is then cut out of the center, 10 x 25 cm. and the space left on the glass is filled with the finely pulverized chemicals, which we know become fluorescent under the Roentgen ray; double cyanide of potassium and platinum, or double cyanid of barium and platinum. This is covered with another piece of cardboard, the same size as the first, enclosing the chemicals. If this screen is held at the cathode end of a Crookes' tube concealed in a pasteboard box or covered with a cloth, the part of the frame that holds the chemicals is instantly illuminated, and a hand interposed between the illuminated frame and the invisible Crookes' tube, becomes transparent, so that nothing but the bones can be seen. Promising results have already been secured by Burka, Roentgen, Salvioli, Lewy, Grunmarch, du Bois-Reymond, etc., who have distinguished the skeleton and organs throughout the body, and diagnosed several cases of arterio-sclerosis, etc., with amazing accuracy. Becher, of Berlin, adds the suggestion that lime water injected into the stomcch or intestines, or the introduction of air, prevents the passage of the Roentgen ray.—*Deutsche Med. Woch.*

Dissemination of X-Rays. Buquet. *L'Ind. Elec.*, Dec. 10., *Electrical World*, Jan. 8.—A reprint of an academy note. The cause of failure of radiographs he claims is often due to the return of the rays from the backs of the plates; he made an experiment to demonstrate the effect of these return rays directly, and showed a means of overcoming it. He made a radiograph of a watch on a plate, half of the back of which was covered with a sheet of lead; the exposure was two minutes: the part which was not protected by the lead was covered with a haziness which almost completely obliterated the photograph, while the part over the lead was very sharp; two radiographs of the watch were made under like conditions, but in one case there was a lead plate below the photographic plate, and in the other case there was not, and the difference in the sharpness was quite apparent. Such protecting screens are not necessary with short exposures and very penetrating tubes, but they become necessary for long exposures; in surgical applications the radiographs also show more detail, even for short exposures.

Experimental Tuberculosis Attenuated by the Roentgen Ray.—Lortet and Genoud report a series of successful experiments with guinea pigs inoculated with tuberculosis in the inguinal region. Three selected at random out of the eight inoculated, were tied on a board on their backs, and the inoculated region exposed to the Roentgen ray for one hour each day, from April 25 to June 18. Ganglionary abscesses developed in the control animals, which discharged spontaneously a whitish suppuration; the inguinal ganglia grew soft and could not be distinguished from the surrounding tissue. The animals also showed great emaciation. On the other hand, the three animals exposed to the Roentgen ray gained in weight; they had no abscesses, and their inguinal ganglia remained hard and distinct, with no tendency to suppuration. The results prove that the Roentgen ray materially modified the acute developement of the tuberculous infection, and justify its application to human beings, especially children, with superficial tuberculosis, limited to the pleura, or with tuberculous ganglia in the mesentery. *Bulletin Medical.*

ROENTGEN RAYS. ROLLINS. *Elec. Rev.*, Dec. 22. *Electric World.* A short article in which he states that Roentgen rays differ only in degree and are dependent for their penetrating power on the voltage and the degree of vacuum; the voltage should be so adjusted that rays of the proper wave length are generated for the specific purpose; for showing the bones of the hand the voltage should be kept low; if the bones are deeply imbedded the vacuum and the voltage should be kept the same and the light should be increased by more frequent impacts of the cathode discharge; if the voltage and the vacuum are raised the proper distance between the cathode and anode is increased and the bones become relatively more transparent; by increasing both of these he believes all the elements would be as transparent as glass is to light.

SKIAGRAPHY OF THE EMPEROR. It is reported that the left arm of the German Emperor has been "skiagraphed" by the Roentgen rays. The experiment revealed the nature of the malformation, and the result has been submitted to eminent surgeons who believe, it is stated, that a simple operation may give partial, if not complete, use of the hand and arm.

THE AMERICAN X-RAY JOURNAL.

Devoted to Practical X-Ray Work and Allied Arts and Sciences.

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THE December issue of THE AMERICAN X RAY JOURNAL completed the first volume of the first journal ever published in the United States in the interest of x-rays and radiant matter. A loose folder of skiagrams with explanatory notes had been printed, and the same is now continued under the title of "Archives of Clinical Skiagraphy" as the official organ of the Roentgen Council of London. A most worthy magazine known as the "Skiagram" is also published in London by members of this learned Council. Nothing, however, approaching x-ray journalism had been printed in this country until the advent of THE AMERICAN X-RAY JOURNAL.

Those who are fortunate enough to own all the numbers of '97 issue can congratulate themselves upon having the first literature upon this all-absorbing subject. As time goes on the first numbers will enhance in value and their worth as pages for reference and as a souvenir can be appreciated.

We can see now how we might have made the first pages more valuable than they are, but the opacity of foresight and the luminosity of afterthought find no exception in new publications. We have done the best we could under the circumstances. The JOURNAL is a success. Medical journals, scientific publications and lay papers throughout the land have given praise and encouragement to the enterprise—more than we deserved. But they were issued in the spirit of true journalism, the rightful effort to encourage a publication which every physician who would be informed should have. Certainly we do feel that taking into consideration our many shortcomings, the life we have was nurtured by the great medical and scientific press of this country and in acknowledging gratitude we shall hope in the future to compensate them by raising the plane of the JOURNAL to what it should be.

The increased demand for space has required us to add 16 more pages to the JOURNAL. We shall continue to print upon this beautiful coated paper of 80-lb. weight.

In the review on pages 192-3 of the first volume of six issues of THE AMERICAN X-RAY JOURNAL, it is found that 123 subjects have been written upon; 50 cuts, mostly half tones, have assisted in exemplifying the subjects, all of which occupy 155 pages; 20 physicians and scientists have contributed original literature and 50 business houses, including one from the Pacific Coast, have liberally patronized these pages.

Subscribers have come in from all over the world. It is interesting to know that we have paid subscribers from England, Germany, France, Russia, Belgium, Turkey, Friendly Islands South Seas, Cuba, Mexico, and South America. It is a great satisfaction to know that the JOURNAL is appreciated everywhere in this countrv a fact proven by the subscriptions received daily from nearly every state and territory of the United States.

ORTHOGRAPHY.

We have been so many times embarrassed with so-called "typographical errors" which have heretofore crept into the JOURNAL that the feeling has ripened into this opinion: While it is of no particular credit to any one to spell correctly it is a disgrace to spell incorrectly.

Typographical errors in spelling must hereafter cease.

Including this issue of the JOURNAL *and all subsequent issues until the June number we will give one year's subscription free to each of the first two persons calling our attention to any misspelled word or words either in the reading matter or advertisements—excluding proper names.*

NONE TOO SOON.—A great abuse to the medical profession is about to be abated in Washington. Representative Powers of Vermont has introduced into the House of Representatives a bill to fix telephone rates in the District at $25 a year for private telephones, and $35 a year for business houses. At the present time the rate is $72 if paid in advance, otherwise $82, and physicians must pay ten cents extra to telephone to their own homes for any purpose.—*North American Medical Review.*

The Washington system is simply one of "hold 'em up." In December last we entered the drug store of the Shorham Hotel and asked permission to use their phone which was politely given. After ringing the bell and called out the number, an indistinguishable voice was heard and thinking that it was myself also that was not understood I repeated the number. Again came sharply the same voice when the druggist relieved my embarrassment by calling my attention to a slot in the box, on the margin of which was written, "Ten Cents." I dropped the dime with much satisfaction and feeling very thankful for the cheap service, repeated to central again the same number and the answer promptly came in measured tones, "The phone has been removed from that house." I looked at that slot in the box and then turned about to see if I was observed. I purchased a cigar and took time to light it, and wafting gently a little smoke to conceal my color, left the place.

ANAESTHETIC PROPERTIES OF X-RAYS.

Surgeons in this city who have made use of the x-rays for diagnostic purposes have reported a condition of anaesthesia in and about the parts after they had been examined. Drs. Schmidt and Koller observed this in patients operated upon in their private hospital. The patients would invariably speak of feeling less sore on the following day and after the operation. It appeared also that the patients were improved. Dr. Krebbs has also noticed that pain due to chronic lung disease would subside after the use of the x-rays.

This anaesthetic condition was noticed by Tesla who caused a continuous impact of the rays upon the human system. He noticed a tendency to sleep was induced and a benumbed condition of the faculties. The parts he observed felt warm and the effect was of a soothing nature. Edison noticed this same phenomenon and also reported that the eyes felt fatigued and later that objects could be more easily distinguished. Roentgen mentioned that the eyes were not affected, but he was working at the time with an apparatus that did not cast the rays beyond seven feet while Tesla's traveled forty to fifty feet. Tesla's late suggestion that the particular phenomena produced by the x-rays may be due to heat of the material particles thrown out from the tube does not seem possible unless the prism is in this case reversed. Heat rays and light rays of low refrangibility have great penetrating power, but do not impress a photographic plate unless of a higher refrangibility than red.

INTERNAL VACUUM.

The discharge a tube, containing radiant matter only, is said to have a variability of vacuum induced by the electric current. This notion is taught and sent out by makers of x-ray apparatus to prospective purchasers.

Experiments conducted by Lenard in 1894 showed that the lowering and raising of the vacuum in a Crookes tube was easily accomplished with caustic potash which had been employed to absorb the last trace of moisture and carbonic gas. When the vacuum was too high in the tube the application of moderate heat was sufficient to alter the density to a point of allowing the current to pass and cause phosphorescence in the glass tube.

Prof. W. C. Peckham in the *Electric World*, May 30, 1896, believed that if the vibrations of the tube can not keep time with those of its coil few or no x-rays will be given off. He says: "The discharge tube is a resonator for its coil and when the coil and tube are properly attuned the maximum effect is obtained." It does not appear possible that rarefaction of gasses in a tube could take place under the influence of an electric current otherwise a tube would exhaust itself without a pump. Monell says in "Manual of Static Elictricity and X-Ray Uses": "What takes place is some rearrangement of the atoms and ions in relation with the electrodes." During the passage of the electric current polarization of the electrodes is constantly taking place within the tube. "We do not raise the so-called high vacuum but I believe that the bombardment of an opposite polarity releases the interfering ions, shakes loose the particles around the electrodes, permits a normal rearrangement of them, and to express it in simple phrase 'clears the atmosphere'". Rest has the effect also of restoring a tube to efficiency when the vacuum is said to be too high. This strange occurrence Monell likens to the cutting edge of a razor which will come again when laid aside after fruitless efforts with the strop.

A dry temperature of 400 or 500 degrees or boiling in oil or heating the tube with a lamp will restore its efficiency. It appears reasonable that when the atomic particles of radiant matter are electrified and are impacted against the inner walls of the tube that they discharge or impart with their magnetic properties which radiate into space in some form of actinic matter. The particles are charged and re-charged with swift succession until polarization occurs in them when they cease to be affected. Time, heat and reversal of current will temporarily restore them. Their properties can not be wholly restored nor can these particles be entirely removed, for their inherent property is injured or become diamagnetic and are thrust into the mechanism of the tube.

Russian Doctors.—Russian Doctors wear, as a sign that they are legally qualified to practice, a little zuak. or badge, a silver oval plate, one and one-half inches long by an inch wide.

BURNS AND TECHNIQUE IN X-RAY WORK.

BY S. H. MONELL, M. D.,
Founder and Chief Instructor of the Brooklyn Post-Graduate School of Clinical Electro-Therapeutics and Roentgen Photography; Fellow of the New York Academy of Medicine.

Theoretically, the subject of so-called x-ray burns reminds one of Banquo's ghost; *practically* the subject contains about as much living interest to the well equipped x-ray operator of to-day as the once much discussed question of "Railroad Spine" does to the rider of a '98 bicycle. When the "boneshaker" was extant, *vibration* was an issue, but the pneumatic tire has buried it. When operators were working in the dark and striving to compensate for the deficiencies of poor tubes, feeble apparatus, and unskilled technique, by long exposures, close proximity to the tube and an excess of current, we had a number of reports of x-ray injuries which now possess an historical interest only. With improved tubes and apparatus safety is simply a question of skilled technique, and it is reasonable to say that from this time forward we should never hear of x-ray injuries again.

I believe that continued agitation of this subject hurts a good cause, and does not advance the science. It is difficult to see any reason for continued speculations which lead nowhere and prove nothing; but since so many physicians find articles in current journals which confuse them I have been asked to set them right.

X-rays have been reported to cause a loss of hair, dermatitis, ulcerations of the skin, and a few deeper injuries. The American X-Ray Journal of August, 1897, published the number of these injuries reported during the first eighteen months of experimental work, and the total number was sixty-nine. Four of these were a mistake. Twenty-three were professional x-ray exhibitors who exposed their hands in close proximity to the tube for four or more hours per day, for weeks and months at a time, before they succeeded in getting hurt. Out of the countless thousands of other persons who have been made the subjects of x-ray examinations, but forty-two had bad effects. Most of these happened during the earliest days. Probably a million x-ray pictures have been taken altogether; probably a thousand experimenters are now daily exposing themselves to x-rays; yet despite these facts, practically no one suffers. If x-rays burn, would not cases be numbered by thousands instead of a few dozen? "Idiosyncrasy" does not explain this.

But it does not make any real matter whether x-rays *can* burn or not, for experience demonstrates three reassuring facts:

1. It is easy to see how every one of the sixty-nine injuries reported could have been *avoided*.

2. It is *easy* to avoid injury during x-ray work.

3. It is *difficult* to cause injury during x-ray work.

It is easy and safe to walk down stairs, but if a man breaks his neck by throwing himself down, the stairs are not to blame. Let us now consider a few practical points:

The *Journal of Electro-therapeutics* for January, 1898, contains an article entitled, "The x-ray and the so-called Burns." With the author's kind permission I will use a few of his remarks for my text, assuring him that I do so in a friendly spirit. Says Dr. Jenkins: "So much for the ray itself, with all its wonderful and alarming results." What alarming results?

"That these rays do produce burns there can be no doubt". Why can there be no doubt? What *proof* has *ever been advanced* that x-rays burn? I have paid some attention to the matter and I challenge any one to produce a demonstration of dermatitis produced by *x-rays.* On the contrary the accumulation of proof points the other way.

Again, the article to which I refer, remarks: "Dr. Monell, of Brooklyn, advances the theory that the so-called burns are not due to the tubes or rays at all, but to the direct contact of the electricity." ***** "There may be some truth in what Dr. Monell says, but it offers no argument in proof that the atomic force of the ray combined with the platinum does not produce the so-called x-ray burns."

I do not exactly understand what is meant by "the atomic force of the ray combined with the platinum," but I presume that Dr. Jenkins could demonstrate the "proof" to which he refers, or otherwise he would not offer the remark as proof that my statement is wrong. Confessing, however, my ignorance of "the atomic force of the ray combined with the platinum," I must say that I do not recognize the above quoted "theory" as a verbatim extract from anything I have ever written. I have examined my Manual of Static Electricity in X-ray and Therapeutic Uses, and some half dozen of my published articles about x-rays, without finding the words mentioned.

An instant later Dr. Jenkins further remarks: "***** indicates that Dr. Monell is evidently wrong in his theory, and that he will not only have to change his opinion as to the cause of burns, but retract his statements about static machines, for if the ray is the cause it makes no difference how the current is produced."

If any operator will kindly come to my office and take charge of my x-ray apparatus for a couple of hours and show me that I am mistaken in the views which experience with my apparatus teaches me to believe correct, I will retract every error of the past and welcome the new truth. Physicians, however, who have come to me for instruction during the past year and a half, and have seen the actual work on which my writings are based, will perhaps be inclined to the opinion that the demonstration might require considerable skill in technique. I am, however, not only willing to be convinced, but am continually seeking new information.

I shall now use the above text to repeat the substance of my teachings on the points noted, and I need not fortify myself by new arguments, for on Oct. 2, 1897, I replied to other inaccurate and similar charges in a manner which requires no alteration now.

"Several correspondents write me that they understand me to claim that the static current does not cause a burn, and go on to notify me of a case reported. My experience demonstrates that with proper management the *direct* static current tends so little to cause injurious action upon the skin that it is easy to avoid all trouble, even when working continuously with tubes for several hours. I have, however, seen evidence that by condensing the current through Leyden jars, and by non-expert methods of employing tubes which really abuse the apparatus even without condensers, and by persisting for a long time, a dermatitis can be set up.

"To set forth my early and present position in regard to static burns it may be best to quote from what I have previously written:

"'While there is no mechanical device which can not be abused, yet if any physician with a Holtz machine and one of the author's tubes would start out in the morning with the deliberate purpose of inflicting upon himself a 'dermatitis Roentgeni,' by nightfall of a long summer's day he would be baffled in the attempt if he employed the proper method. The direct static discharge of high potential and infinitely small amperage does not produce electrolytic or chemical effects upon the human tissues without x-rays and consequently does not produce such effects in conjunction with x-rays."

If the current is transformed by condensers, or backed up by the resistance of a high vacuum tube, and if a powerful spark interruption is maintained, the current is *altered* and my statements above quoted do not apply to the condition. Every one who uses a static machine certainly knows that by the use of a covered electrode vesication can be caused by a static application, but this ancient fact does not make a sedative breeze vesicate. The term "proper method," must define the scope of my assertion that the static current is safe, for it certainly does no harm ordinarily, and must be used under altered conditions to cause dermatitis. As proof of this there comes to my notice the experience of an x-ray exhibitor whose hand is now inflamed to a moderate degree. He tells me that during a special exhibit he exposed the back of his hand at close range, often in contact with the bulb, for a total of twenty hours divided between two days. The current was pushed to its utmost. There were but two tubes employed, one being kept going constantly for six hours. They were the "Monell Static Tubes" and remained in working order despite this severe use. In about ten days a dermatatis appeared, but has not proved to be very severe. A powerful spark was used and the hand was often in actual contact with the bulb. This bears out all my assertions about the slight liability of this form of current to do damage in x-ray work. The operator was sufficiently skilled in handling tubes, but was not familiar enough with static apparatus to *regulate the current* and avoid an excess. Had this been done he would have been able to keep his hand free from injury, especially if he had used reasonable caution as to distance. He, however, had a firm belief—not correctly understood—that it was impossible by *any* use of static electricity to cause an inflammation of the skin. Had he not been so convinced of this by his previous immunity while exhibiting for several months, often subjecting his hand to long exposures—once as long as six hours without harm—he would have been more careful. So rarely is an injury caused by operators using static machines correctly that alarm may be dismissed from patients' minds."

I stand by every word of the above statement, written six months ago. Time has not impaired its accuracy, nor subjected it to change; and now let us state a few operative details.

We place a tube in its standard upon a table, connect its terminals with the prime conductors of any large therapeutic static machine, and start it into action. If the tube operates perfectly by the *convective* discharge of the direct current we observe no noise, no heating of the tube beyond about blood heat, and no spray about the external surface. If the palm is folded around the bulb no sensation except the slight warmth is felt.

All the current is now going around the circuit within the tube and there is nothing outside the tube to cause a burn. It is my belief that a tube operated in this way can not cause a so-called x-ray burn, but perhaps I had better say that it has never done so in the severest tests that time has permitted me to make. Even if an exposure was continued for a week without interruption such a tube would apparently not injure a patient because no discharges except those of a harmless nature take place outside the bulb. The x-rays penetrate readily enough, but x-rays do not burn or ulcerate any tissues through which they pass.

Now let us put a pair of interrupters on the sliding poles of this giant machine, and regulate the intensity of the bombardment to suit the given tube. If the internal resistance does not exceed the resistance of two inches or less of ordinary air the current in this case will also discharge within the tube and no overflow will sputter and fly across the terminals around the external surface. Exposures of any length of time may be made with this tube with absolute safety at any distance from the tube, whether six inches, twenty inches, or one inch, so long as the patient does not feel upon the surface of the exposed skin the familiar sensation of the static spray.

But suppose the resistance of the vacuum increases during use, or is higher than stated above. Let us consider that it equals the resistance of three and a half inches of air gap; and across the space between the internal electrodes the current will only jump under the pressure of a tremendous bombardment. In fact all the current will not discharge itself within the tube, but backs up and makes a luminous brush along the positive wire, and sputters in a visible spray discharge upon the outer surface of the tube. If the hand is placed within the radius of this external electrical discharge it will be subjected to the action of the same needle-like shower upon the skin which is familiar to every patient who, upon the static platform, has received a negative spray through resisting garments. If this bombardment upon the skin is maintained long enough it will set up a dermatitis, but it will take some time to do it. To avoid the possibility of a dermatitis we need not seek an "aluminum screen," or send a cry for help to distinguished electrical inventors. The spray acts injuriously only through resistances and only when the object is within the short radius of its bombardment. We can either move the tube a few inches further away and escape danger altogether, or we can dispose of the resistance of the dry or cloth-covered skin by removing the clothing over the part, and moistening the skin a little, just as we moisten it in the direct application of a galvanic or faradic current. The most rudimentary experience in actual electro-therapeutics divests the whole subject of x-ray burns of all the practical interest which has been supposed to belong to it. Any therapeutist can demonstrate the actions upon the skin of different therapeutic currents and can show how to prepare the contact so as to avoid irritation while securing proper effects.

No operator with well instructed skill would place a tube from which an external spray sputtered, so near the patient that the electrical bombardment would irritate, for the brilliant radiance produced by such a tube would make it unnecessary in the first place, and in the second place the operator would know better.

Having command of a tube of high efficiency the physician can regulate the distance between the patient and the tube to suit his own judgment, and if his judgment is good his patients will be as safe as an infant slumbering in its cradle. Even if the vacuum of an exceptional tube may at first compel the use of an excess of current, as I have stated above, yet in a few moments it will be possible to regulate the current so as to control in a large measure the external spray, and this regulation will also remove the possible cause of complaint. This is solely a question of *technique*, and in its practical bearing upon the physician's work calls for no scientific speculation, or profound experiments from the laboratory of the physicist. It is, I say, a question of technique, and not of vague speculations, and so important is technique in all the work of the physician with Crookes' Tubes that a few notes of some of its relations to results may interest the reader of this article.

Instead of reciting imaginary conditions I will report, in synopsis, a little of last evening's work.

Present, Dr. W—, of Rochester, N. Y., an operator with considerable previous experience but who desired further instruction in securing maximum effects. In one, two, three order, about ten tubes were rapidly tested, the value of the vacuum resistance of each tube practically measured, the working x-ray value of each tube instantly determined and the luminous manifestations of each shown to be the language by which to interpret its condition.

The tubes tested varied in size from the smallest x-ray tube I have ever seen, its bulb being about the size of an English walnut, up to tubes eighteen inches in circumference. The internal resistance varied in different tubes from the low vacuum of a sixteenth of an inch of a resistance, up to full three inches, and the measure of the resistance of each tube accurately informed us of its efficiency for x-ray work.

Having completed instruction in thus ascertaining the value of any given tube we next took in hand a tube of low vacuum to demonstrate the method of raising the internal resistance to a working point. A tube, twelve inches between the terminals, with a bulb five inches long and thirteen inches in diameter, possessed so low a vacuum that the discharge between the electrodes was a direct stream like a pencil, bluish near the cathode and somewhat pink near the platinum reflector. The resistance equalled only about one-sixteenth inch of air gap between the sliding poles of the apparatus. I asked Dr. W— what he would do with such a tube in his own office. He replied that he would throw it away, considering it impossible to make any use of it. "However," said he, "you teach that by reversing a tube you can raise its vacuum; I would reverse it and see if that would do any good." Permitting Dr. W—— to assume charge of the tube, it was reversed and the current again started.

How long should it be kept reversed? Until the blue disappears and as much green as possible is developed in the phosphorescence. In about five minutes I stopped the machine to permit Dr. W—— to test the result of his work. The tube was the same as before reversal, and not improved in the slightest degree. It gave out no x-rays, as a blue stream between the electrodes is not the high potential bombardment which is required to produce x-rays. The suggestion to "reverse the tube" was, however, all right, and the result is a question of technique. Taking the tube in hand in a different manner it required less than three minutes to demonstrate with it a bright green luminosity and x-rays as good as the average operator throughout the country is obtaining with his best tubes to-day. So much for raising a low vacuum.

A tube with more than three inches resistance and of a larger size was next connected with the machine. The current backed up along the positive wire and flared out of the terminals of the tube. The resistance was just high enough to prevent immediate action and in former days the alcohol lamp would have been brought into service to heat it. By re-enforcing the strenuous pressure of the current with the sharp blow of a sudden "break and make" the tube instantly glowed with bright green and gave out superb x-rays. In a case of still higher resistance the use of tin foil around the terminals, as I have described on page 621 of the second edition of my book, is perfectly successful.

Next in order followed a demonstration of tests of the comparative value of x-ray efficiency in different tubes, or in the same tube at different times, and working under a different dosage. With the fluoroscope, and depending on the eye and observation of the bones of the hand alone, a non-expert may think two tubes of equal value when one is several times as efficient as the other. This is important in regulating the exposure time in photographic work. A simple test exactly measures the values. Adjusting different tubes with different dosages of the current, beginning with a very low current, I took Dr. W—— along a succession of steps of x-ray penetration as follows: 1. The hand cast only a black shadow on the fluoroscope. 2. The bones of the hand appeared lighter. 3 The bones of the hand became very transparent. 4. The bones were almost of the same transparency as the soft parts. 5. The metallic objects on the back of a strip of pine were plainly visible through a Webster's Unabridged Dictionary. 6. Wrist, elbow, shoulder, ankle, and knee were transparent. 7. A watch was held upon the left side of my head and was visible wherever moved, the fluoroscope being placed against the right side of the head. 8. Dr. W—— obtained the best view of the author's heart at about thirty inches from the tube. 9. Through all parts of the body of men aged over forty the rays penetrated with brilliant light, and with definition according to the part. 10. When the fluoroscope was held over the region of the pelvis and hip joint it was brilliantly lighted up, and coin in a purse in the subject's pocket, the suspender buttons, the drooping links of a watch chain, the watch in the lower vest pocket, and the outline of the head of the femur were visible. The transparency of the bones of the thick pelvis of a large man aged about forty-five was fully equal to the ordinary transparency of the hand with ordinary apparatus, and the sharpness of the metallic objects was as well defined as ordinarily through the simple resistance of a book. 12. The x-radiance produced by this tube was shown to render objects as transparent ten feet away as at ten inches with many common tubes.

To demonstrate facility in operation and the comfort of the operator, it was shown that no puttering was required to produce the different desired effects with any of the different tubes manipulated. It was also shown that while working in front of the tube the operator has no care on his mind; he practically ignores the machine after having once adjusted it, and whether ten minutes, or an hour, or two hours, goes by, there is no occasion to stop the current, rest the tube, or cool it off; there is no great amount of noise, and no disturbance of any kind to distract the operator or make the patient nervous.

These results are simply a question of technique. I demonstrate them over and over again. I can repeat them at any and all times. There is no reason why every operator in the country should not command an equally certain technique. I teach the operator to understand exactly what he is doing and what the tube is doing, in a practical sense. I have little knowledge of the kind that eminent physicists bring to bear upon the consideration of x-ray phenomena, but I know how to *make a tube work* and teach others to do the same. It is unsatisfactory to do x-ray work when the operator is obliged to fuss and putter with his tubes, sometimes for half an hour, before an examination can be made. Operating by guess work, with no clear idea of the meaning of any of the actions of the tube or current, and continually troubled by perplexities as to the best means of proceeding is unsatisfactory. It is unsatisfactory to do x-ray work when the operator lacks the guidance of comparative tests to inform him exactly what his tube is doing; whether it is doing its best, or could be made to do better, or how it compares in efficiency with the maximum now known

A knowledge of correct technique ends

all this uncertainty and removes dissatisfaction from the manipulation of a Crookes tube. "Technique" is the jockey in the saddle that drives the electrical current to a finish, commands the most balky tube, points its head in the right direction, and spurs it into brilliant action with neither hesitation nor swerving to the right or left.

With skilled technique the question of x ray burns becomes as obsolete as the customs of the Aztecs. It really matters not what has caused the burns of the past, for there certainly need be none of them in the future. Among abundant evidence, however, that the burn has never been due to the x-ray I think the experiment of Elihu Thompson last spring supports, by the weight of a direct experiment, the common observation of all competent x-ray workers. In setting up a dermatitis on his own hand he produced no effect where the skin was covered with lead and tin foil. Tin foil did not prevent the x-rays passing through his hand anymore than a sheet of paper would prevent them, but the tin foil prevented the burn, during an exposure at the extraordinary small distance of five-eighths of an inch from the platinum reflector. It is to my mind absolutely certain that the x-ray does not inflame a tissue through which it passes; but nothing is more certain than that a sufficiently energetic electric current passing to tissues which it can reach and enter only after electrical energy has been transformed into heat by resistances such as dry and hair-covered skin, or clothing, will vesicate, and can be made to produce intenser and deeper inflammatory action by the technique of a competent electro-therapeutist. Competent technique can also *avoid* these effects at will. Those who study electrical phenomena along the lines of engineering and metallic conductors should take into account the vastly different experience of therapeutists who employ electrical currents upon and within human tissues. Many of the matters discussed by electricians in a perplexed and puzzled manner during the past two years of x-ray work have dealt with the rudimentary and long established facts of electro-physiology and electro-therapeutics as if they were unknown. It would have been well for the best interests of practical x-ray work if some of the discussion had first waited to read the A B C's of electro-physiology.

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The origin of the word "deadhead" is explained as follows: Fifty years ago the principal avenue of Detroit, Mich., passed close to the entrance of the plank-road leading to Elmwood Cemetery. As this cemetery had been laid out some time previous to the construction of the road, it was arranged that all funeral processions should be allowed to pass along the latter toll free. One day, as Dr. Pierce, a well-known physician, stopped to pay his toll, he observed to the gatekeeper: "Considering the benevolent character of our profession, I think you ought to let us pass free of charge." "No, no, Doctor," replied the gatekeeper, "we can't afford that. You send too many deadheads through here as it is." The story traveled around the country, and the word "deadhead" was eventually applied to those who obtained free admission to the theatre.

Kites sent up on Oct. 15, from the Blue Hill Observatory, surpassed the record of Sept. 19 by more than 1500 feet. They carried the meteorological instruments to a height of 10,900 feet above the hill top, or 11,500 feet above sea level. The kites were sent up at 3.50 o'clock in the afternoon and reached the highest point at six oclock.

At that altitude the temperature was forty-three degrees, while it was seventy-three degrees at the ground, showing as much difference as one might expect.

THE ROENTGEN RAY WAVE LENGTH DEPENDS UPON THE POTENTIAL.

BY WILLIAM ROLLINS.

When we try to see what goes on in a vacuum tube, looking at it "with that inward eye which is the bliss of solitude," the Roentgen rays appear to differ only in degree, and to be dependent for their penetrating power upon the potential of the current and the degree of the vacuum in which the cathode discharge takes place.

We should bear these probabilities in mind in the practical application of the rays to medical diagnosis, arranging the potential so as to make rays of the proper length for our purpose.

If we wish to see the outlines of the bones of the hand distinctly, we shall keep the potential low, to make the contrast with the soft tissues great, while if the bones are more deeply seated we should not use a tube with a higher vacuum to send the rays through a greater thickness of tissue, but we should keep the potential and vacuum the same to prevent altering the wave length, and increase the light by making more impacts upon the target from the cathode discharge.

Suppose we take a tube with the lowest vacuum in which we can generate any considerable number of Roentgen rays. In this tube the anode must be cooled and the cathode movable. The tube should have a potash bulb, as used by Crookes, to quickly lower the vacuum or raise it again. The curvature of the concave cathode is to be that of a sphere of two inches diameter. A spherical curvature is not the best: but, as Kipling says, "that is another story."

With a very low vacuum we can generate Roentgen rays with the anode nearly in the center of curvature, or a ittle over one inch from the cathode, and yet have good definition if we have taken care in grinding the concave surface. Then, if we look through a hand, the bones seem very dark, because of the contrast with the softer tissues. If, now, with the same potential, we increase the number of impacts upon the anode target from the cathode discharge, we make both bones and tissues lighter without much changing the relative values.

If we raise the potential and the vacuum, focussing the cathode stream on the target again, we shall find as previously stated in these notes, that the distance between the cathode and anode is increased, while the bones are, relatively, more transparent. Every time we do this with higher potentials and vacuums, the relative capacities of two substances are changed; and we could go on building more powerful apparatus until we could make rays to which all the so-called elements would be as transparent as glass to light. Platinum being then permeable, we could, for some of our work, abandon internal cooled reflecting anodes and use a form of tube employed in some of my experiments, the platinum, in the form of a disk, being sealed into the wall of the tube, corresponding somewhat to Lenard's aluminum window. Then, by using higher potentials and cooling both terminals, we could approximate to that vibration to which the worlds are transparent.—*Electrical Review.*

EFFORTS have been made, and are likely to be consummated, for mutual affiliation with the University of Chicago and Rush Medical College. The second stipulation provide "that the requirements to admission to the college shall gradually be increased until the Autumn of 1902 when those only will be admitted who have completed the freshmen and sophomore years of regular college work."

A NOTABLE X-RAY OPERATION WITH DENNIS' FLUOROMETER.

BY JOHN DENNIS.

Late in the month of November, 1897, Mr. B. was brought from Northeastern New York to the Hahnemann Hospital at Rochester. Over thirty years before he had received a charge of squirrel shot in the right leg, midway between the knee and ankle. Some of the shot had, at two different times, been removed, but such was the condition of the limb that it was determined by his home surgeons that an attempt should be made to remove the matter by means of the Roentgen rays.

The day after the patient arrived at the hospital the limb was brought within the influence of the Roentgen rays and measurements made by means of the Dennis Fluorometer. The first observation was made from the side, the cross section view of the limb being secured in about the center of the group of foreign matter which was revealed by the superficial view. A position satisfactory to the surgeons having been obtained, a Fluorograph was taken. It will be seen by examination of the Fluorograph (Fig. 1.) that the foreign matter was considerably scattered.

FIG. I

An observation was next made from beneath the limb, it remaining in the same position as before. It was found that the shot were practically in a line, which extended about one inch above the cross formed by the Fluorometer, and about two inches below the line of the cross section that is up and down the limb. The forked sights were then placed in position, and the divergence or obliquity of the rays eliminated, thus showing the exact position of what may be called the "layer" of shot.

It was upon this observation, which was later followed by operation, that the diagnosis was based, and it is perhaps of sufficient interest to warrant a more detailed description. After the first observation at the side a line of India ink had been drawn around the limb marking the cross-section which had been produced by the Fluorometer practically in a thin layer, the edge of which layer was toward the observer. One of the forked sights was then placed on the Fluorometer arm nearest the observer, and thus nearer the screen of the Fluoroscope, in such position that the layer of shot intersected the notch of the sight and about midway of its length; that is up and down the limb. On the upper arm of the Fluorometer nearest the tube (now the crosspiece) was placed

FIG. II.

appliance. A cross-piece was next placed over the upright arms of the Fluorometer for maintaining the cross sectional view during the second observation and the tube was placed above the limb, instead of at the side as before, the observer with the Fluoroscope placing himself beneath the table. The first observation from this second view-point, was of course for the purpose of finding the shot, and they were, as has been said, a second forked sight, at a point equally distant with the first from the left side of the Fluorometer. The tube was then shifted until the grooves of the sights coincided; in other words, until a straight ray passed through both. It was then noted by means of the metallic grating, which had been placed on the level of the top of the table under the Fluorometer, that the layer of shot appeared about one-half inch to the left of the right line through the two forked sights. The sights were then moved one-half inch to the left, both being moved the same distance. The tube was again shifted slightly until the straight ray was through the notch of the upper sight, through about the center of the layer of shot, and through the notch of the lower sight, thus bringing the three in line, so that a coincident shadow was thrown on the screen of the Fluoroscope.

All that now remained was to draw a line in India ink on the upper surface of the limb, corresponding in position with the notch of the upper sight, and to draw a similar line on the under portion or calf of the limb, corresponding with the notch of the lower sight. When thus corrected by the Fluorometer, this line was two and three-fourths inches long, and of course ran at right angles with the line which marked the cross-section of the limb. The sights were then removed and another Fluorograph, (shown in Fig. 2) was taken, as a matter of record.

A few days later the patient was placed under the influence of anaesthetics, and the operation for the removal of the shot performed, the India ink markings on the limb being relied upon as a guide to the surgeon. At the very first incision, made in careful conformity to the lines which intersected the cross-section line on the upper and lower portions of the limb, the scalpel encountered three of the shot, showing the geometrical accuracy of the diagnosis. These three shot were removed and fourteen others, mostly imbedded in the bone, were found on the line between the two and three-quarter inch Fluorometric markings, above and below. It will be seen that the Fluorograph (Fig. 2)places this line of shot apparently three inches from the left side of the Fluorometer appliance. As seen by direct examination of the limb while in the Fluorometer appliance the indication lines were a fraction less than two and three-quarter inches from the outside of the Fluorometer appliance. This difference (in this case something over one-fourth of one inch) represents the divergence or obliquity of the rays between the uppermost shot and the sensitive plate. In other words; had the incision been made three inches from the square edge of the Fluorometer appliance as indicated in the picture, the scalpel would have gone astray a trifle over one-fourth of an inch, with the distortion of the ray corrected, in the manner which has been described, as has been said, the first incision of the scalpel resulted in its encountering three of the shot.

The Fluorometer is so constructed that the effect of the distortion caused by the obliquity of the rays is ascertainable in each and every case.

DEEP BREATHING.

In an excellent little work entitled "Deep Breathing," edited by Dr. M. L. Holbrook, the author, Sophia Marquise A. Ciccolina, sets forth her method of developing lung power, and so promoting the physical health.

Her method is, briefly, to breathe from the abdomen entirely; so exhale by compression of the muscles overlying the stomach, and to inhale by expansion or inflation of the stomach. The ribs are motionless during the acts of inhalation and exhalation. The inhalation is slow and deep, and the air is to be held for a few seconds after a little practice; is forced into the upper chest by contracting the abdomen, drawing back into the abdomen by expansion of the stomach, and finally exhaled rapidly. According to the author, this rapid exhalation has the effect of actually expanding the chest, and the whole process, if practiced for an hour each morning, and persevered in until it becomes second nature, tends to cure nervousness, consumption, hysteria, and many allied pathological conditions.—*Journal of Life and Health.*

X-RAYS AND ABNORMAL PHENOMENA.

EDITOR AMERICAN X-RAY JOURNAL.

After reading in the November number of your excellent journal the remarkable results reported by Dr. Astudillo, of Havana, Cuba, in the use of the x-rays with the blind, I am constrained to write you of a peculiar experience which I had with a blind man a short time ago.

There is a blind man here, who tunes pianos for a living, who goes all over the city alone. He is about thirty years of age, and began to get blind when he was a boy, after an acute disease of some sort, I have forgotten what now, but that is immaterial.

After going to many oculists, he became totally blind, except to very bright light, about four years ago. He can now tell when he faces a window, or a match is moved before him, and he lights his own cigars. There is a total opacity of the right cornea and but a thread of dark color about the circumference of the left cornea, which is otherwise entirely opaque.

He came to my sanitarium at my request to experiment with the x-rays, as he is well educated and intelligent, having been through the State School for the blind.

I told him of Dr. Astudillos and your experiments with the x-rays, and he was curious to try them himself.

I handed him the tube, to let him feel the shape, and explained the mode of attachment, etc. After he had examined it, he made the remark that that was the first time he had ever seen a Crookes' tube, and that now he knew what it looked like. It is amusing to hear a blind man talk about seeing. He can run my Remington typewriter first-rate, and speaks of seeing the keys, etc.

I purposely refrained from telling him what the color of the tube would be, when it was acting, as I wanted him to tell me if he saw anything. As he once was able to see, when a boy, he knows what colors are.

I attached the tube to my static machine, placing it in the holder, in an upright position in front of him, with the platinum anode on a level with his eyes, and about six inches from his face.

When it was acting well I asked him if he saw anything. He hesitated a minute, and then told me that he saw a blue light, a dark blue light. I asked him if it was violet, and he said yes.

I then told him, the room being dark, that all that I saw was a greenish yellow light, but he said it was bluish to him. After looking steadily at the tube for several minutes, he volunteered the statement that his eyes felt better that the pain and fulness which was there before was better, and later he said that it was gone. I made no suggestions to him, so that there was no psychic or hypnotic treatment attempted. He was pleased with the feeling produced, which I had not thought of before.

I passed my hand between the tube and his eyes, and he could detect the shadow, likewise that of several metal instruments, but he could not tell what they were. He could only tell there was a shadow passing before his vision. In his case the optic nerves are not destroyed, but he is blind on account of the corneal opacities. I might state here in passing that there is a constant and involuntary lateral oscillation of the eyeballs, which he is unable to control by will power. His attention had never been called to this nystagmus before, which he tried to control, at my suggestion, but failed.

We know that at the upper or blue end of the spectrum, there are still further colors, which we are unable to see, which we call the ultra violet rays. There are some eyes which are very sensitive, either naturally, or have been so educated, that they can detect shades of color beyond the range of ordinary vision.

To the ordinary vision these ultra violet rays of light or color are invisible, and it is supposed that the x-rays are somewhere beyond the violet, out of our sight. But we know they are there.

Is it not probable that in the case of this blind man, whose eyes are blind to ordinary rays, that his vision is so sensitive that he can detect the ultra violet colors, in the x-rays?

We know that when we lose one of our senses, that the other senses are more acute. The sense of touch, and pressure, is highly developed in this man, and he says that he can tell when he is approaching a person or object, before he strikes it, and that if he is not going too fast that he can avoid it, without seeing or touching it. There is a totally blind dog here in town that can go anywhere, and it must be by the sense of smell, and hearing, as he never strikes anything, and he trots fast.

Verily, "there are more strange things in this world, Horatio, than are dreamed of in thy philosophy."

Allow me to quote from an article by the late Prof. G. V. Riley, of Washington, on "The Senses of Insects", published in "Insect Life" Vol. VIII, page 40, in which he says:—

"There is every justification for believing that all the subtle cosmic forces involved in the generation and development of the highest are equally involved in the production and building up of the lowest of organisms, and that the complexing and the compounding and specialization of parts have gone on in every possible and conceivable direction, according to the species. The highly developed and delicate antennae in the male Chorononomous, for instance, may be likened to an external brain, it's ramifying fibers corresponding to the highly complicated processes that ramify from the nerve cells in the internal brains of the higher animals, and responding in somewhat similar manner to external impressions. While having no sort of sympathy with the foolish notions that the spiritists proclaim, to edify or terrify the gullible and unscientific. I am just as much out of sympathy with that class of materialistic scientists who refuse to recognize that there may be and are subtle psychical phenomena beyond the reach of present experimental methods. The one class too readily assume supernatural power to explain abnormal phenomena: the other denies the abnormal, because it, likewise, is past our limited understanding."

The same author goes on to quote from an article by William Crookes, entitled "Some Possibilities of Electricity", which appeared in the Fortnightly Review, March, 1892, as follows:—

"The discovery of a received sensitive to one set of wave lengths and silent to others is even now partially accomplished. The human eye is an instance supplied by nature of one which responds to the narrow range of electro-magnetic impulses between the three ten-millionths of a millimeter and the eight ten-millionths of a millimeter. It is not improbable that other sentient beings have organs of sense which do not respond to some or to any of the rays to which our eyes are sensitive, but are able to appreciate other vibrations to which we are blind. Such things would practically be living in a different world from our own. Imagine, for instance, what idea we should form from surrounding objects were we endowed with eyes not sensitive to the ordinary rays of light, but sensitive to the vibrations concerned in electric and magnetic phenomena. Glass and crystal would be among the most opaque bodies. Metals would be more or less transparent, and a telegraph wire through the air, would look like a long narrow hole, drilled through an impervious solid body. A dynamo in active work would resemble a conflagration, while a permanent magnet would realize the dreams of mediaeval mystics and become an everlasting lamp with no expenditure of energy or consumption of fuel. In some parts of the human brain may lurk an organ capable of transmitting and receiving other electrical rays of wave lengths hitherto undetected by instrumental means. These may be instrumental in transmitting thought from one brain to another."

The above words quoted from the inventor of the tube with which we now generate the x-rays, and written long before they were discovered by Roentgen, were they not prophetic, and is not this blind man who can see the ultra light, fulfilment of the prophecy?

Truly we are in the beginning of a wonderful era, and still more wonderful things are to be accomplished, and the American X-Ray Journal is going to be of great help towards the advancement of this new science, and I wish you well.

Yours Fraternally,

H. C. Bennett, M.D., M.E.

Storage Battery Applications. Clark. *West Elec.*, Jan. 1.—A short article on the future of the storage battery business. After enumerating the well-known advantages of storage batteries, he calls attention to their use in the future when storage becomes necessary to utilize the whole of a water power; another opening is in the installation of batteries on the premises of large users, a business which is already being exploited successfully in connection with a station in the East; reliability and endurance are the chief requisites, as distinguished from the reduction of the weight; he thinks there is more than a probability of a profit in storage battery traction as compared with the underground conduit system; train lighting by batteries will be universally used.

BLESSINGS OF BACTERIA.

It is rapidly becoming the opinion of a great many intelligent but unscientific people that the doctors are running this bacteria theory into the ground. If Job had lived in the present generation his apothegm to humanity might have read: "Man that is born of woman is of few days and full of microbes." Under the bacteria theory that everything he eats, everything he drinks, everything he wears, the air that he breathes and the tools that he handles, are infested with deadly germs which have no other function in the economy of nature than to lay him low. It is, therefore, with pleasure that once in a while we encounter a scientist who has discovered some microbes which appear to take the part of man in his battle with ill-health, death and the devil. At a meeting of the Washington Chemistry Society last week President Schweinitz devoted his annual address to those microbes which are at peace with mankind, and we have taken a few sentences at random from this address for presentation below:

"Our ideas of germs are so thoroughly associated with disease that we are prone to forget that many of them are very useful fellow-workers after man has learned how to use them. The value of this cell life in the production of beer, wine and other fermented liquors is too well known to need more than passing notice. But you may not all know to what extent the aroma and flavor of butter and cheese are due to the products of micro-organisms. Now these products are frequently ethers and esters, sometimes acid and acid derivatives or amines, the latter a class of compounds to one of which smoked herring owes its peculiar flavor and which is also formed by a number of bacteria."

This extract alone ought to be sufficient to convince any thoughtful man that President Schweinitz is on the right track, for the similarity between some kinds of butter and smoked herring is too apparent for dispute. Indeed, one occasionally encounters butter which in flavor resembles the herring that has not been smoked, but which has departed this life from old age and decreptitude. But we are interrupting the scientific gentleman, who proceeds as follows:

"When milk is first collected from healthy animals it is almost free from germs, but exposed to the air it quickly becomes filled with those forms of life which are harmless to man. If placed under suitable conditions they will multiply very rapidly and the milk becomes sour, due to the formation of lactic acid produced from the sugar of the milk by one or more of these germs. If the germs present happen to be those giving an ether and ester which have a pleasant flavor and aroma, good butter may be made, but if they give rise to the formation of disagreeable thio, or some amines, the butter is poor and bad. Now, by isolating different germs in the milk and cultivating them separately, so as to discover their own peculiar product, it is possible to always have good butter of the same sort and flavor by first destroying the other germs present by Pasteurization and then inoculating the cream with the particular germs desired."

If we have followed the Professor intelligently, he proposes to vaccinate butter. The possibilities are too enormous to be rightly appreciated all at one time, but no one can fail to comprehend the pleasure and satisfaction which will follow the ability to pick up a roll of butter at market, and find stamped on the end: "Inoculated by the Anti-Rancid Co., of Podunk," or "Guaranteed to be Vaccinated with Best Microbes That Ever Crawled," or "No Germs Like Ours." The possibilities are too enormous to be absorbed at one sitting, but no one will dispute the proposition that right on the surface it presents the grandest emancipation which has attended the progress of this marvelous century."—*Exchange.*

RADIOGRAPH showing fracture of Styloid Process of left ulnar and bird shot in hand. The thumb was shot off twenty-three years ago, the scattering

shot remaining in hand ever since without apparent disability. Injury to wrist occurred four months ago. By August Schmidt. M. D., 2105 South Broadway, St. Louis. Mo.

Dr. Burton Ward, according to the *Medical Age*, declares that there is one infallible symptom indicating whether one is sane or not. Let a person speak ever so rationally and act ever so sedately, if his or her thumbs remain inactive there is no doubt of insanity. Lunatics seldom use their thumbs in writing, drawing or saluting.

WAVE LENGTH OF ROENTGEN RAYS.

Practically all the results of experiment have so far pointed to the truth of the hypothesis that Roentgen rays differ from ordinary light rays and other manifestations of radiant energy only in the item of wave length. The supposition that they are radiations of almost inconceivable frequency of vibration and having a wave length many times less than that of violent light is a competent explanation of most of the phenomena due to them, leaving their remarkable action in discharging electrified bodies and certain others as yet dimly comprehended actions for further explanation. These, however, do not seem inconsistent with the theory that the Roentgen ray is simply an ordinary transverse ether vibration of high frequency.

In another column is a translation in abstract of a recent article by Mr. J. Precht, giving an account of some experiments with cathode and Roentgen rays. Three different determinations of the wave length cf the Roentgen rays resulted in widely varying figures, the lowest wave length found being 0.00016 millimetre. The result of the experiments, assuming that they are all entitled to equal weight in consideration, simply leads to the negative conclusion that the wave-length measurements obtained by them are entirely indeterminate. If the assumption is permitted that the wave length of Roentgen rays is so small as to be comparable to molecular sizes, it can be readily seen from physical considerations that the phenomena of refraction and diffraction would not manifest themselves or at least not in the manner with which we are accustomed: and that no surface would give such reflection as may be had with ordinary light waves, but rather that each surface upon which Roentgen rays impinge would become a new source of diffused radiation of the same character. It seems that no method of wave-length measurement that has been utilized for the determination of the elements of wave motion of ordinary light would be satisfactory for the determination of these incomparably finer vibrations, and that the grossness of structure, even of such bodies as we are accustomed to consider as having high refractive indices, will probably permit these rays to go through them in much the same fashion that a light ray shines through a swarm of flies.

MR. GLADSTONE AND VARIED EXERCISE. —Mr. Gladstone is noted for his outdoor life, and his enjoyment in felling trees in Hawarden Park. When asked the secret of his vigorous health at eighty three, he replied: "There was once a road leading out of London on which more horses died than on any other, and an inquiry revealed the fact that it was perfectly level. Consequently the animals, in travelling over it, used only one set of muscles. Continuous employment of the same physical powers on the same lines, result in physical exhaustion. It is varied and symmetrical exercise of the mind and all the muscles that lie at the base of any sound system of physical training.—*Modern Medical Science.*

SHE WAS BADLY DISABLED.—A Lawyer having some papers to be executed by an old Irishwoman went to her house one morning for her signature. On his arrival he requested her to sign her name "here," indicating the spot.

"Och," said she, with a bland smile, "you sign it for me, for sure, since I lost me glasses I can't write."

"Well, how do you spell your name, Mrs. S.?"

"Martha dear," she cried, come here directly and shpell me name for this gintleman, for sure, since I lost me teeth I can't shpell a word."

It will be observed that the x-ray portrait No. 1. herein reproduced from Vol. 1, No. 3, of THE AMERICAN X-RAY JOURNAL, is quite free from shadows or evidence of clothing having been worn by the subject at the time the picture was taken, except the shoes. The subject is a woman thirty years of age. The picture was taken in full dress.

The x-ray portrait No. 2, reproduced from No. 5, Vol. 1, of the same journal is of a man thirty years of age with his usual dress. It will be seen that the clothing shows clearly. The cloth in the pantaloons, lining in the same, the shoe tops, the muscles and bone are all seen overlaying one after another in the same plane. No. 2 is a composite picture and the human frame is about as clear in this as in No. 1.

The American X-Ray Publishing Co. offers a Premium of $10.00 for the most instructive article explaining the reasons for the difference in appearance of the two radiographs.

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NO. 1.

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The awarding committee will consist of three well known x-ray experts.

It is desired that the communication be sent in early as convenient. If contributors so request, all manuscript, except the successful article, will be returned, provided the necessary stamps accompany it.

NO. 2.

X-RAY THIRTY MILES FROM R. R.

EDITOR OF THE AMERICAN X-RAY JOURNAL:

Popular curiosity regarding the x-rays seems to have grown with wonderful pace. From reading I would judge that the only stony ground on which the seed has fallen is amongst those who have gotten hold of poor machines. Even the busy country doctor does not lose sight of a scientific discovery which has accomplished so much in a single year. Thirty-five miles from a railroad and the busy marts he has no opportunity to witness the wonderful search-light of the Fluoroscope and Crookes' tubes. In his rounds he finds some cases difficult of diagnosing and is led to wonder if these penetrating rays would aid him. There seems to be several different kinds of rays: the Cathode, Leonard, Rayons Wrainques, by H. Bicquerell, glow-worm rays and the rays emitted by fluorescence. No doubt under influence of higher vacuum or other improvements greater results remain to develop.

With the fluoroscope it seems that every part of the human body can be seen. Yet we have doctors, some old and some just from college who do not believe this. Thus it is seen that "Thomas" remains.

Since the discovery of x-rays they have been applied in nearly every existing art and science. To one who like the writer has never seen a fluoroscope or Crooke's tube, the wonder is, what will next be the result of investigation along this line? Will it be made to penetrate fossil remains? Will it yet be intensified in focus and vacuum until the bowels of mother earth will show up as it does the human brain. Perchance some long range method will be found to cast a search light that will show up the starry canopy. We do not know but that treasures on both land and sea may be equally revealed. We are yet infants in the domain of science.

The x-ray has become a potent factor for every physician who can use it and will be true to his patients. It is not a Koch lymph, an elixir of life or a blue glass fad. J. C. EMMONS, M. D.

Scotland, Ark., Oct., 1897.

The editor of this journal would like brother Emmons to know that perfectly efficient x-ray apparatus, practical for all medical and surgical purposes, can be had without the use of city electric currents, dynamos, storage batteries, or cells dry or fluid. X-ray apparatus are now constructed so that they can be used thirty-five miles from a railroad and at the cross road, with proficiency and he who will can become practically learned as those in the "busy marts."

We appreciate Dr. Emmons' letter and invite others to write.

LIVE FROGS AS AN ANTITHERMIC.—An English practitioner of Constanta, Roumania, writes: On the evening of October 19, I was called to visit a Roumanian boy, 6 years old, suffering from typhoid fever. I found him *in extremis*, almost pulseless. The child's head was completely wrapped over with a large white sheet, and as I looked at it this enormous white envelope seemed to be on the move, and while I was surveying this covering there crept from under it a small frog, which quietly sat over the child's left arm. It seemed quite content. I immediately called the mother's attention to it and requested her to take the animal away, thinking it had crept there as an intruder. "Oh, no!" said the old lady, "a doctor recommended that a lot of them should be kept to the head to keep it cool." Seeing the head covering still on the move, I raised it for curiosity, and in a second out jumped about twenty other frogs and hopped away in all directions. I have often heard the expression "as cold as a frog," but this was the first time I had seen a frog applied as a head-cooler."—*London Lancet.*

SOCIETY PROCEEDINGS.

CHICAGO OPHTHALMOLOGICAL AND OTOLOGICAL SOCIETY.

Dr. Starkey opened a discussion on the use of x rays in ophthalmology. as follows: We all know that certain substances which are transparent, or nearly so, to ordinary light. are opaque to the x-rays, and *per contra* certain substances opaque to ordinary light are more or less transparent to the x-ray. In general, it may be said that the greater the density of the object, the greater its opacity to the x-ray, and it may also be said that the higher the vacuum tube the more transparent are bodies to the x-ray. Starting with this knowledge we can readily see that pieces of metal will cause a denser shade from the x-ray than bones. if a sufficiently high vacuum is used.

As far as I am aware, the case I shall report is the first one ever successfully skiagraphed in Chicago as to the location of a foreign body in the eye. It can be seen that it is necessary in the majority of instances that the skiagraph should be taken from two positions, from the side of the head and from the front, and by means of those two skiagraphs the body can often be definitely located. Dr. Sweet, of Philadelphia has invented a plate holder and indicator which I had hoped to show, but am not able to do so.

The first patient is a male thirty-one years of age, who was struck in the left eye on June 28 with a piece of metal. He was seen the next day, when the lens was found opaque so that nothing could be seen within the eye. The eye quieted down and he was discharged from the hospital, but in August the eye began to soften and it appeared that it was going to be destroyed. On August 20 a skiagraph was taken and it showed definitely that he had a large piece of metal in the eye. An attempt was made to extract the bit of iron with a strong electro-magnet, but was unsuccessful and the eye was removed.

The second case was seen October 28, male, struck in the eye with a piece of metal. A hole in the cornea, and iris and lens opaque. The next morning a skiagraph was taken, which showed the presence of a foreign body in the eye. An unsuccessful attempt was made to remove the steel, although it was only forty-eight hours after the accident. The eye was removed and a piece of steel imbedded in the blood clot, so that a magnet could not affect it much.

Dr. Starkey showed many interesting skiagraphs of the bones of the head and of foreign bodies in different parts of the body.

DISCUSSION.

Dr. Casey A. Wood.—Two or three weeks ago a man appeared in my office with, presumably, a foreign body in his eye, but the patient refused to have a skiagraph taken because he feared untoward results. It certainly looks as if with improved methods and short exposures we may expect some benefit from the use of the x-ray in ophthalmology in the future.

Dr. Hale—My experience, which is limited to one case, has been very disappointing, but I am also inclined to think that it was due to imperfect apparatus.

Dr. Starkey, in closing, said that the exposure is never longer than eight minutes with the proper vacuum tube.

Electrical Phenomena in the Sahara.— Courmelles.— L'Eclairage Elec., Dec. 25.—A brief abstract of a paper read at the French association for the Advancement of Science. He attributes the electric manifestation noticed in that desert and the production of ozone to the friction of the particles of sand raised by the wind, and the medical effects of the station at Biskra to this phenomena.

HOW THE SURGEON LOST HIS FEE.

A famous Vienna surgeon was asked, by telegraph, how much he would charge for a capital operation on Reb Chaim Rosenbaum, a young, promising merchant in darkest Polish-Russia. The reply was that 5,000 gulden ($2,000) would be a fair compensation for the job: After various negotiations it was agreed that the desired amount should be paid after the operation was performed. The surgeon left sunny Vienna at once to emerge, after a thirty-six hour's journey, in the garlicky atmosphere of a small Polish town. There he was met by a congregation of long-bearded and long-coated individuals with long faces, who explained that the life-saving professor was too late this time and that good Reb Chaim Rosenbaum was gathered to his fathers the previous night. The surgeon's disappointment was so much greater as the mourning survivors did not show any willingness to pay his expenses. He concluded, however, to take a day off in the town. The population heard of the presence of the celebrated surgeon and it was not long before he saw himself surrounded by a crowd of surgical cases. He was kept busy operating the whole day, receiving fees of 50 to 100 gulden from each patient, so that, while not getting the stipulated 5,000, his trip was not a dead loss. When on the following day he was entering his train to return to Vienna, an old Polish gentleman most politely approached the professor, wishing him a lot of good things, praising his skill and many virtues, and finally saying that the whole town was forever under deep obligations to him, and to show his everlasting gratitude he would confide a secret to him. The professor could do no better than to listen and great was his surprise when he heard the following confession: "Don't you know, dear professor, that there is some mistake about Reb Chaim Rosenbaum's premature end and that in fact he found it preferable to stay with us instead of being gathered to his fathers. Among the many patients you operated upon yesterday you also operated upon Reb Chaim Rosenbaum, and God bless you, you were satisfied to take 50 gulden instead of 5,000. Thanks to Heaven and to the greatest of all great professors, he is on the road to recovery. Great is your kindness and great is Allah!" The professor made an unsuccessful effort to smile, the locomotive began to puff, and when next he goes to Rosenbaum's town, without a payment in advance, may we be there to see.—*Clinical Recorder.*

DEATH RATE AMONG PHYSICIANS.

This interesting question has been raised by a communication to the Brooklyn *Medical Journal* by Dr. Kortright. The death record given is of four hundred and fifty-eight medical men who departed this life in New York and Brooklyn during the past eight years. It shows the average life of the decedents to have been 54.6 years, and the mortality 25.53 per cent—a mortality exceeded only among saloon-keepers, butchers, quarrymen and poor factory operatives. The death rate among clergymen is only 15.93, and among lawyers, 20.33. It thus appears that the practice of medicine is more hazardous than that of any of the other learned professions The ailment which claimed most of the victims, according to Dr. Kortright, is the pathological condition which obtains in the group of affections classed as Bright's disease, viz.: arterial sclerosis and degeneration of the muscular fibres. This condition is responsible for 35 per cent of the deaths among doctors. This showing agrees with that made by English statistics. The cause is found in the vicissitudes to which the general practitioner is of necessity subjected the loss of sleep, exposure to the inclemencies of the weather, irregularities of meals, overwork, mental anxiety, etc. The constant variation of the tension of the arteries from such causes results in fibrinous deposits and inflammatory changes involving the kidneys as well as the heart and arteries. Poisoning and starvation of the tissue involved, through necessarily consequent defects of elimination, soon manifest themselves. The step is short to changes in the specific gravity of the blood from retained products of metabolism and pathologic conditions expressed in the term arteriosclerosis.

United States Consul Childs has informed the State Department that an electric light plant has been established in Ch'ang Sha, capital of the most exclusive and hostile province in China, where, a few years since, the people refused to allow telegraph poles to be erected. A native company has been organized to light the city with electricity, and it will only be a short time before it will be under way, as most of the capital has been subscribed. The consul states that the public buildings will be electrically lighted, and that prejudice is giving way to the modern invention.

The Dyea-Klondike Transportation Company's aerial tramway over the Chilkoot Pass, Alaska, referred to in the last issue of *The Electrical World,* will be operated at first by a temporary steam plant, in Dyea, driving a Westinghouse two-phase 45-kw generator. The current will be transmitted 20 miles by the Scott system, and will actuate electric drums near the summit of the pass. There will be about 6900 feet of Telfer-system aerial tramway, constructed, probably, in two sections. Mr. W. A. Burkholder expects to spend three months in installing the system.

X-RAY BLINDNESS.

BY ERNEST B SANGREE A M M D
Professor of Pathology and Bacteriology in the Medical Department of the Vanderbilt University, Nashville Tenn.

The late Centennial Exposition in this city is, so far as I know, the first very large exposition at which x-ray machines have been exhibited, and it has thus happened that probably a great many more people of all grades have looked through the screens here than have ever before done so in the same space of time.

A gentleman of much more than average intelligence and of considerable knowledge of electrical phenomena presided over one of the machines and he told me that out of about thirty-five hundred persons who looked through the screen, four failed to see anything—not only could they not see the bones of the hand, coins in a book, and the like, but they were not even able to see any light in the screen—it was as dark to them after the current had been turned on as before.

Two of these individuals he had come back and try again at night, and he experimented with them in every way he could devise, but all to no avail; they were unable to distinguish anything.

Though I believe no one has mentioned such a condition as blindness to the x-rays, it is not strange that such a condition should exist. Indeed the fact of color blindness would rather lead us to look for some whose eyes would not respond to the special vibrations set up by the x-ray apparatus. The gentleman to whom I allude was not the only one to notice this peculiarity; for several others in charge of machines, said, in response to his remarking this, that they had also occasionally run across people of the same kind and that it was of no use to try to make them see, for it was impossible.

LEGAL NOTES.

WANTED THE MORTGAGE FIRST.—A Swede came into a lawyer's office one day and asked: "Is hare ben a lawyer's place?" "Yes, I'm a lawyer." "Well, Maister lawyer, I tank I shall have a paper made." "What kind of a paper do you want?" "Well I tank I shall have a mortgage. You see, I buy me a piece of land from Nels Peterson, and I want a mortgage on it." "Oh, no. You don't want a mortgage; what you want is a deed." "No. maister; I tank I want a mortgage. You see, I buy me two pieces of land before, and I got deed for dem, and 'nother faller come along with mortgage and take the land; so I tank I better get mortgage this time."

AN IMPORTANT CIVIL SERVICE DECISION.—Judge John H. Rogers of the Federal Court, Fort Smith, Ark., handed down an important decision last week in the case of W. J. Fleming against S. F. Stahl. Mr. Fleming was an office Deputy under former Marshal J. G. Crump. Mr. Stahl was appointed by President McKinley to succeed Mr. Crump. He undertook to remove Deputy Fleming, and the latter brought suit to restrain him, alleging in his bill that the position of Deputy United States Marshal was, by order of President Cleveland, placed upon the qualified civil service list, and that his removal was about to be made because he was a Democrat.

The decision was rendered on a demurrer to the bill. The Court held that it had no jurisdiction to restrain a removal upon the facts stated in the bill. In regard to the effect of the order of the President by which the office of Deputy Marshal was placed in the classified civil service, the Court said:

"The civil service law never contemplated that the President or the Commission or both could make any rule or regulation which could have the force and effect of law. True, the President may make rules and regulations administrative in their nature which would govern the policy of his administration, and he could enforce the same by the removal of any person from office who refused to abide thereby, but they could not have the force and effect of law nor would the Courts enforce them. Such rules and regulations are purely administrative and may be altered, amended or approved by the President at any time or by his successor in office."

The injunction was dissolved and the bill dismissed at the cost of the Plaintiff.—*Chicago Law Journal.*

Medical examiners of U. S. Pension Boards are effected by this decision. —Ed.

THREE THOUSAND DOLLARS FOR A SPRAINED ANKLE.—At first thought, the supreme court of Minnesota says, it would seem that $3,000 for what counsel called "a sprained ankle" was much too large. But it believes that "sprains" may often be much more serious than broken bones, and it holds that the evidence in the recent case of Christian v. the City of Minneapolis justified a verdict of $3,000 for the so-called "sprained ankle," and that the damages awarded were not so excessive that it would be warranted in disturbing the verdict.

X-RAYS IN FEDERAL COURT.—The Roentgen, or x-ray photograph was declared by Judge Seaman in the United States Court competent as evidence in the recent suit of Patrick Shea against the owners of the steamer Osceola for damages for personal injuries. After the physician, who treated Shea, gave expert testimony as to the present condition of the plaintiff, Shea had himself photographed according to the Roentgen process. The photographs were shown in Court, and they corroborated the testimony given by the expert.—*Chicago Law Journal.*

CONDENSED X-RAY INFORMATION.

Switch for X Ray Work.—Kolle.—Elec. Eng. Dec. 9.—An illustrated description of a double switch by means of which the motor circuit is closed first and that of the primary coil later, the circuits being opened in the reverse order.

Physiological Effects of X-Rays.—Balthazard.—Rev. Gn. dees Sciences, Nov. 30.—A short article, in which he endeavors to prove that the physiological action of these rays is much less important than that of the electric radiations which accompany them; in all experiments with x-rays the electric radiations should be excluded by a screen of aluminum.

X-Rays and the Tubercle Bacillus.—Pott.—Elec. Rev., Dec. 8; reprinted from the London *Lancet.*—He gives the results of experiments which were undertaken to ascertain the effect of x-rays on cultivations of the tubercle bacillus, and the conclusions were that they had no effect; he believes that the improved condition of patients who have been submitted to these rays was due to other causes.

The X-Ray in Corneal Opacity.—Dr. E. Bock, in Memorabilien, Feb.—The author says that if letters are painted on a sheet of cardboard, afterward varnished and dusted with powdered metal, or if the letters are made of gold leaf, the Roentgen rays will throw their shadow through the opaque cornea; and if the optic nerve is healthy, the blind person will see the shadowgraph thrown on the retina. Prof. Eder, of Vienna, has verified these experiments.

Phosphorescence by Electrification. Trowbridge and Burbank. *Am. Jour. of Sc*, Jan.—A short article, in which they endeavor to verify by means of phosphorescence the statements that x-rays communicate an electric charge to bodies. They believe that it is not inconsistent with the electromagnetic theory of light to conclude that the phosphorescence excited by sunlight or daylight is due to "an electrical condition which can be dissipated by heat." phosphorescence may be an evidence of the electrical stresses which produce the phenomena of ultra violet light.

X-Ray Tubes.—Rollins. Elec Rev., Dec. 15.—A short description of his tube, in which there is a movable anticathode secured to an iron ring which may be moved in the tube by means of a magnet on the outside so as to put it into the best possible position; the tube can not be transported. In two other short notes by the same author he considers it probable that one cause of the rise in the vacuum in x-ray tubes is that particles of the platinum leave the anode and carry the molecules of the gas against the glass, where they remain; he also believes that the angle of the lines of force with the surface of the cathode depends on the degree of vacuum in the tube.

Heart Changes Observed by X-Rays.—By Theodore Schott, M. D.—Deutsche Med. Woch., April 1, 1897.—Not entirely satisfied with the results of percussion and palpation, the author, in order to demonstrate the diminution that takes place in the size of the heart after treatment with cool saline baths and passive gymnastics, has undertaken to photograph a number of cases with the Roentgen rays. The vacuum tube is always placed at a certain distance from the patient, and it is possible therefore to express the result in centimetres. Unfortunately, the shadows of the sternum and the vertical column prevent the measurement of the vertical diameter. In two cases, one a boy of eight and one-half years suffering from insufficiency of the mitral valve, the greatest transverse diameter of the heart diminished from 12.3 cm. to 11.2 after passive movements. The other, a girl of fourteen, remained for ten minutes in a saline bath at a temperature of 31 deg. The greatest diameter diminished in this case from 11.1 cm. to 10.3 cm.—SAILER, in *International Medical Magazine*.

ROENTGEN-RAY NOTES. ROLLINS. *Elec. Rev.*, Jan. 5.—A continuation of his notes. In order to see through greater thicknesses, and yet have marked contrast, he recommends raising the amperage, thus keeping the wave length unchanged, but increasing the amount of light, which does not change the relative transparency very much; he endeavors to show why there is a change in the relative transparencies; for greater details in the bones waves of shorter wave lengths are required. He also found no reason why a brass anode should not be used instead of the more expensive platinum. He found that the burning from vacuum tubes not generating x-rays may be severe, the tube being exhausted to such a degree that no Roentgen light could be produced with the voltage used.

SELF-REGULATING X-RAY TUBE.—ELEC. ENG., Dec, 16.—An illustrated description of Rice's modification. A well-known system of regulation is in use, in which there is a spark gap shunting the tube, in series with which gap there is a small tube containing the usual volatile salt ; the objection to this is that the spark is annoying, that the regulation produces a flickering, and that the sparks sometimes partially short circuit the tube. In the present arrangement the shunt spark gap is replaced by a long tube containing water, the resistance of which is very high ; a shunt current passes through this continuously ; otherwise the arrangement is similar to the well-known one. He found that a tube three thirty-seconds of an inch inside diameter and about two feet long, filled with water, affords the proper amount of resistance.

ACTION OF ROENTGEN RAYS ON PLANTS. ATKINSON. *Science*, Jan. 7.—A description of some extensive preliminary experiments to determine what lines of investigations might be profitably carried on in order to find what influence, if any, the Roentgen rays would exercise on plants as a possible stimulant. An illustration is given of an ordinary and a Roentgen ray photograph of part of a plant. He found that plant tissues absorb the Roentgen rays quite freely, and was surprised to find that there was not a more marked influence on growing plants. and especially that there are no visible external injuries even when they are exposed to close range a large part of the time during several days. No other general conclusions appear to be drawn.

X-RAYS AND MINERAL PHOSPHORESCENCE. BURBANK. *Am. Jour. of Sc.* Jan.—A short article describing experiments with fluorescent minerals under the action of the rays. Fluorite phosphoresces with a bluish white light which continues for a very long time afterwards; it is sometimes used below the photographic plate in radiography to increase the effect, but it unfortunately fogs the plate and blurs the outlines. Many minerals were tried, and more than two-thirds were found to phosphoresce, those containing calcium being the most susceptible, and in general those containing the ores of the metals being non-phosphorescent; with calcite the effect of heat is to greatly brighten the light emitted: with other crystals heat sometimes increased, sometimes diminished, and in several cases did not affect the light.

ROENTGEN RAYS. ROLLINS. *Elec. Rev.*. Jan. 12.—A continuation of his notes. He gives the reasons why Leonard's x-rays were feeble. In discussing the question whether the cathode stream goes forward in a high vacuum, he states that with the degree of vacuum used in producing Roentgen rays the position of the anode in relation to the cathode may be of importance. In discussing the question whether the Roentgen rays are strongest when the anode is the source, he states that if the target for the cathode discharge is in line between the cathode and the anode it need not be an anode and with powerful generators it is better not to have the target the anode, as a cold target not in circuit does not blacken the tube as quickly as when it has the function of the anode; he also shows that there are two sources of Roentgen rays in every tube.

VOLTAGE OF SPARK DISCHARGES. TROWBRIDGE. *Am. Jour. of Sc.*, Jan.—A short article on E. M. F., in which he gives the results of experiments made with his improved Plante rheostatic machine with sixty condensers and a 20,000 volt accumulator, thus giving 1,200,000 volts; with this he investigated the conditions necessary to produce a spark of great body, 48 to 50 inches in length; the length corresponding to the latter voltage is 48 inches. E. Thomson, with transformers sparking 50 to 60 inches, estimated that the voltage necessary to produce a spark of 80 cm was 500,000; the present writer believes this is nearer the truth than the 100,000 claimed by Heydweiler. The results show that Lord Kelvin's conjecture that the electrostatic force necessary to produce a spark in air "remains sensibly constant for all distances" beyond the limit he described is correct, for when the length of spark is plotted as abscissas and the corresponding voltages as ordinates a straight line is obtained. The rheostatic machine is much more efficient than the transformers for such high voltages; with the former one-third of a horse-power will produce the effects which heretofore required from 30 to 40 horse-power; the method of charging and discharging the condensers was to use lever arms instead of rotary cylinders, thus securing greater uniformity of action. He also tried the discharge through Crookes' tubes, one of which was exhausted so that an 8-inch spark preferred to pass through the air; the discharge produced by the machine passed readily through the tube, producing brilliant x-rays and the degree of rarefaction of the tube was not sensibly affected by single discharges. The results so far obtained show that the length of the spark is proportional to the voltage, and that rarefied spaces hitherto considered to have too high a vacuum to conduct electricity cease to act like such a vacuum to these very high voltages.

STRONG JOURNALISM.—Evidence of strong journalism is measured by the influence it wields amongst its readers. The Medical Brief enjoys the distinction of having the largest circulation of any medical monthly published in this or any other country. Its veteran editor and owner, Dr. J. J. Lawrence, ripe with experience, full of technical learning and withal a determined mind, advocated his views in the pages of his journal, upon the financial system of the country; and with amazing boldness in the face of statistics and argument, urged a protest gainst the medical use of certain animal products. Scarcely another publication could have so successfully waged a siege to the extent at least of eliciting inquiry into the truth.

DR. NICHOLAS SENN, of Chicago, it is said, was recently arrested and taken to Galena, Ill., by a constable. He was summoned to testify in a case, but telegraphed that he was unable to leave his practice, whereat a writ was served on him for contempt of court. When he appeared the judge accepted his excuse as a well-grounded one and imposed no fine.—*Philadelphia Med Journal.*

CAMPHO-PHENIQUE POWDER.

The following article, showing the value of Campho-Phenique Powder as a dressing, in crushed and comminuted wounds of the muscles, by H. L. Gault, M. D., Surgeon of Chester and Centralia Railroad, Sparta, Illinois, appeared in May number of Kansas City "Medical Index:"

"The following little report is given to brother physicians to illustrate how easy it now is to get splendid results and quick recoveries in a class of injuries which, up to a few years ago. were justly regarded with dismay and dispair by almost all practitioners and surgeons—injuries in which the crushing force of machinery has reduced muscles to almost a pulp, beside bruising the periosteum, if not cracking the bones. A. B., a railroad employee, came to me a short time ago, with the hand in the conditicn described; two of the fingers were ground almost to tatters. On first looking at them my impulse was to amputate them at once, but having had considerable experience in that class of cases, I proceeded slowly and carefully to approximate the bits of muscle that hung together, and finally got them into some sort of shape. I then dusted them plentifully with CAMPHO-PHENIQUE POWDER, covered them with a bandage, also thoroughly impregnated with the powder, and sent the patient home. On the ensuing day, finding no suppuration, and the patient in no-wise suffering, the dressing was left intact. It is scarcely necessary to go into further details. The same dressing and the same treatment was maintained throughout, recovery being rapid and perfect. At no time, from first to last, was there anything but healthy pus, and but little of that. There was absolutely no odor, and no pain after the first dressing.

Regarding the antiseptic and vulnerary used, I will say that as a dry dressing I have never yet seen anything equal to CAMPHO-PHENIQUE POWDER. I am in constant employment of CAMPHO-PHENIQUE, both in its original, liquid form, and in the powder, and I can not say too much for it, especially in the latter shape."

JOURNALISM IN THE KLONDIKE.—The *Midnight Sun* is the name of an enterprising newspaper printed in Dawson City. The editor thereof is looking forward with much anticipation, to the time when wireless telegraphy will be an accomplished fact, and he is already making preparations to avail of its advantages in behalf of his publication. He is, according to an editorial in our sprightly contemporary, "fixing up" a receiving station on his roof garden to catch all the late news that may float in the upper air currents. These waves of intelligence he says will probably have to be thawed out before they can be deciphered, but he has provided for such an emergency, by connecting a hot-air cylinder with his receiving apparatus. "No expense will be spared," he remarks with enthusiasm, "to make the *Midnight Sun* the finest example of advanced journalism north of Galveston."

APPENDICITIS.—Dr. Pepper states that in appendicitis, in spite of the claims to the contrary, twenty cases to one are cured permanently without operation. The University of Pennsylvania is efficiently equipped with X-Ray apparatus, an Institution in which Professor Pepper is an honored teacher.

BOOK REVIEW.

The Treatment of Disease by Electric Currents.

BY S. H. MONELL, M. D.,
Author of "Manual of Static Electricity," Founder and Chief Instructor of the Brooklyn Post-Graduate School of Clinical Therapeutics, and Roentgen Photography; Fellow of the New York Academy of Medicine. William Burts Hanna, N. Y. 1100 pages, $7.50, net.

We find in this volume a condensation of facts which physicians have long sought in vain.

In the hands of expert operators electric currents have been for a long time used with success for the treatment of disease, and with such startling results in many instances that learned professors in medical therapeutics, have reflected doubt upon the correctness of the reports and thereby biased young practitioners from the use of electro-therapeutics. Again, success in the hands of the few has spread apace the knowledge which has allured the untaught who, hoping for like good results, purchase apparatus that are worthless for medical purposes and therefore fail utterly.

Dr. Monell has cleared away in a few pages the perplexities that have befogged the source of knowledge. The quibbles, the confusion, the vague meanings which have hitherto characterized electro-therapeutic literature are here wholly unmasked—the subject being treated with the plainness of the Anglo-Saxon tongue.

The book abounds in common-place similes which are used for the purpose of imparting accurate meaning and setting aside all ambiguity and doubt. In every paragraph the reader finds something new and so easily does he grasp the thoughts that with hours of reading he does not tire.

The author betrays a familiarity with the subject not equally enjoyed by any other writer. The writing is essentially Monell. Every sentence bristles with the evidence of self conviction won by labor, experience and thought. His language is simple, pure and rich. Upon one page we found more than 175 variable words.

Many medical authors writing upon questions peculiar to their practice have been enthusiastic in their opinions, but at the same time displayed an incautious tendency to frown upon the results claimed by electro-therapeutic writers. Recent writers upon electricity, have properly conceded to medicine the place it occupies in therapeutics. The "over enthusiastic claims of electro-therapeutic advocates" can be no longer justly written. This book marks an essential feature in that it makes no claim whatever in its teachings, but simply states the demonstrated action of electricity.

Medical men can find in this book all that they need of the physics and physiology of galvanic, faradic and static currents. The author has simplified the method of teaching by a clinical course. Individual cases including almost the domain of pathology are used subjectively. How to obtain the current, the nature of current, the pole used, duration of each seance, changes to be looked for and all practical methods are taught with the conviction of pure clinical teaching.

The book is divided into 70 chapters, several of which are devoted to pelvic disorders of women. The bipolar method for relieving pain in this situation and the clear practical course adopted for curative treatment with electrical currents appeals to the understanding of every reader. The force of this observation culminates on page 398 in the following: "When structural changes have occurred the prognosis is affected rather than the method of treatment, the differences in the latter consisting chiefly in selecting the pole (either positive or negative) which conforms to the indications present. In one way or another almost all these cases, even those which have been sent by thousands to the operating table can be either entirely cured or given symptomatic relief by the persisteut use of conservative electrical methods, and the number who will find no relief except by the removal of the diseased organs is so small that the physician in ordinary practice can not compute the vanishing percentage."

The chapter devoted to "Urethral Strictures" details plainly the method for treating certain cases successfully where the modern and successful practice of divulsing urethrotomy has exceptions. This teaching must arouse the attention of all genito-urinary surgeons.

The subject of "Pain" treated by electricity for cure or palliation must engross the attention of every practitioner. The resources of medical electricity for this purpose are many. While its advantage is superior in most cases to anodynes Monell says, "It also imparts a general neutritional benefit".

The book is essentially practical for the doctor and should be studied until he becomes familiar with every detail. The index is alphabetically arranged and is full and complete.

The volume was given to the profession just at the time it was most needed. This is the beginning of the electrical age in which electro-therapeutics is making such conquering advance. This book is an index of the progress of the medical profession.

AN ELECTRIC MAIL WAGON.—The British Post Office has had on trial in London an electrically driven van for the carrying of mail matter between the main office and sub-stations. The experiment at the start seems to be successful.—*Electric World*.

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X-RAY APPARATUS FOR SALE.

The owner is offering this apparatus for sale because he is in other business.

The machine is practically new, having been used but a few days and is offered at a very low price. Good work is done with it and with a proper rheostat it can be used for electra-therapeutic purposes.

With the coils there are in addition two rubber pans 14x16 inches for developing purposes, the condenser is mounted in the coil base, one fluoroscope, one stand and eight storage batteries. The speed regulator and breaker are conveniently combined with the switch.

The coil is thoroughly insulated with black hard rubber and mounted on polished cherry—the base being but 16x30 inches.

It gives a strong eight inch spark and generates abundant x-radiance. One half of the strength of the eight storage batteries will discharge a spark six inches. The eight cells afford abundant current for all purposes. The coil is a most powerful one and can be used for the demonstration of many mechanical devices in addition to x-ray therapeutic work. The cells are large and can be used singly or in combination.

Letters of inquiry will be promptly answered by addressing "K"

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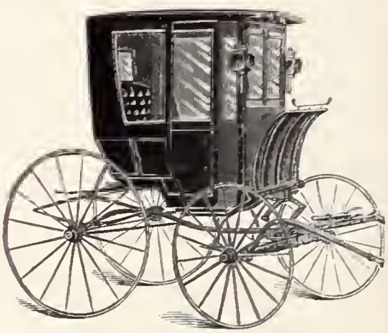
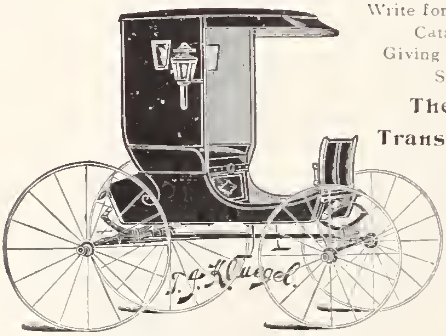


THE DOCTOR'S FRIEND.



J. E. W. Schuright, Patentee.

WITHOUT ATTACHMENT.

J. E. W. Schuright, Patentee

WITH ATTACHMENT.

THE AMERICAN X-RAY JOURNAL.

Devoted to Practical X-Ray Work and Allied Arts and Sciences.

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THE electric current will be diminished if the carbon in the electric cell is touched with paraffine or wax.

CERTAIN substances may be caused to pass through the skin in the direction of the positive to the negative or negative to the positive pole, but the medicament in each case is mostly limited to one direction.

THE green serpentine movement seen within a Crooke's tube when charged with a coil machine indicates either that the tube is worn out or the voltage is too low, if with an influence machine it indicates wrong connection to the tube.

SOME of the best operators with x-ray machines have never had any previous experience with electrical apparatus. The genius of man is often best developed when he is made self-reliant. The race is not always to the swift, nor the battle to the strong.

WIRES paraffined will prevent "crosses" and "short circuits" when they run in numbers. Single wires may be sufficiently insulated with cotton, silk or mackite. All textile material is hygroscopic and are therefore poor insulators when the wires are bunched.

THE subject of the first lesson for every prospective electro-therapeutist should be patience. The lesson should be memorized and worshiped with the zeal of the Mohammedans worshiping Allah. The x-ray student must "learn to labor and to wait." The reward in either case is bountiful.

COMMERCIAL formol is the best preservative of tissue. A 10 per cent solution will preserve the color of the brain and the smaller vessels will after months still have red color of the hemaglobin. 60 per cent of ethyl alcohol and 10 per cent of formol will harden nerve tissue and preserve the normal dimensions.

OUR published offer in the February issue to give to each of the first two persons who would point out misspelled words in THE AMERICAN X-RAY JOURNAL, one years' subscription, was answered by five persons on the third day after the Journal had gone into the mails. They were the first and since they all came in the same delivery we have concluded to give credit to each and therefore the one years' subscription goes to the following:

Dr. John Pitkin, Sr., Buffalo, N. Y.; W. H. Van Sickel, Electric Engineer, Eau Claire, Wis.; Dr. Fred. H. Holcom, Buffalo, N. Y.; N. L. Pence, M. S., Professor Physics, Lexington, Ky. and W. W. Judd, M. D., 93 Flournoy Street, Chicago.

Prof. Van Sickel pointed out the greatest number of errors which are as follows:

Page	163	second col	third line	"elictricity'
"	166	first "	35	"	"dermatatis"
"	189	second "	32	"	"gainst"
"	190	first "	14	"	"dispair"
"	192	" "	38	"	"radigraphy"
"	193	" "	18	"	"indispensible"
"	178	" "	8	"	"decreptitude"
"	iii	" "	22	"	"gynescologist"

The same offer is to continue until and including the June issue.

The use of the electric street current in the treatment of disease has been recently adversely criticised. It is claimed that during treatment the patient is in constant danger from a sudden overflow of electricity. Under usual conditions the variation of voltage is but slight, but there is danger of leading-in wires crossing of higher voltage which would greatly increase the pressure. This could occur also from an accident which might happen in the engine room that would greatly increase the speed of the generator. It is also said that before the current could be cut off it would pass through the protecting devices and through the body. We have no authenticated account of an accident occurring from any such cause.

In using the dynamo current in coils for x-ray work the tubes are known to be exceedingly sensitive to the varying demands made from time to time upon the street current. A change of two or three volts in the street current instantly affects the x-radiance to an appreciable extent.

If three parts of sifted and calcified oyster shells are mixed with one part of flour of sulphur and exposed to high heat for one hour the result is one of the phosphori. Exposure of this powder in a glass tube to burning magnesium will cause it to shine and emit different colored rays of light in the dark. This curious effect is called phosphorescence. If the tubes containing the powder are exposed to the sun-rays the effect is the same and the resulting phenomena are called phosphorescence after insolation. Many other substances are made to produce the same curious effect. It is found that almost all bodies which acquire phosphorescence by exposure to the sun or by heat, become luminous by friction. Mechanical force can only be regarded as an indirect mode of producing light, because heat is first developed; heat is a source of light, and *vice versa*.

It is the phosphoregenic rays or those which have the power of continuing chemical changes that render certain bodies phosphorescent by insolation and these rays extend from the indigo to beyond the violet.

If the original rays of certain substances undergo a change in their refrangibility that substance may become self-luminous. The electric lamp casting its bright rays through blue glass and then falling upon a plate of glass colored yellow by the oxide of uranium will cause the latter to become self-luminous. This is internal dispersion of the rays and is titled by Professor Stokes fluorescence. A strong solution of sulphate of quinine with tartaric acid spread over a surface will become self-luminous and fluoresce when rays passed through violet glass are allowed to fall upon them.

Long before Professor Roentgen had

identified the x-rays it was known that "a tube of uranium glass, conveying the coil discharge *in vacuo*, is similarly, with fluorescence, affected by this peculiar electric light."

The *Electrical Engineer* editorially warns the government of a serious omission in the equipment of our war ships. There is no adequate means for ascertaining the temperature of the magazines or coal bunkers at sufficiently short intervals. While merchant marine vessels are adequately protected by thermostats as a safeguard against fire, the war ships lack this necessary precaution.

This is certainly timely warning, but of much less importance than that which should be given against the appointment to office of stubborn and eccentric characters. Eccentricity is the bordering line to insanity, the affected person's mind running in deep channels with a deaf ear to all but his own opinions. If the navy authorities had heeded the admonition of the commanding officer of the Maine no explosion would have occurred.

ELECTRIC POWER PLANT, HELENA, MONTANA.

Below Canyon Ferry in the upper Missouri, seventeen miles north of Helena, Mont., the river was recently dry for forty-eight hours because of a dam that had been completed by the electric power Co., of Helena. It required two days for the river to fill the great lake made by the dam. The surface of the lake has an area of six square miles. Before the water flowed over the dam prospectors were washing for gold and large catches of trout, stone rollers and other fish were taken out of the pools formed in the bed of the river.

The dam is 35 feet high and was built at a cost of $450,000. It is to furnish electric power for Helena. The city has some 20,000 inhabitants and boasts of the possession of more wealth per capita than any other city in the world. Forty millions of dollars was washed from the sands within the city limits. It was here that the Parent Shrine was banqueted in its pilgrimage across the continent from New York to San Francisco.

It is said that every person in the town above eight years of age can read and write, including the Chinese.

The city is beautifully located at the foot of Mount Helena, overlooking an extensive fertile plain to the east and to the north more than fifteen miles. Here the tortuous Missouri wends her way, upon whose farther shores rise precipitously a range of lofty mountain peaks.

COAL DISCOVERY.

The South African Journal, *Machinery*, reports a find of coal, sixteen miles from Johannesburg which measures 217 feet in thickness and forms the thickest seam in the world. It is 150 feet thicker than the Mammoth seam, which is also located in South Africa. This seam of coal lies in a basin limited to about 1,200 acres. The first indication of coal was met by a native while sinking a well. Several years after Mr. J. B. Garbe, of Johannesburg, advised the owners to bore. Coal was first struck at 304 feet, after passing through about 200 feet of clay and shales and 104 feet of sandstone. The thickness of the first seam is 18 inches. Further passing through 9 feet of sand stone the main body of coal was struck at 313 feet.

The statement made some time ago by Dr. Estes that "nowadays a surgeon will rarely be satisfied that a bone is properly set until verified by the x-rays" is supplemented by the fact that "the day has passed when arbitrary illustrations on the surgery of bones and joints will be appreciated without radiographs to prove the case."

A FEW ILLUSTRATING CONTRIBUTIONS TO THE SIGNIFICANCE OF FRACTURES AND DISLOCATIONS.

BY CARL BECK, M. D.,
Professor of Surgery, New York School of Clinical Medicine, Surgeon to the St. Mark's Hospital, etc

Since the Roentgen rays began their triumphal, revolutionizing march through the world, our knowledge of fractures and dislocations, has been greatly widened. In trying to comply with the kind request of the editor of this Journal, to prepare an article on an x-ray subject, I do not intend to enter into a general discussion on this most interesting and delightful topic, but I just beg to submit a few illustrations of fractures and dislocations of various regions of the body, which may speak louder than any well prepared treatise.

The reader particularly interested in the study of the Roentgen rays in general is referred to my former publications in the January and June issues of the *International Medical Magazine.*

Fig. 1 represents a slight thickening of the joint-surface of the first phalanx of the left thumb in the metacarpo-phalangeal joint and an extensive exostosis of the second phalanx of the second right finger in a boy, twelve years of age. The swelling around the joint was thought to be of a tubercular character first, as the boy showed a tubercular habitus, swollen glands in the neck, rhachitic thorax, etc.

Fig. 2 shows the dislocation of the second phalanx of the right thumb in the phalangeal joint of a woman 32 years of age. The accident happened four years ago. The function of the joint is greatly impaired.

Fig. 3 shows compound fractures of the second phalanx of the fourth and of the second and third phalanges of the fifth finger.

Fig. 4 shows a fracture of the ulna, sustained two days before the radiograph was taken, in a child two years of age. The fragments are overlapping.

Fig. 5 represents a compound multiple fracture of the elbow in a man 40 years of age, whose elbow was crushed in a machine three months before the skiagram was taken. An operation, consisting in the removal of fifteen bone-splinters, representing fragments from both condyles and the olecranon, was performed one week after the accident had happened. The large cavity was packed with iodoform gauze. Recovery was nearly perfect, the functions of the arm being but little impaired. Now the pati nt is even able to do heavy work in his trade as a butcher. The skiagram shows the irregular attachment of the different fragments.

Fig. 6 shows a fracture of the middle of the right humerus in a boy 10 years of age. The skiagram was taken two months after the accident. There is slight deformity. The extensive callus-formation impaired the function of the arm, particularly of the biceps muscle. The adhesions which had formed between the muscle and the callus yielded to massage treatment.

Fig. 7 shows a fracture of the anatomical neck of the right humerus in a girl six years of age. Dislocation of the humerus was first thought of by various physicians of excellent repute, until the rays revealed the true nature of the injury. The skiagram was taken two weeks after the accident.

Fig. 8 shows a compound fracture of the lower third of the tibia and of the external malleolus, caused by the new United States (Krag-Jorgensen) army bullet, shot from a distance of about 200 yards. The picture shows, that the bullet does not cause, as it is generally erroneously assumed, a clean, round, canal-like foramen, but that it destroys organic tissue, particularly bone, most extensively, at least in a zone of 400 yards.

(Cut produced in Oct. issue of THE AMERICAN X-RAY JOURNAL.)

FIG. 1.

FIG. 2.

FIG. 3.

FIG. 4.

FIG. 5.

FIG 6.

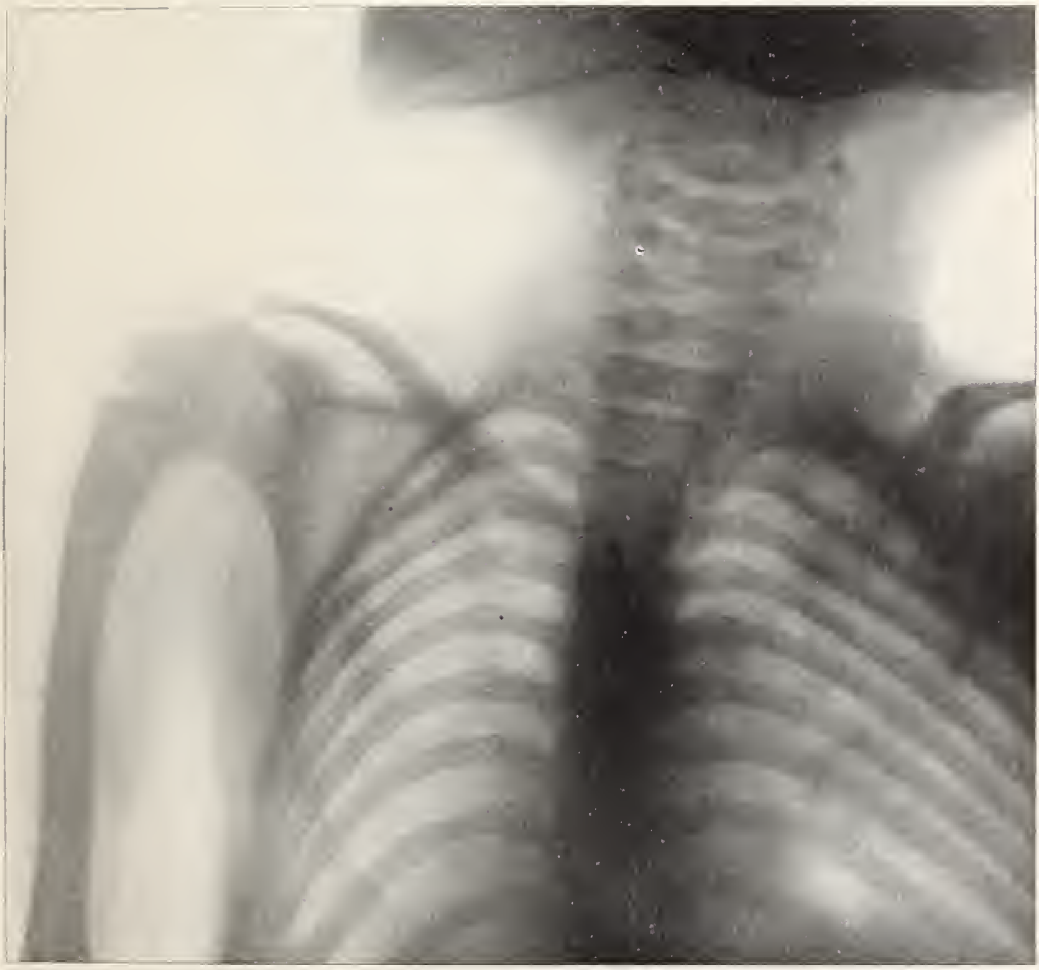

FIG. 6.

FIG. 9.

FIG. 10.

Fig. 9 represents a case of Pott's fracture, sustained 18 months ago, where only slight thickening of the internal malleolus can be noted on external examination. The patient complains of intense pain in the fractured area, the cause of which was thought to be callus-formation in the inter-osseous space. But the rays showed that the seat of the pain could only be within the soft tissues, as the conditions of the bone were entirely normal. Later the diagnosis neuritis was made by an eminent neurologist.

Fig. 10 represents an oblique supramalleolar fracture of the tibia in a lady, 68 years of age. No immobilization had been tried in this case for a whole week, so that the displacement could not be reduced entirely. The skiagram was taken two months after the accident.

HIGH E. M. F. TROWBRIDGE. *Sc. Am.*, Jan. 15. *The Electrical World.*—A short article describing his high voltage battery and experiments; a short article referring to these was noticed in the *Digest*, Jan. 15. He believes this to be the largest plant for the study of discharges of electricity that exists at present: it consists of 10,000 storage batteries, of which an illustration is given; it is combined with a Plante rheostatic machine, by means of which he obtains over 1,000,000 volts, producing a spark in air more than four feet in length. Each cell is composed of a test tube 5.5 inches long and 0.75 inch internal diameter, containing two strips of lead separated from each other by rubber bands, and immersed in sulphuric acid; each has an internal resistance of 0.25 ohm; they are mounted in sets of three in blocks of wood which have been carefully paraffined; the battery gives 8 amperes (!) at 20,000 volts. He found that x-rays require at least 100,000 volts. With the rheostatic machine, condensers are charged in parallel and discharged in series; there are sixty condensers made of plates of glass 15" x 18", coated on both sides with tin-foil, and with 20,000 volts he can therefore obtain 1,200,000; this machine, which is illustrated, is operated by lever arms instead of the usual cylindrical commutator. Besides the results already noticed in the previous article, he states that he has shown conclusively that the length of the spark between points separated by more than 1 inch varies directly with the E. M. F.; a spark 48 to 50 inches long requires 1,200,000 volts, and a lightning discharge one mile long would therefore require over 100,000,000 volts. Burns like those produced by x-rays will be obtained if the hand is exposed to the brush discharge from the terminals of this machine. He shows that there is no use insulating lightning rods: also that no vacuum tube which he could produce could resist the discharges due to this voltage.

ROENTGEN RAYS AND GOLD QUARTZ.—Tesla believes that mountains can be radiographed by the x-rays, and gold located without the trouble of excavation; that such mining is possible at Klondyke, though as yet only to a limited extent. He says that some Roentgen rays "are without limit as to length and radiography. They are limited now because of our almost toy apparatus for producing them. He thinks that as it is only a question of tubes and currents, at any moment a way may be found for producing rays that will penetrate hills and mountains, perhaps the earth itself. A noted metallurgist has a radiograph of quartz with gold imbedded in the center and concealed from the naked eye. He believes that much labor can be saved and a great deal more gold mined at Klondyke if the beds and mounds of sand and gravel are searched by x-rays as they are thrown up. Then only the highest dirt need be washed.—*Med. and Scientific News.*

ROENTGENOGRAM ETHICS.

Radiographer to the Methodist Episcopal Hospital ; Member of the Kings' County Medical Society, the Brooklyn Pathological Society, the Long Island College Hospital, and Kings' County Hospital Alumni Association, of Brooklyn, N. Y.

BY FREDERICK STRANGE KOLLE, M. D.,

Now, that most experimental research among radiographers, has been laid aside, the most important questions arise, as to how these invisible rays of Roentgen, are to be applied, by whom, and for whom? I refer to cases of a surgical or anatomical nature only. In answer to the first question, it would hardly be necessary to dilate at length upon a description of the methods used by the various specialists ; by all means care, judgment and practical knowledge are to be employed.

There is no danger in these cathode emanations—that is, as far as we now know. The early cases of dermatitis and alopecia Roentgenosa, resulting from exposure, have been satisfactorily proven, to be either, due to carelessness, poor judgment, or an insufficient knowledge of the apparatus used ! There is no need for such results and I believe later statistics show a very marked decrease in the number of cases of injury reported.

The question as to who should be permitted to make a radiogram is a very important one. The fact, that so much nonsense as to the dangerous results following the application of the x-rays, has been infused into the minds of the general surgical fraternity, is principally due to the fact, that, men, professional and otherwise, have jumped at the conclusion that either they were electrical experts or cut out for expert witnesses in damage suits ! Humanity and suffering seems to have been entirely overlooked by many x-ray operators ! They seem to be in the specialty, for what financial benefit and fame they can derive from the mysterious work.

For the past eight months, practitioners and even surgeons of repute have asked me, how could I account for the dullness of x-ray work? Why was it not used in every hospital—as it should be ? Why has it dwindled down so suddenly ?

I will gladly answer for the hundredth time, that, the stagnation of radiography, etc., is not due to its loss in value, but to the fact that so many inexperienced men are and have used the rays both privately and in hospitals ; that, more of these self-dubbed physicists, are handling delicate apparatuses that require a most expert knowledge and that, owing to these facts, hospitals and private individuals have laid aside the affair, as exceedingly expensive—even dissatisfactory ! For no other reasons? In the first place, a vacuum tube needs to be thoroughly understood before even an electrician can use it. Invariably a tube is pierced the first or second time it is used, or it is otherwise misused, so that it is ruined. Tubes are expensive—they should be, and the result is, the operator becomes disgusted, says it does not pay him to continue the work. The hospitals can not allow a requisition for new tubes every week ; consequently, the entire usefulness and value of the rays, is entirely overlooked and allowed to rest in statu quo, or sink into a rustful abyss of dear oblivion !

This goes to show, that, either an operator must be an electrician, a physicist or, have studied the uses and application of this new art from beginning to end. One or two hours instructions are not to be considered at all ! It requires weeks to understand the apparatus alone, and even months to learn how to use it properly and with success ! Experience alone, is the educator and that must be obtained, before a man launches himself into the specialty. Do we expect physicists, electricians and experimenters to do all for you ; you have their results in plain facts ; they are obtained by deep and careful study; every new idea represents the spirit of the scientist: he lays the foundation of a grand branch of science for you—therefore, to build, you must labor, too, and to labor, is to study. Schools of instruction should be opened in every large city; every medical and physical college should install an apparatus and teach students its use and value! Luckily our city is the pioneer in this direction, we have a school where physicians can study the process of radiography, and I have no doubt, the practitioners who have studied there, can appreciate my remarks.

With proper men at the rheotome and tube, radiography will yet become the all important branch of surgery—without them it will die an ungrateful, unappreciated death!

For whom shall radiograms be made? They should be made by the physician, that is, an electro-medicist, and be made for the physician and surgeon!

This assertion leads on to important questions relative to legal cases. In the first place, the specialist called upon should be a man entirely conversant with anatomy and pathology—you will at once note the importance of this—for this reason: If the patient is brought to you by the attending physician he requires you to make radiograms of certain parts of the body, to show, if possible, the cause of deformity and pain or loss of locomotion. Now just imagine how the operator would feel under the circumstances, not understanding a word of the statements made. Even should the physician overlook the matter, it becomes the source of considerable doubt, as to the findings, *in the radiogram!* There is such a fact, as *understanding the negative*, as every radiographer will acknowledge. Again, the radiograms have been completed; the patient brings his suit into open court, and you appear before a severe counter-counsellor, a critical judge and an interested jury—imagine how poorly your broken unapplied knowledge will impress the jury and the court, even should your improper statements, on general belief be accepted. Is it correct? Is it over, or underrated? Is it fair? I say, No! It can not be either one or the other! Only lately, I was called into a case to interpret the findings in a doubtful radiogram for a so-called electrician—a bell-hanger perhaps, from what he knew of the parts involved. All he knew was, that a bone should be straight and unbroken, except at the joints. Such a pipe-stem arrangement of bones seemed to make up the whole body! This is only a picture—an illustration of what can occur! Now picture yourself, an electrical expert calling iodoform packing a shattered bullet; the sesamoids, broken bone ends; an epiphesial separation, a fracture, etc., etc. There is no end to these questions.

Therefore, again I say, let the specialty as used in medicine and surgery, be applied by medical men, who are fully acquainted with this important branch of service, and who know, and know *well*, whereof they speak!

Borough of Brooklyn, G. N. Y.

Apostrophe to the Dollar.—An editor has been inspired, after looking over his list of delinquent subscribers, to compose the following: "How dear to our heart is the silver dollar, when some kind subscriber presents it to view; the liberty head without necktie or collar and all the, strange things which to us seem so new; the wide spreading eagle, the arrows below it, the stars and the words with the strange things they tell; the coin of our fathers, we're glad that we know it, for some time or other 'twill come in right well; the spread-eagle dollar, the star-spangled dollar, the old silver dollar we all love so well."—*Life and Health.* Jan. 1898.

THE EFFECT OF ROENTGEN RAYS ON PLANTS.

Prof. G. F. Atkinson, of Cornell University, publishes in the January 7 number of *Science* a "Report upon some preliminary experiments with the Roentgen rays on plants," from which the following extracts are taken: Since it is a matter of some interest to know what influence, if any, the Roentgen rays would exercise on plants, I undertook a series of somewhat extensive preliminary experiments to determine what lines of investigation might profitably be carried on should there be marked indications of any response to possible stimuli from this source.

The author then describes twelve experiments in which he used the following substances: Leaves, seedlings of corn, a begonia plant, a caladium plant, species of mucor, several forms of chromogenic bacteria, a motile bacillus, sensitive plants, etc., and draws the following conclusions: It is thus seen that plant tissues absorb the Roentgen rays quite freely, and it is singular that there is not a more marked influence on growing parts, especially that there are no visible external injuries, even when the parts are exposed at close range a large part of the time during several days, since the general impression is that the rays, even with comparatively short exposures, are injurious to the human tissues.

The longer his experiments continued the more mysterious the whole subject seemed. On a dark night, when the electric light rays were intercepted by a black screen, exploring the field with a fluoroscope there was an abundance of light, flashing and quivering with the variations in the electric transmission through the tube, penetrating, and yet capable of absorption to a considerable degree. That it should present no easily discernible influence for the time during which the work continuel was cause for profound surprise.

SKILL EASILY ACQUIRED.

Brooklyn, N. Y. March 3, 1898.

Editor of The American X-Ray Journal:

After each article I have published during the past year and a half about x-ray work I have received letters of enquiry in which the writers refer to "the wonderful results I mention," etc. My article entitled "Burns and Technique in X-Ray Work," in your Feb. number has beeu no exception to the rule, and I beg your permission to say to your readers that the results mentioned were of very *commonplace* character. None of the results reported in that article deserve to be called "wonderful", for they are only ordinary practical work. At this stage of x-ray work it is disappointing to find that so many physicians write me that they "are getting no such results and regard them as almost beyond belief". I can only say that they are within the reach of every medical man who adopts a correct technique and who will provide himself with efficient apparatus of any kind. There is no trick or secret about it and the intelligence of a child ten years old would be quite equal to acquiring the necessary skill. Allow me to say in closing that the most brilliant results that I frequently obtain are never set forth in my published writings for the reason that I value my reputation for conservatism and adherence to facts, and I never print what I can not demonstrate to each and every physician who comes to me for instruction.

Very Truly,

S. H. Monell.

Effect of Cathode Rays on Air. Lenard. "Wied. Ann.," 63, p. 253; noticed briefly in the *Am. Jour. of Sc.*, Feb.—He shows that these rays form regions of mist condensation far more powerfully than x-rays do.

Is There a Relationship Existing Between The X-Ray and the Luminating Power that Obtains in Telepathic Vision?

BY J. J. FLY, M. D.

This may seem to be a very strange question to those who do not know from experience anything of the mysterious faculty of telepathy ; and those who do not yet believe that this wonderful occult faculty is a part of the make-up of human beings, may think strange of a man who would propose it. Yet, in these days of strange innovations and wonderful results of experimental investigation, the majorities have become resolved into the status of not being surprised at anything, but simply pose in silence and watch results and verifications of the claims that are being made. I am glad that this is so ; I am glad that the disposition to ostracise anything new, and bring into disrepute the originator, is fast becoming a relic of the past. It shows that the world is open to investigation and that man has at last conceded the right to every individual to think along the line to which his mind naturally inclines. With these rights conceded and the shackles broken that have hitherto bound down the creative powers of the mind to old creeds and dogmas, there is nothing to obstruct the genius of man from sweeping into boundless infinity and fearlessly facing and interrogating every phenomenon that addresses itself to the human mind. But the methods of investigation themselves become a question of grave import. How is it that we know a thing? and how do we come to know? What is knowing? This is the most wonderful question, and involves more than any other. I think we may safely say: "The reason why the material world is intelligible, why we can interpret the signs it gives us, is because there is an intelligence behind the universe which has been and is related to the universe. The trend of materialistic science is to abolish faith, and pose upon demonstrated facts ; but it only takes a few moments of meditation to determine that we can not know anything without transcending the phenomena upon which the knowledge is based, and bring to bear upon our conscious entity, the potencies of faith. Science says, the truth of knowledge rests upon experience and observation ; but here again the interposition : What of the methods? What of the sensations that lend our intelligence to confirm or deny a given proposition? and what is this sensation, and how did it reach our intelligence? These questions are legal notwithstanding their metaphysical character, the solution of which has ever been a task before human intelligence. The convictions of knowing are evinced by certain states of consciousness, certain symbols—signs evoked in our minds by events happening in the universe outside our minds. We do not really know anything of things within themselves ; we do not perceive the actual world around us, nor anything like it ; what we see is not any more tangible than the emotions we feel.

The sensation of sight is not in the retina, it only bears an image of external things which become resolved into a conscious sensation in some mysterious manner through the avenues which impress the living, acting, cellular structure of the gray matter of the brain. Therefore all sensations coming from the impact of undulating, vibratory or pulsating ethers, every conscious fact relating to the external or internal world, can be only psychologically regarded.

But we started out to discuss the comparative analogies existing between the x-ray and telepathic vision, having witnessed the light and studied its peculiarities.

I thought I might make a declaration of my experiences and at the same time establish a favorable conviction in the minds of others by showing up what appears after having had some experience in both, an analogy between them. And, while dealing with the phenomenal characteristics growing out of these inner sources of light, impinging upon the conscious mind. We almost tremble in anxious hope that we shall reasonably find the one to be an analogue of the other, instead of an analogy existing between two entirely different things. We are fully aware of what this means; of the new world it would open up, and the relations it would establish between the outer and the inner being—between materiality and spirituality. It would show that the universe had its counterpart in the invisible, with similar tangible relations to conscious entities adapted to its more ethereal environments. If such a hope as this should be rebuked, it would be nothing new. Has not every great truth been opposed? Such is the history of the past. Let us follow a few of the steps made by experimental research in the unfoldment of the different forms of light, together with their adjustment to human powers of co-ordination. We are not interested in the nature and source of light, as these form no part of our subject. It being the different forms or phases taking place in this great force, and the law that governs it as applied to the perceptive powers of man that more particularly interests us at present. My proposition here affirms that there are different forms or manifestations of light and we wish to show how beautifully nature economizes her powers in her transmissions from one medium to another while she retains the same principle through the whole transformation. The principle of evolution is as beautifully illustrated in the trajections of light from one medium to another with its co-ordination to the perceptions of the human mind as could be. We hope to illustrate our position by the following short history of the different manifestations and properties of light. It has been said of light, "That it reveals the glories of the external world and yet is the most glorious of them all. It gives beauty, reveals beauty and is itself most beautiful. It is the analyzer, the truth teller and the exposer of shams, for it shows things as they are. Its infinite streams measure off the universe and flow into our telescopes from stars which are quintillions of miles away. On the other hand it descends to objects inconceivably small and reveals through the microscope objects fifty millions of times less than can be seen by the naked eye." Yet, as the investigation of light goes on, the more wonderful are its phenomena, the more amazing is its power, and the greater the mysteries it reveals. It was no doubt incontrollable impulses akin to the above, that awakened the sublime powers in the mind of Newton to strike the key-note to the proper methods in the investigation of light, and from which he evolved his molecular theory; and while the undulatory theory is more generally accepted, it appears that any one can see its utter inability to explain one of the most important phenomena of light, viz.: its dispersion into its component parts. Before Newton, the ancients had learned that light moved in straight lines, they knew that rays were reflected from polished surfaces and the angle of incidence was equal to the angle of reflection; they also knew that an opaque body interrupted these rays. Snell discovered the law of refraction which became the chief corner stone of optical science. It was while Newton was experimenting with this law of light through a prism in the window shutter of his room that he dis-discovered that light was a compound body and consisted of seven colors which is called the solar spectrum. He verified this fact by again condensing the colors and focusing them into white light. Newton thought that we could not have dispersion without refraction; his experiments led him to think so; but Dolland subsequently proved that he was in error. However, Newton's experiment has established one of the greatest truths, by showing that natural objects have no color of their own; but that their action is limited to colors that are showered upon them. How wonderful! What a field of light was thrown upon the subject of this great law of force that illumines the external world giving it its various tints, colors and shades of colors, as we see chromatically arranged in hill, dale, and the mountain range; in the grasses, flowers and foliage; in the pigmental expression of the human race and the iridescent hues of the lower animal world.

It was through this problem solved by Newton that science bounded forward through many centuries in a single day and set the scientific world thinking along the line of legitimate conclusions. The phenomena of light that we have just enumerated we will call ordinary light, adjustable to the organs of light perception (the eyes) through which the radiant beauty, harmony and incongruities of the external world are reflected into sensations upon our psychic natures, and by which objective nature may be realized and studied together with the intelligence that is related to it.

Let us now take our second step into the ultimates of light; the second step in the line of its unfoldment of its greater powers and capabilities as has been evinced by experimental research. It has been proven that the eye is not commensurate with the whole range of solar radiation. Above the visible spectrum it has been found that there are other spectra of color. Stokes has counted ten octaves above the violet and Muller has demonstrated two below the red. This fact could not have been discerned without an intervening medium between the eye and this more refined ethereal light; consequently a substance that neither transmits nor absorbs light was exposed to these invisible rays and their presence shown by converting them into another kind of light—a fluorescence that could be perceived by the eye. Thus we have found that our second step above the ordinary is made easy, and can appreciate Tyndal's thought when he said: "If we allowed ourselves for one moment that notion of gradual growth, amelioration and ascension implied by the term evolution, we might fairly conclude that there are other visual impressions awaiting man far greater than those of which he is now in possession. For example, beyond the extreme violet of the spectrum there is a vast efflux of rays which are totally useless as regards our present powers of vision." We will say in regard to this thought, that we have dared to embrace that hope; that we believe that nature has not made a single ray of light or a single entity in her grand emporium that is not adapted to some of the perceptive powers of the soul of man. Man is a microcosm!

From the ulterior rays let us proceed to the third step up the ladder of the evolution light. Here we meet the cathode rays. Lenard, in the investigation of the cathode rays with a view of determining their nature, concluded they did not differ from the nature of ordinary light. It will be remembered that the cathode rays produce a phosphorescent glow from the bombardment of the remaining particles of air in the tube, their collision with one another producing light · but on exhausting the tube to one-millionth of an atmosphere the purplish cloud on the inside has disappeared and the interior of the tube is clear, but the glass itself has become fluorescent from the bombardment of the remaining molecules of air against the walls of the glass. (A. B. C. of the x-rays). Hertz showed that the cathode rays passed through thin sheets of metal placed within the tubes and Paul Lenard established their existence on the outside ; that they could pass through substances opaque to ordinary light and cast shadows of other objects less opaque and that these shadows might be impressed upon an ordinary photographic plate and be developed in the usual manner. His investigation showed that these rays possessed all the properties of ordinary light with the exception that they were unperceived by the eye, and that they possessed greater power of transmission through solid bodies that were opaque to ordinary light. As it is only this property that we wish to call out as belonging to these rays, we will not ask space for a further interview of the literature upon their nature, excepting to make the statement that the conditions under which they have been adjusted to the higher functions consummated by them are also different from those that obtains in the atmospheric media through which ordinary light is impressed. There appears to be only three dimensions of space, but if there is anything in "Algebraic Variables" there can be no such limitations.

The extreme rarefied condition of matter that obtains in Crooke's tubes has been called by both Faraday and Crookes radiant or the fourth state of matter ; that is, matter whose molecules are "relatively as far apart as compared with those of gas, as the molecules of a gas were as compared with those of a liquid." Thus while we have here a still finer degree of light, we find it arising in a medium more ethereal and spiritual than the medium of ordinary light and one that is adjusted to it in perfect adaptation as far as can be determined.

The fourth and last step to which the genius of man has reached, is the x-ray. We have not space to review the literature upon its source or to discuss the probability of its being a pulsating stream of ethereal atoms. We are inclined to accept that it is anticathodic in its origin ; that it originates from the fluorescent spot on the wall of the glass opposite the cathode plate, and emanates from the bombarded surface. It differs from the cathode rays, which seem to rise from the cathode plate, in possessing greater power of penetrating opaque substances. It has been found to differ in some other respects, viz.: that the air absorbs a much smaller fraction of the x-ray than it does of the cathode and that the fluorescent effect of the x-ray is observable two feet away from the discharge tube which is not observable of the cathode ; that other bodies are more transparent to the x-ray than to the cathode, and that the x-ray is not deflected by the strongest magnetic fields, which is not so with the cathode ; that there are different kinds of cathode rays distinguishable from one another by their phosphorescent powers, absorption and magnetic deflection. Roentgen calls it a ray because of the very regular shadows it forms on the screen. The nomenclature we have adopted here in the classifications of different grades of light, from the coarser to the finer, from the ordinary to the inordinary, may be correct or otherwise ; but, be this as it may, it can not be disputed that we have shown from experimental investigation that there is an evolution of the phenomena of light which reaches into states or conditions that the ordinary powers of vision can not utilize by ordinary methods ; it has also been shown that the objective mind can not even know of these higher modifications without studying them through a medium which serves to bring them within the functional range of objective sight. Now, with the intervention of this medium, the phosphorescent screen, it follows that there is not an organ in the human body that may not be seen and studied with the natural eye. How wierd and strange does it sound to say you saw the waving motion of the heart, as it forced the blood current through the vessels of the human body that stood by your side, alive and well, and with whom you were engaged in conversation. Moreover, the blind have been made to see and read, and further, those who never knew what the sensation of sight was like, have been blessed for the first time in life with that knowledge.

Further, it has been demonstrated by the application of these finer ether streams that there are other avenues for the transmission of light to the organs of light sensations in the brain than the retina and optic nerve. The evidence has come in a way that clearly points out the fact that every pore of the human cranium is an open window from which the soul may look out upon the common world and common things and by changing its focus just a little behold the transcendent beauties of a more ethereal state. It is here that telepathy begins; but we reserve its consideration for the next number of this magazine.

IS GRAVITATION EARTHLY MAGNETISM?

BY W. R. D. BLACKWOOD, M. D., PHILADELPHIA, PA.

Magnetism acts on iron actively, on steel less powerfully and to a small degree on other metals. It has no effect whatever on textile stuffs such as cotton, woolen, hemp, etc. Gravitation is a force which compels every known substance to fall to the earth unless supported by such means as will overcome the attraction of gravitation. A tin pail with the engineer's dinner in it may stand by the most powerful dynamo, whose fields are saturated magnetically to such a degree that all iron or steel within a considerable distance will be drawn to it, yet the pail lies quietly within an inch of the active poles; let, however, the support on which the pail rests be withdrawn from beneath it and the dinner falls to the ground at once. This shows another force than magnetism altogether. So with every known substance on earth; thousands of differently constituted objects—stone, wood, cheese, oysters, fruits, books on electicity or theology, and millions of other examples—none of such will move a particle toward any magnet, yet they all fall to the earth if not held above it by artificial support. The earth's magnetism is produced, it is now believed, by the friction of the tides, the friction of air-currents, the revolution of our globe on its axis, etc.—*i. e.* by deduction. The difference in potential at differing points, and also at the same points at different times is due to the conductivity of the metallic strata underlying the surface which transmit the currents toward or away from the points of friction or induction, just as in artificial batteries or mechanism used to produce electric force, *i. e.* to send the force along given conductors, for we do not *make* electricity at all, we simply send it hither and thither precisely as the pump makes no water, but lifts or forces the fluid from the well to its destination. The atmosphere is always charged electrically, sometimes more powerfully than the earth beneath a given locality, owing to currents being driven aside as the clouds move in the wind. Now if magnetism is gravity, then articles would be hauled up at such times into space instead of going to the ground. Even when the atmosphere and earth are at equi-potential gravity acts just as it does when the earth charge is the stronger. The varying charge is adjusted through storms, when lightning equalizes the polarity and the static capacity also. Gravitation acts equally on all objects at all times, notwithstanding the condition of the earth's charge; hence, as magnetism is a form of electric force, were gravitation magnetism it would vary continually as the potential varied. It never varies.—*The Medical Summary.*

THE X-RAYS IN OBSTETRICAL DIAGNOSIS.

Levy and Thurnim record a method of measuring the dimensions of the pelvis by means of the Roentgen rays. (*British Medical Journal.*) Previous attempts had been made by means of plates introduced into the vagina, and had failed on account of the limited space and the length of exposure required. The authors place the patient horizontally over a plate twelve by sixteen inches in size, and set the tube vertically over the symphysis, and exactly twenty inches above the center of the plate; an exposure of two to five minutes suffices to give a satisfactory skiagraph, on which the pelvis is faithfully represented. This is measured, and as the distance of the tube from the plate is known, the pelvic dimensions can be accurately computed. To facilitate this Levy has designed an instrument on the principle of the pantagraph, by which the true conjugate can be mechanically determined. The transverse diameters at the brim and outlet can be estimated with equal certainty, and the method has been satisfactorily tested in a number of cases in Landau's clinic. Further investigations have been carried out by the authors on pregnant women with flat pelvis in order to ascertain the dimensional relations between the fetal head and the pelvic outlet, but the results are not at present unobjectionable; further research is being undertaken, and a satisfactory and practical outcome is anticipated.

NEW HINTS FOR RADIOGRAHY.—Marcus states that iodoform, vaseline and iodoformed ether introduced into deep cold abscesses, form a mixture with the contents of the abscess impermeable to the Roentgen ray. Also that insufflation of air into hollow organs renders them perfectly transparent to the ray, which fact can be utilized in obtaining information in regard to the stomach, or the intestines insufflated from below, as they leave a blank space on the plate.—*Presse Med.*, Nov. 27.

THE ROENTGEN RAYS.—During 1897, great activity has been displayed in the perfection of radiographic and fluoroscopic apparatus with the result that those who are expert in the invention and practical employment of such apparatus are enabled to secure clearer and larger pictures than ever before. The rays have proved of value in the detection and sometimes the rectification of obscure deformities following fracture and dislocation, in the location of foreign bodies in the body, and in particular in the esophagus and other portions of the gastro-intestinal tract. Foreign bodies in the eye have been successfully located by their use.

The work of their application to the diagnosis of internal disease, particularly of the chest, has been actively pursued during the year, and they have proved of value in the diagnosis of thoracic aneurisms and other tumors, tubercular processes in the lungs, and in accurately mapping out the extent of cardiac enlargements. With regard to proving of service in the early diagnosis of phthisis, it may be said that, in the early stages when the disease is simply a catarrhal bronchitis at the apex, for instance, and no solidification has occurred, the interference with the rays would hardly be sufficient to produce a shadow, although the stethoscope would reveal the presence of fine crackling rales.

It is improbable that the rays will prove of value in the diagnosis of phthisis in the early and therefore most important stages, until the apparatus is perfected so that it will bring out much finer differences in the consistence of tissue than it does at present.—*The Virginia Medical Semi-Monthly.*

AN X-RAY PICTURE OF A LOADED LEBEL RIFLE.

Professor Roentgen has shown that the x-rays are disseminated in the bodies which they traverse similarly to light passing through distorted media. Recently the importance of this discovery has been more fully recognized in regard to the disturbances which are produced in certain radiographic operations.

When a very opaque object, like a large watch, is interposed between a powerful Crooke's tube and a photographic plate, the x-rays are powerfully disseminated in the space which they traverse behind the plate, making impressions on the back, that is the side of the glass which carries the sensitive film. This impression, or shadow, increases uniformly with the duration of exposure. The result is that a relatively short exposure gives a faint silhouette of the mechanism of the watch, but the impression seems a trifle blurred. The value of the impression at first increases with the time of exposure, but this reaches a certain limit when the impression rapidly grows bigger under this double radiation and becomes more and more gray until all the details of the silhouette are lost.

It is evident that one can prevent the shadows of the return rays when, in getting ready for the experiment, a sufficiently opaque screen is placed against the back of a sensitive film. A sheet of lead half a millimeter in thickness is ordinarily sufficient. This thickness can be increased in exceptional cases.

This precaution is not necessary when a little less powerful tube is employed, because the glass on the back of the plate is then sufficient to arrest all the return rays. For the radiographs of very opaque objects requiring very long exposures, placed in front of powerful tubes, it has been found expedient to use a sensitive preparation of loose films of double commercial gelatine and lay them on lead sheets of the same shape, enclosing the whole in black paper whose object it is to arrest the ordinary rays of light.

The role played by the black screen is clearly brought out in a radiograph of a large watch obtained after an exposure of two minutes at a distance of 12 centimeters from a very powerful tube, only half of the back being protected against the return rays by a metallic screen. The protected part gave a very detailed silhouette of the interior mechanism, whilst a thick shadow conceals nearly the entire other half.

This may explain the numerous failures which have been met with in even the best radiograph work designed for the study of very opaque substances in the human body and of metallic objects generally.

By using a back screen, there are obtained, for example, all the details of construction of cartridges. The hunting cartridges, for example, allow the experimenter not alone to see the arrangement of the charge, of the wadding and the nature of the powder, but also the irregularity of the metallic socket, the form of the capsule and the position of the trigger.

A copper pistol and a revolver which will not produce a shadow by the old methods, exhibited the balls clearly in place when the back screen was employed as described. This has helped the experimenter to obtain also several radiographs of a Lebel gun by relatively short exposures, these having been, at 20 centimeters, 10 minutes for the locking parts, and 1 minute for the other parts. Referring to the figure, one can clearly see through the two steel jaws, the swinging tray, and the cartridge which it contains ready to pass into the barrel. Eight cartridges can be distinguished at different angles and all pressing in line against the coiled spring which pushes them forward.

One can finally distinguish that these cartridges are of the kind used by shooting clubs, as the powder is granulated and not "ribboned" like that which M. Vieille uses for cartridges for warlike operations.

The above data is part of an article contributed to *La Nature* by Abel Buguet, Professor at the School of Sciences and the School of Medicine at Rouen.—*Electrical Engineer, N. Y.*

THE APPLICATION OF THE X-RAYS TO THE DIAGNOSIS OF TRAUMATISMS OF THE ELBOW.—The diagnostic value of the skiagraph in cases of injury involving the elbow-joint is fully appreciated by QUENU (*Rev. de Ortho.*, July, 1897), who reports a case that had been diagnosticated by one physician as a posterior luxation, and by another as a fracture. At the time he saw it the oedema was so great that it was impossible to determine exactly the relations of the bones; the olecranon alone was accessible, and it appeared to be in its normal position, or at least only slightly elevated. The contraction of the muscle prevented the least motion without intense suffering. A skiagraph was made, and the ulna was shown to be in a state of subluxation, the former attempts at reduction having been only partially successful. He succeeded readily in reducing the luxation, but there was so much swelling that it was impossible to definitely determine when the reduction was complete. A second skiagraph showed that full reduction had been secured. The author says that the painlessness of this diagnostic method, its certainty and harmlessness make it of great value and almost a necessity if the surgeon would treat fractures involving joints with the greatest care and precision.

ELECTRICITY AND THE MYSTERIOUS.—The general comprehension of electrical phenomena which exists in the lay mind is rapidly becoming greater with the constantly increasing use of electrical apparatus in every day work. There exists still, however, a tendency to ascribe nearly everything that is mysterious or unaccountable to electricity. Nearly every fire whose origin is unaccounted for is laid to electric wires, although in all probability gas is a much more dangerous incendiary than electric current as now used. The daily papers, realizing this peculiarity of the public mind, cater to it by attempting to bring in electrical causes for everything not obviously explainable on other grounds. The recent destruction of the battleship Maine by an explosion, the cause of which is unknown, has given ample opportunity for many able theorists in the electrical field. One paper states that the explosion was due to the short circuiting of a dynamo, and another that it was due the "explosion of the boiler of the dynamo machine." Many hypothetical causes have been evolved tending to show how the damage might have been inflicted by interested persons, by means of wonderfully contrived electrical devices. The electric detonator and push-button, alleged to accompany it, have received great prominence, while the time fuse and percussion cap have been neglected.—*The Electrical World.*

THE AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION.

The seventh annual meeting of the American Electro-Therapeutic Association was held at Harrisburg, Pa., on September 21, 22 and 23. Dr. W. T. Bishop, of Harrisburg, being President. Among papers of interest and importance to the general practitioner, as well as the specialist in electro-therapy, the following were read: "Electric Treatment in Gout and Uric Acid Diathesis," by Dr. R. Newman, of New York, who presented the advantages of static electricity in these conditions; urinary analysis were submitted substantiating his claim. In "Chorea," by Dr. F. T. Bishop, of Washington, static electricity was again set forth as a very valuable aid in treatment. "Sources of Atmospheric Electricity," by Dr. R. J. Nunn, of Savannah, Ga., had for its object the suggestion to practical students of physics to test with mechanical devices the correctness of the theory that the solar system acted as a vast static induction machine, producing by its motions a difference of stress or potential. "Some Thoughts and Considerations on X-ray Work," by Dr. E R. Corson, of Savannah, Ga., gave many valuable ideas. The writer thought that the x-ray was destined to be even more valuable in dislocations than in fractures; he suggested that a careful outline tracing of the negative by transmitted light, all extraneous light being shut off, would enable the eye to pick out the essential features more readily than from the usual radiograph. Experiments in diagnosis were given, and radiographs presented showing that the x-ray penetrated urate of soda much more readily than bone. In "Some Considerations Relative to the Therapeutic Application of the Current," by Dr. G. E. Bill, of Harrisburg, many suggestions, especially as to polarity, were thrown out. "The Early Electrolysis of Naevus," by Dr. C. R. Dickson, of Toronto, set forth the advantages of operating in early infancy, when the operation was much more simple, and the chances of scars much less than when the patient was of mature years. Dr. E. H. Coover, of Harrisburg, gave many suggestions as to the most appropriate methods of treatment in "Heart Failure in Cardiac Diseases due to Defective Circulation." "Expenditure of Electrical Energy," by Dr. Margaret A. Cleaves, of New York, was accompanied by a large number of clinical records illustrating the value of accurate dosage of electricity, as knowledge of the rate of current flow was necessary, as well as the time of flow in order to apply electrical methods intelligently. Professor Dolbear, of Tuft's College, Boston, gave a masterly paper on the laws governing molecular motion, entitled "Molecular Effects of Electricity." He considered that the molecular effects produced by what we call electricity, are really due to heat. "The New Electro-Mercuric Treatment of Cancer," by Dr. G. B. Massey, of Philadelphia, was a further elaboration of a paper read before the American Medical Association in June last. The treatment was only applicable where the disease was still local. Mr. E. Jewell, E. E., of Chicago, presented "Current Regulating Apparatus," describing methods of controlling dynamo currents and adapting them to therapeutic uses. "Galvanism as an Aid in the Treatment of Goitre," by Dr. C. Brown, of Sac City, Ia. Mild constant currents frequently repeated were found beneficial. In "Further Studies of the Manifestations of Uric Acid, and their Treatment, Electrically, and Otherwise," by Dr. J. Griffith Davis, of New York, the writer laid special emphasis on the statement that uric acid and its salts are the result of product of nerve and muscle waste. Electricity, the bicycle and woolen clothing next the skin, were methods of prevention. Dr. Lucy Hall-Brown, of New York, sent "A New Electrode for Use with the Static Machine," which was read by Dr. Nunn. The electrode was a wire brush, of about four hundred fine steel wires mounted on a handle, and by means of it an efficient spray current could be administered. Dr. J. Bergonine, of Bordeaux, France, sent three communications: (*a*) "A New Localizing Electrode to prevent the Diffusion of the Current," (*b*) "Palliative Treatment of Tic Doloureaux of the Face," (*c*) "The Action of the Roentgen Rays on the Vitality and Virulence of Koch's Bácilli in Cultures." These papers were translated and read by Dr. F. Schavoir, of Stamford, Conn., (*a*) eight or ten narrow electrodes were connected alternately with the positive and negative poles, none but a very intense current could become diffused; (*b*) a large electrode is used on the face and an indifferent electrode on the dorsal region. A continuous current of fifty volts and thirty to fifty milliamperes is employed, and the periods of the ascension and diminution last from seven to ten minutes, the maximum intensity should be maintained for at least twenty minutes ; (*c*) the exposure of the culture for one hour did not destroy the virulence of the culture, but retarded its development, the vitality of the culture was not modified. Very interesting reports were presented by the Committees of Investigation as follows : "Meters," by Dr. M. A. Cleaves ; "Electrodes," by Dr. C. R. Dickson. On the recommendation of this committee the metric system of measurement was adopted by the Association. "Electric Light for Diagnosis and Therapy, and the Roentgen x-rays," by Dr. F. Schavoir. The president's address dealt with the past history of the Association, and suggested several changes that might increase its efficiency while lessening the work of the Executive. On motion of Dr. C. R. Dickson, it was resolved that the Executive Council should be directed to consider the suggestions of the president, and also the revision of the constitution and by-laws. Buffalo was chosen as the next place of meeting, on Tuesday, September 13, 1898, and two following days.

The following officers were elected for the ensuing year : President, Dr. Charles R. Dickson, of Toronto, Canada ; First Vice-President, Dr. F. Schavoir, of Stamford, Conn. ; Second Vice-President, Dr. Caleb Brown, of Sac City, Iowa ; Secretary, Dr. John Gerin, of Auburn, N. Y. ; Treasurer, Dr. R. J. Nunn, of Savannah, Ga. Exec. Council : Dr. Robert Newman, of New York, N. Y. ; Dr. William J. Morton, of New York, N. Y. ; Dr. William J. Herdman, of Ann Arbor, Mich. ; Dr. William T. Bishop, of Harrisburg, Pa.; Dr. G. Betton Massey, of Philadelphia. Pa.

After the customary votes of thanks had been passed, Drs. Newman and Nunn conducted the newly elected-president to the chair. Dr. Dickson, on receiving the gavel made a very happy address, and requested the active assistance of each member in order that the meeting in Buffalo might be the most successful yet held. He would appoint the committees on the investigation of scientific questions, at the earliest possible date.

A very fine exhibit of therapeutic, diagnostic and x-ray apparatus was held in the Academy of Medicine, also under the auspices of the Association, and many demonstrations of a particularly interesting character were given by the exhibitors during the sessions.

The Association is to be congratulated upon the success of the meeting.

THERE are two hundred and seventy-five medical journals in the United States, with a combined annual circulation of 16,017,200 copies.

X-RAYS.

BY J. M SCOTT, M D., KANSAS CITY, MO.

The so called burning is an electrolysis and is not caused by the x-ray at all, but by the current of electricity.

The current used for exciting a Crooke's tube has a voltage or pressure of from one-half to one million volts and a very small amperage or quantity. Now if you hold any part of the body within one to six inches of a wire carrying such a high voltage of electricity, whether for exciting a Crooke's tube or not, or near an excited Crooke's tube, there will be a current of electricity passing to the part exposed. If the exposed part is very near the current will feel like a very slight breeze of air blowing against the part and if held a little further away it can not be felt at all, but is passing just the same. If the part is held within an inch or closer, the electricity will jump to the part in the form of the spark, which will produce a stinging sensation. Exposing for a minute or two, even if close will not produce an electrolysis, but if a part is exposed for five minutes within two or three inches, or for twenty minutes at four to six inches, it will generally produce an electrolysis, the severity depending on the strength of the current. A tube generating an x-ray which would just penetrate a body if held four inches from it, would not penetrate it at all if held ten inches away. From this it will be seen it would be possible to take a picture with an inefficient, weak apparatus if the tube was held four inches away, while it would not if held ten inches away, and if the apparatus was so weak, it would take a long exposure and be very liable to produce an electrolysis. However, if using a good apparatus there is no necessity of holding the tube closer than ten inches. A current of so great power as of two million volts can not pass to the part exposed if placed seven or more inches away, and if the current of electricity can not pass more than seven inches it can easily be seen that electrolysis or so-called burning can not take place and there is absolutely no danger in using the x-ray if the part exposed is held seven inches or more from the tube and conducting wires. Electrolysis can be produced with a physician's galvanic battery if the current is concentrated by using a small electrode on the body in one place for some time.

I operate a Crooke's tube on an average of one hour every day, and stand within about two feet of the tube and have never noticed any effect.

The strength of the x-ray decreases as the square of the distance increases, so it will take just nine times as long to take a picture at fifteen inches from the tube as at five, because fifteen is three times five and the square of three is nine.

The length of exposure in taking a picture also depends on the thickness. For example if it takes one minute to take a picture through a hand one inch thick, to take an arm five inches thick it will take five minutes exposure. Of course the tube in both cases would have to be the same distance from the plate. —*Kansas City Medical Index.*

PHOTOGRAPHY WITH ROENTGEN RAYS.

There can not be said to have been, hitherto, any general agreement among experts as to the best plate to use for Roentgen photography. Experiments described by J. Gaedicke in the *Photographisches Wochenblatt* throw a considerable amount of light on this question. Two ordinary dry plates were taken, and one was dipped in erythrosine of silver to render it isochromatic. Over these two plates was placed a composite screen divided into five sections, one of which was coated with barium platino-cyanide, the second with Kahlbaum's tungstate of calcium, the third with A. E. G. tungstate of calcium, and the fourth with the double fluoride of ammonium and uranium, the fifth section being left uncoated. After an exposure of thirty seconds the plates were developed, and a considerable difference in the density of the impression made by the five sections was found to exist. The conclusions drawn from the experiments were as follows :

1. The orthochromatic plate shows a much stronger action than the ordinary without the screen, and it increases the action of all the screens. It is thus shown that for the x-rays only erythrosilver plates should be used. The increased action should be ascribed to the fluorescence of the erythrosine.

2. The fluoride of ammonium and uranium reduces the action of the rays to one-half on the ordinary plate, and to about two-thirds with the orthochromatic plate, and ought not, therefore, to be used for this work.

3. The calcium tungstate of the Electricitats Gesellschaft (A. E. G.) doubles the action, and Kahlbaum's preparation quadruples their action on ordinary plates, and gives a yet greater action on orthochromatic plates.

4. The platino-cyanide screen gave a very interesting result. With the ordinary plate—which, as is well known, is very sensitive to yellowish-green light—there was no intensifying action, but just the reverse ; the screen reduced the action by one-half. From this it follows that this screen had converted the greatest part of the x-rays into yellowish-green fluorescent light. The orthochromatic plate showed the most intense blackening of all.

A similar series of experiments is described by A. E. Livermore in *Photographic Scraps*. In this case an Ilford special plate and an isochromatic plate were used, and native tungstate (sheelite), double fluoride, and platino-cyanide were used on the screen. Livermore's results agreed with those given above, in showing that the most efficient arrangement was an isochromatic plate with a platino-cyanide screen, but they differed *in toto* as to the effect of the double fluoride of uranium and ammonium. This, according to Livermore, gave almost as good an effect as the platino-cyanide, and he recommends it as being the best to use when cost of material is a matter of importance. Both experimenters agree in saying that the isochromatic plates are in general superior to ordinary plates for Roentgen photography.—*Journal of Electro-Therapeutics.*

Table of Absolute Air Pressures and Densities at Various Altitudes above Sea Level.

Altitude. Feet	Absolute Pressure Lbs per sq inch.	Density —
Sea Level.	14.7	1.00
1,320	14.0	0.96
2,640	13.3	0.91
3,960	12.7	0.86
5,280	12.0	0.82
6,600	11.4	0.78
7,920	10.9	0.74
10,560	9.9	0.67

NOTE.—Absolute pressure is the pressure above a vacuum ; gauge pressure is the pressure above the atmosphere. To convert ordinary gauge pressure into absolute pressure, 14.7 lbs. must be added.

Absolute pressures are always to be used in questions relating to temperature and expansion of steam, air and gases.

INTERNATIONAL HEALTH EXPOSITION.

An International Health Exposition is planned to take place in New York City, April 25 to May 31 in the Industrial Building known as the Grand Central Palace, Lexington Avenue. Mr. Charles F. Wingate is to be Supervising Director and the exhibition will enlist the co-operation of the New York Household Economic Association, the Brooklyn and New York Health Protective Association and other kindred organizations.

The classification embraces Domestic Sanitation with 11 groups; Municipal Hygiene with 20 groups; Food Products, Health Resorts and Sanitariums; Hygienic Literature; Sanitary Organizations and their work; Progress of Preventive Medicine; Military and Navy Hygiene; Animal Sanitation; Industrial Hygiene and Fire Protection. A series of popular lectures will be provided daily during the exposition, in a separate lecture hall.

Tickets will be sold at nominal rates to employers of labor, who will be asked to distribute them among their workmen. An effort will also be made to interest the residents of the tenement quarters of the city in the exposition. The scope of the exposition seems wide enough to embrace almost everything that concerns our daily life.

DR. NYE: Mr. J—aet 38. Fracture of tibia and fibula with astragalus forced up between the fractured ends. Fracture caused by alighting heavily and suddenly on right heel, producing fracture of both bones about 1½ inches above the ankle joint. The fracture was set by Dr. Nye, assisted by Dr. Anderson. To be satisfied that everything was correct, an x-ray picture of the limb was taken. The x-ray apparatus belonging to the Denver Homeopathic Medical College was used and excellent results were obtained. By the way, our facilities for x-ray work are the best in the State, or in the entire west.—*Clinic, Denver, Homeopathic Hospital.*

SIGNALING WITHOUT CONNECTING WIRES. LODGE. *Lond. Elec. Rev.* and *Elec.*, Jan. 28. *Elect. World.*—An abstract of a recent Physical Society paper, the former journal containing a diagram of one of the arrangements described. He prefers the above term to "wireless telegraphy." The first thing necessary is to have a persistent vibration which can be tuned to, and not one that dies off rapidly and irregularly; this excludes the Righi transmitter; capacity is necessary, and the period can be altered by varying either the capacity or the self-induction, both of which he uses in his system, tuning with the latter; the receiver is a real resonator, and not a mere collector; the most novel feature is a coil of copper introduced between the two triangular wings; the waves used are over 30 yards long, thus shortening the shadows of an obstacle of moderate size, as the Hertz waves would bend around it like a sound wave; the length of Marconi's waves is about 4 feet; the coherer may be reduced with advantage to a single contact, for instance, a needle pressed against a flat spring, which is the most sensitive of all coherers, and requires no mechanical tapping; under certain conditions it is too sensitive. It is editorially suggested that the coherer may be rendered sensitive to light. The instrument illustrated diagrammatically is capable of being used both as a transmitter or receiver.

Polk's Medical and Surgical Register of the United States and Canada is now undergoing its fifth revision. Physicians who have not given their names to the canvassers are urged to report to headquarters at once, giving full information. Address, R. L. Polk & Co., Detroit, Mich.

NEURECTOMY FOR TIC-DOULOUREUX.

Bernays' "Report of a Surgical Clinic," complimentary to the members of the Mississippi Valley Medical Association, contains the following, in reference to his patient's condition and treatment before neurectomy for tic-douloureux was decided upon:

"Case V.—The patient, aet. 50, white, female. Family history: Has one sister who suffered from emotional insanity; otherwise the family history is good. Previous health excellent. The present trouble began with a severe neuralgic toothache, localized in the right lower molars. Paroxysms of pain were of daily occurrence, and most severe in the mornings about breakfast time. The pain subsided temporarily whenever the teeth were pressed firmly together or upon any substance held between them, but only to return when the pressure was withdrawn. The presence of anything cold in the mouth immediately produced the most exquisite pain; moderate heat produced a soothing effect. After two months, the pain became continuous, and four molars were extracted without in any way relieving it. On the contrary, the pain increased in severity until October when it ceased entirely for a period of two weeks, and then returned as severely as before. Another tooth was sacrificed, but without relief; the pain became continuous until last June when it again subsided for a period of six weeks. A recurrence then took place together with an involvement of the parts supplied with the second branch of the fifth nerve. Pain has been constant until the operation. She had strenuously avoided the use of narcotics, but during the more active periods of pain, anti-kamnia in ten grain doses was found to be an efficacious obtunder." After describing the neurectomy, Pof. Bernays says: "Eight weeks have now elapsed since the operation, and no recurrence of the trouble has taken place."

ORTHOGRAPHY.

We have been so many times embarrassed with so-called "typographical errors" which have heretofore crept into the JOURNAL that the feeling has ripened into this opinion: While it is of no particular credit to any one to spell correctly it is a disgrace to spell incorrectly.

Typographical errors in spelling must hereafter cease.

Including this issue of the JOURNAL *and all subsequent issues until the June number we will give one year's subscription free to each of the first two persons calling our attention to any misspelled word or words either in the reading matter or advertisements—excluding proper names.*

SOURCE OF X-RAYS. TROWBRIDGE AND BOURBANK. *Am. Jour. of Sc.*, Feb.—An article describing experiments with Crooke's tubes through which continuous wires are passed and in which there is no discharge in the usual sense; it was discovered that x-rays were given off from every element of this conductor at right angles to its circuit when a disruptive discharge occurred in the circuit; this was obtained by means of the very high E. M. F. obtained from a Plante rheostatic machine and 10,000 storage batteries. Their conclusions are that such a tube is well suited for studying electric lines of induction; that the direction of the so-called x-rays and cathode rays can be changed by electric induction; that the so-called x-ray burn can be produced by an intense state of electrification; that the so-called cathode and x-rays are given off from every element of a continuous conductor at a high stage of the vacuum, both when it is the cathode or the anode of the electrical circuit. They suggest the term electric rays or rays of polarization as preferable to cathode and x-rays.

X-Ray in Medical Work.—The statement that at a Liverpool hospital x-rays were utilized in no less than 57 cases during the year 1897, is followed up by the treasurer of the St. Thomas's Hospital, Albert Embankment, who says, in a letter to the *Times*, that at St. Thomas's as many as 416 patients passed through the x-rays department during the year. So great is the work, that an assistant to the officer in charge is about to be appointed.—*Electrical Review*, London.

A Rythmic Dilation of the Heart Discovered by the Roentgen Rays.—A special dispatch from Paris of February 12 says that Prof. Bouchard has discovered a new movement of the heart by means of the Roentgen rays. It is a rythmic dilation during respiration and is not connected with the ordinary movements of the heart. It appears to arise from a diminution of pressure in the interior of the thoracic cage during inspiration.—*Electrical Eng.* N. Y.

A Perfect Co-adjuvant.—Physicians should not forget that no matter what their preference may be as to the form in which milk should be used for their patients and the babies under their care, whether it is Modified, Sterilized, Pasteurized, Peptonized, treated by some other method, or natural, they can always depend on the perfect co-adjuvancy of that unrivaled dietetic preparation Imperial Granum. Many years of successful clinical experience having proved this combination of nutriments to be acceptable to the palate and also to the most delicate stomachs at all periods of life, being in many cases retained and assimilated when everything else is rejected, though in very extreme cases the Imperial Granum is often prepared with pure water only.

GAROFEN.

Condensed From an Article in the *Medical Summary* by Dr Ben. Brodnax, Brodnax, La
Name of Product Changed From Gurania to Garofen

After trying a preparation called Garofen I thought some of my brethren would like to know of a pleasant pain reliever. Some time ago I received a sample of the remedy from the Phenique Chemical Co., of St. Louis, Mo., but as I had a supply of other material, and not many cases requiring the effects, I put off testing it until I had a case of sick headache. I watched the effects of one tablet every half hour, with the results that the second tablet gave relief, and after the third the patient slept well. There was no diaphoretic effect from it, and no after effects that were unpleasant. The lady woke up as from a natural sleep. In a case of uterine pain from suppressed menstruation the effects were immediate; and after five tablets—one every half hour—there was perfect ease. I had used Macrotis (B. Keith & Co.'s Concentrated Tincture), for a day or two, and continued the same for several days after the flow commenced. I have also used Garofen in several cases of measles in people over forty years old, with the effect of quiet sleep and much comfort to the patients. I can not but think that it is the hypnotic which will take the place of morphine, acetanilid and its many compounds and mixtures. It answers a splendid purpose where you desire to allay pain without any sweat, or any of the effects of heart action with which the coal tar preparations are charged. As a quieter of pain, pure and simple, I have found nothing superior to it outside of a hypodermic of morphine. I dread the use of morphine among my clientel, and have for several years tried everything that would in any way supplant it. This preparation, I believe, comes as near to it as any that I have used.

X-RAY APPARATUS FOR SALE.

The owner is offering this apparatus for sale because he is in other business.

The machine is practically new, having been used but a few days and is offered at a very low price. Good work is done with it and with a proper rheostat it can be used for electro-therapeutic purposes.

With the coils there are in addition two rubber pans 14x16 inches for developing purposes, the condenser is mounted in the coil base, one fluoroscope, one stand and eight storage batteries. The speed regulator and breaker are conveniently combined with the switch.

The coil is thoroughly insulated with black hard rubber and mounted on polished cherry—the base being but 16x30 inches.

It gives a strong eight inch spark and generates abundant x-radiance. One half of the strength of the eight storage batteries will discharge a spark six inches. The eight cells afford abundant current for all purposes. The coil is a most powerful one and can be used for the demonstration of many mechanical devices in addition to x-ray therapeutic work. The cells are large and can be used singly or in combination.

Letters of inquiry will be promptly answered by addressing "K"

X-Ray Publishing Co.,
St. Louis, Mo.

Garofen.—Cut this out and mail to the Phenique Chemical Co., of St. Louis, Mo., and you will receive free of charge, sample, literature and reports on the New Vegetable Analgesic and Anti-pyretic that has come to take the place of Morphine Acetanilid and its many compounds. Garofen contains no coal tar products, nor opium or its alkaloids in any form.

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A PRELIMINARY REPORT ON A METHOD OF OVERCOMING HIGH RESISTANCE IN CROOKES' TUBES; A POSSIBLE STEP TOWARD MAXIMUM RADIANCE.

BY WM. W. GRAVES, M. D., ST. LOUIS, MO.

S. H. Monell, in his "Manual of Static Electricity in X-Ray and Therapeutic Uses," makes the following observation:

"I maintain that the tube can not be made too good for general work. The utmost penetration that can be secured still falls far short of what is sometimes to be desired. There are a thousand tubes in actual use which are too poor to give satisfaction while there is one which is doing fine work, and tubes which are too penetrating must as yet be placed in the same category as nuggets of gold which are too big. Anybody can cut down penetration to any low point he wishes by acts which are as simple as the turn of the hand, but to reach a high point of penetration, is one of the things which still puzzles almost every operator."

Whether for fluoroscopic or cathodographic work, approaching maximum radiance is always to be desired. A tube which gives only fair radiance has little practical value, other than from development by usage it may attain high efficiency.

Maximum radiance is sought by all operators of x-ray apparatus, but up to the present moment, the means of securing radiance approaching the maximum have been uncertain, on account of the difficulty in readily overcoming resistance in high efficiency tubes. High resistance in tubes that have at one time afforded radiance is due to but one cause —usage. So far, no tube has been constructed that is as constant as the incandescent lamp. Every user of Crookes' tubes is daily reminded of their variability. The state within the tube fluctuates from day to day, until from more or less usage, a tube which in the beginning gave off good rays will, in course of time, offer so much resistance that the discharge will no longer readily pass through, and by persisting in the use of the tube the resistance becomes so great that by every heretofore known means of "coaxing," it is no longer possible to overcome it.

"One of the most practical matters which can concern the operator in x-ray work is the question of getting the current through the tube when the resistance becomes too high." (Monell.)

The heretofore described and most readily accessible methods of overcoming high resistance are as follows: (A) Application of heat from alcohol lamp. (B) "Making bridge with hand between cathode and reflector. (C) Coating terminals with tin foil beginning at wires and extending over arms of tube until they begin to expand into the central bulb." (Monell.) I should also mention, baking tube in an oven of moderate temperature, boiling in oil, and lastly, setting the tube aside for rest for a few days or weeks.

"Finally, when the process becomes difficult, and the result unsatisfactory, the tube can be exhausted again." (Monell.)

"At last a point is reached when even heating with a flame—so far as is consistent with safety—fails to reduce the vacuum and again the tube is useless and must be sent to be re-exhausted." (Wm. J. Morton, "The X-Ray," p. 118.)

"As the resistance of the tube continues to increase with use it will gradually exceed the power of the coil. It should then be opened, attached to the pump and once more exhausted. The resistance may be temporarily reduced by warming the tube for some time before using it, or by running the current for a few minutes in the opposite direction. Various other expedients may be adopted, but it should be clearly understood they restore the activity of the Crookes' tube for a short time only." (David N. Walsh, "Roentgen Rays in Medical Work," p. 30.)

"With each time of heating the subsequent usefulness of the tube becomes less and less until, finally, no further work can be obtained from it. The only recourse when that time arrives is to have it re-exhausted by the manufacturer." (William H. Meadowcroft, "The A. B. C. of the X-Rays," p. 126.)

Of course if the tube rises so high in vacuum that no discharge can be sent through it there is nothing to do but to have it re-exhausted, unless it is a tube of the adjustable vacuum kind, in which case the vacuum can be lowered in a few seconds." (Same author, p. 154.)

Frederick Strange Kolle in his work, "The X-Rays" (p. 124) after speaking of the methods of heating, baking and boiling, says: "The last means of all is to have it retubed—to have it opened, the air let in, and again exhausted by the vacuum pump until it gives off the rays so much desired."

In a letter dated February 8, 1898, from Messrs. Van Houten & Ten Broeck, makers of the type of tube employed in my experimental work, it is stated: "That if all the methods set forth in Dr. Monell's book for the controlling of the vacuum in the tube fail we can offer no further suggestion and would advise that tubes be sent to the maker for re-exhaustion."

All authors, users and makers practically agree that if the various procedures for the control of vacuum as engendered by usage fail, there is but one thing to do—have the tube re-exhausted. If one has a large stock of tubes on hand, and a tube becomes somewhat rebellious, and demands rest, another of lower resistance may be used. If one has only a few tubes, and is doing much work, he soon finds that his tubes have become unmanageable and will require either rest or re-exhaustion.

Now if it is a fact, and experience so teaches, that the greater the resistance, as afforded by the vacuum tube, the higher will be its efficiency when the resistance is overcome, it must follow that approaching maximum radiance will not be attained until it is possible to overcome all resistance. Therefore, those tubes that are set aside for rest, and those tubes that are returned to makers for re-exhaustion, are the very tubes which if their resistance can be successfully overcome, are capable of affording the nearest approach to maximum radiance.

If there were a way of overcoming the resistance in such tubes, approaching maximum radiance would be the rule, and not as now, rarely seen. I believe there is a way, but it is not found by using tubes which have regulating devices, for in such tubes no sooner does the radiance begin to approach the maximum than its penetration is lowered by the use of the "extinguisher." In fact, may not the trouble be in improper manipulation of the tube and current, and not in the tube?

It is difficult to believe that the vacuum actually increases or that so long as a tube remains intact that it may, from usage, become incapable of affording radiance. The incandescent lamp is a vacuum tube, not nearly so high as the Crookes' tube it is true, but the difference as far as vacuum is concerned is one of degree only. The incandescent lamp may be used repeatedly until some part of its mechanism gives way, then why not the Crookes' tube? With such thoughts for a working basis, unhampered by theories, but with a firm determination not to give tubes rest or to have them re-exhausted, I have experimented with so-called dead tubes.

In order that an approach to maximum radiance may be obtained it is necessary to have efficient generating apparatus, and to keep it in condition to practically generate its maximum output of current at all times. An inefficient generating apparatus and a high efficiency tube are incapable of producing any kind of radiance. It is also necessary to be perfectly familiar with the care and management of the apparatus and to have some knowledge of technique in current and tube manipulation. Technique may be acquired by proper instruction, study and observation, but after all, personal experience is the best teacher. If any one doubt the truth of the old maxim, "There is no true excellence without great labor," he may soon become convinced of it after a short experience with rebellious Crookes' tubes.

The generating apparatus employed by me is an eight-plate, thirty-inch Morton-Wimshurst-Holtz Influence Machine, operated by a one-fourth horse power Crocker-Wheeler motor. This report is based upon experimental work with this apparatus; but the principles upon which this report is founded will apply, I presume, to coils, though I have had no personal experience in that direction.

The tube used in actual as well as experimental work is known as the "Monell Static Tube." Tubes of this kind are strong, well made, have a wide radius of action and are probably as near perfection as any tube on the market. I have found but one fault with the Monell tube and that is common to nearly all tubes—I refer to air-bubbles in the glass, particularly of the bulb. Air bubbles are, undoubtedly, weak spots in the tube, and affording less resistance, puncture may ensue. I have recently had the misfortune to puncture two very fine tubes, and in both instances puncture took place through an air bubble in the bulb. Had proper care been exercised this would not have occurred, but it did occur, and I have modified my method of manipulation so that however careless one may be it will not occur again. I have written to the makers and asked if it is possible to avoid air bubbles in tube construction. Being weak spots, all else being equal, the fewer the bubbles, the stronger the tubes.

The Monell Static Tube is said to be

exhausted by true pump exhaustion to about one-millionth of an atmosphere. Like all tubes, if used often, radiance increases with resistance until a point is reached when the current will no longer readily pass through. By resorting to the heretofore mentioned methods, the resistance may be temporarily overcome. If the use is persisted in, the resistance soon becomes so great that all heretofore known procedures fail. The tube is then said to be "dead" and to require rest; rest failing, re-exhaustion.

Such a tube "Is not dead, but sleeping," so to speak, as I have demonstrated in my experimental work time and again, and when aroused is capable of affording radiance exceeding its former penetration and brilliancy—radiance—one step nearer the maximum.

My experimental work confirms me in the belief that success in reviving dead tubes will depend, not upon the carrying out of one, but of all of the following essentials: (1) An efficient generating apparatus capable of generating its maximum output of current. (2) Correct method of operating tube and proper use of current interrupters. (3) Reversal. (4) Application of tin-foil.

APPLICATION OF TIN-FOIL.

Early in January, 1898, one of my tubes died—that is to say, after trying every accessible method save rest, baking and boiling, the discharge could not be gotten through. While the machine was in full operation a piece of tin-foil, which I held in my hand, fell upon the tube in such a manner as to form a bridge from within one-half inch of cathode terminal wire to a point on bulb about midway between cathode and anode. Immediately, the tube glowed with brilliant radiance. On removing the foil, the glow died out; on replacing it, the glow returned. I noticed at this time that a fine brush discharge, intermingled with a few sparks, was taking place between the cathode terminal wire and the foil, and that from the other end, in contact with bulb, fine, forked, radiating discharges were taking place, spreading over the bulb in every direction from margin of foil, the discharges being thicker at the margin, growing thinner a short distance away, and finally disappearing. See Plate I. On placing the foil in similar position to anode end of tube, no glow was obtainable; but on placing it on cathode end, the glow returned. I observed further on this occasion that if the foil were allowed to remain in position for a short time it might be removed and the glow would continue, but if I now placed the foil to anode end of tube, the glow died out. By taking two strips of foil, and placing one at cathode end and the other at anode end of tube, no glow was obtainable. These experiments seemed to indicate that the tube was not yet dead, and so far did not require rest or re-exhaustion; that by the application of foil to cathode end of tube, the resistance would be seemingly lessened; that by similarly applying it to anode, the resistance would be apparently increased, and that by applying it to both ends, no effect on resistance was noticeable.

Further experiments have so far confirmed what seemed to be true as far as the proper position for application of foil is concerned, but I soon found that increasing resistance from continued use had become so great that the application of foil alone would not overcome it.

I have tried a great many ways of applying foil to cathode end of tube. My first method was to have a bridge and clasp constructed from imitation whalebone covered with foil, and attached to the tube as shown in Plate I. I took the precaution to have one terminal of bridge so constructed as to fit accurately the convexity of the bulb so that even contact would be assured; likewise, the portion of bridge which was to rest upon arm of tube near the cathode terminal

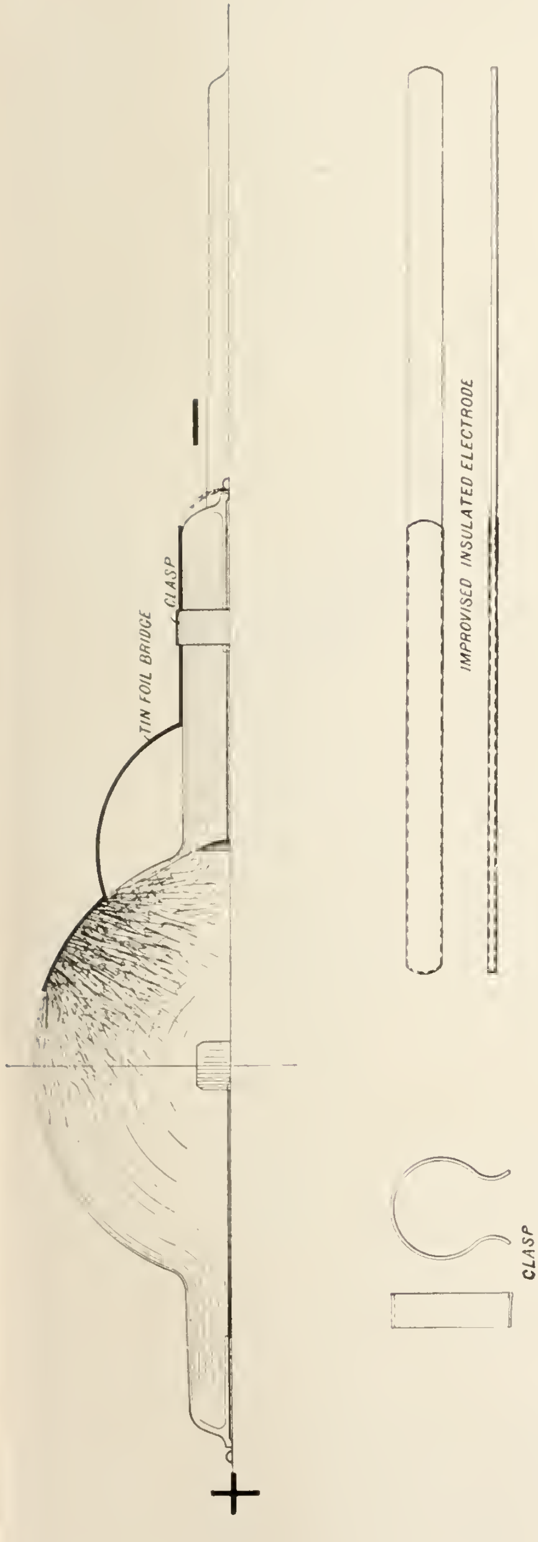


PLATE I.

wire. This precaution was taken on account of fear of puncture from the discharge taking place at a possible point of imperfect contact with the bulb. The bulb being thinner than the arm, and having more air bubbles, rendered this precaution necessary. As bulbs vary in size and convexity, it was necessary to have a bridge and clasp for each tube. The puncturing of the two tubes before mentioned was due to my carelessly applying bridges that did not conform to the convexity of the bulbs, but rested on the bulb, in each instance, at distal end of bridge, thus making imperfect contact. The concentrated discharge taking place at point of contact, in both instances happening to be over a bubble, punctures ensued. This unfortunate accident, I am positive, would not have occurred had I used bridges making close contact with bulb. The only reason for using the whale-bone bridge in applying foil to tube was that when clasped in position, it would not fall off in turning the tube in holder.

Since puncturing these tubes, I have adopted the plan of either clasping a strip of foil of several thicknesses on tube, with two clasps on arm, one being near the cathode disk and the other near the cathode terminal wire, or of gluing in a similar manner such a strip to arm and bulb. See Plate II. The latter method makes perfect contact, avoids all possibility of puncture by reason of close contact, and for the further reason that the glass is thicker and has fewer bubbles at portion of tube to which the foil is now applied. A useful accessory is a piece of whale-bone about ten inches long, one-half of which is coated with foil. It answers the purpose of an insulated electrode, and by its use, unpleasant sparks are avoided in tin-foil and current manipulation.

METHOD OF OPERATING TUBE, AND USE OF CURRENT INTERRUPTERS.

I invariably employ what is known as

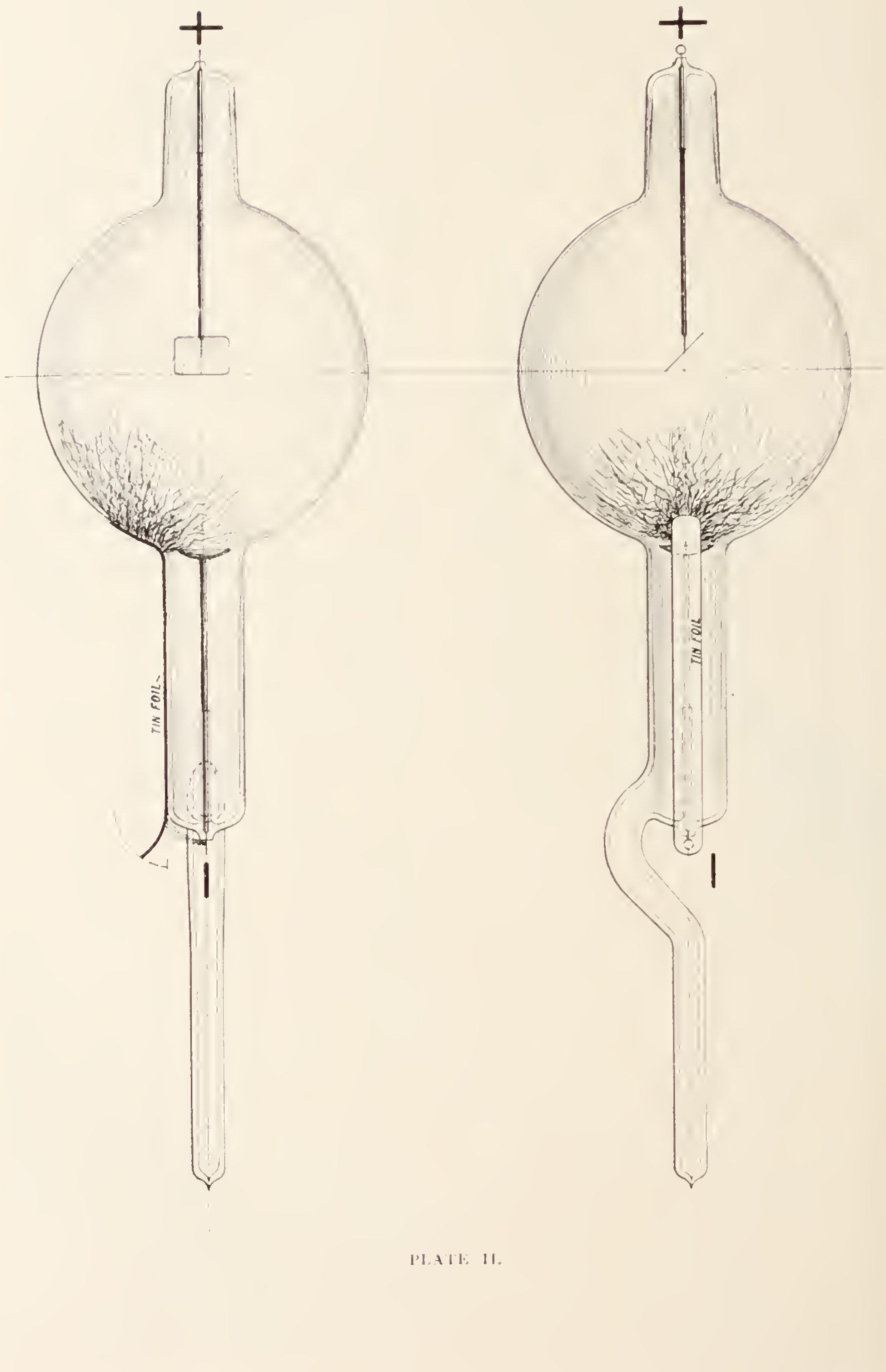


PLATE II.

the "Convective Method with Current Interrupters," as described in S. H. Monell's work, p. 134.

Whether for a tube of low or one of high resistance, this method answers every purpose. It is non-heating and is almost noiseless, and under proper conditions, the glow of the tube in action is practically as steady as incandescence.

"Monell's Improved Current Interrupters" are extremely useful devices to users of static apparatus, and in attempting to overcome high resistance are indispensable. Monell says of them: "They will make a tube of moderate efficiency do good work more quickly and with less trouble than any other way." In this statement I most heartily concur, and I will say further, that if properly employed, they will contribute more to success in overcoming high resistance—all things being equal—than any one thing.

I have observed a difference in effect produced on tube resistance by the interrupting of either the positive or negative discharge. In any case, if the radiance is satisfactory the interrupters should not be used. Either one, or both, should be used for a specific purpose, for under certain conditions, by using the one or the other, resistance may be increased or diminished. In a tube of low resistance the use of either, or both, will seemingly increase its efficiency. In a tube of ordinary resistance—that is to say, one which will back up a spark gap of from one to two inches, as described in Monell's work p. 125, interrupting the discharge at positive pole appears to increase the efficiency of the tube more than by interrupting the discharge at the negative pole.

In a tube the resistance of which has become so great from usage that the discharge will no longer readily overcome it, only the interrupter at negative pole should be employed. In my experimental work, I have observed repeatedly that if the interrupter at positive pole be employed, resistance will increase rapidly, so that the discharge will not pass through; whereas, if the interrupter at negative pole is employed, resistance is seemingly lessened and the tube will often glow.

The preceding statements are intended to apply to tubes when resistance has not gotten beyond the point of control by the various measures heretofore employed by others for overcoming high resistance. In working with tubes whose resistance has become so great that they are believed to be dead, and to require re-exhaustion, it may be stated positively, as far as the use of interrupters is concerned when the tube is connected positive to anode, and negative to cathode, that if necessary, the interrupter in contact with negative pole should alone be employed. When a tube is working in an ideal manner, that is, with neither interrupter in action, great care should be exercised, that from the vibrations of the machine the interrupters in contact with poles do not become separated, causing slight spark gaps. Should this occur at positive pole, causing a spark gap of one-half inch or less, the glow in the tube may suddenly cease.

On interrupting the negative discharge at cathode terminal wire with the foil, as well as at the pole of the machine, the negative discharge is seemingly intensified, so that internal resistance may be overcome which could not be overcome by interrupting the discharge at either point alone. A spark gap, a brush discharge, either or neither, may be readily had between cathode terminal wire and foil, by shifting the position of the foil up or down, and by varying the length of spark gap at negative pole. The effect on tube resistance is greater with a spark gap between foil and terminal wire, and less with brush discharge, the foil having no effect when neither is passing. The ideal glow in a tube is to be found when nothing save the whirl of the plates can be heard; and the interrupting of the discharge at negative pole and cathode terminal wire should be done, only for the purpose of attaining the ideal. From the foregoing considerations, the conclusion may be drawn, *that by interrupting the positive discharge on its way to the tube internal resistance is increased, and by interrupting the negative discharge internal resistance is lessened. If, on the other hand, the tube is connected positive to cathode, and negative to anode, that is to say, reversed, the converse of the foregoing conclusion holds good.*

REVERSAL.

With apparatus generating its maximum output of current, by correctly manipulating foil on arm of tube near cathode terminal wire, and with proper technique in the use of current interrupters, one may be able to overcome resistance heretofore believed to be impossible: but until the tube is reversed, and the discharge in passing through the tube reversed, shows in a satisfactory manner the phenomena peculiar to reversal, all possible resistance, as engendered from usage, will not have been successfully overcome. Reversal is, therefore, one of the essentials for success. In the course of my experiments I have encountered tubes whose resistance was so great, reversed, that for a time it was seemingly impossible to overcome it.

There is considerable difference in the degree of resistance in tubes reversed and of those properly connected. A tube of ordinary resistance, properly connected, will back up a spark gap of from one and a half to two inches; reversed, not more than one-half inch. My investigations seem to indicate that the resistance is about three times as great, positive to anode, and negative to cathode, as it is reversed. This being the case, when the resistance, reversed, shows the test of a six-inch spark gap between the poles, without the discharge going through the tube, its enormous resistance, properly connected, may be readily appreciated. This degree of resistance was developed *by usage* and *by improper use of current interrupters* and the difficulties encountered in overcoming it were due to the latter cause. For a long time I was successful in securing the necessary phenomena in the tube reversed by employing the interrupter at the negative pole and by the use of tin-foil attached to anode end of tube, until from so doing, for a time, it was no longer possible to get the discharge through, reversed. When I corrected the error, by interrupting the positive discharge at both machine and tube, the resistance, reversed, was readily overcome.

In observing the phenomena peculiar to a tube of low resistance reversed, and comparing it to one of high resistance reversed, several differences were apparent. It occurred to me that if these differences are brought about by usage, the causing of the discharge to pass through in a reversed manner until the phenomena in a high resistance tube would resemble, in certain particulars, the phenomena observed in a tube of low resistance, reversed, it would indicate the proper degree of reversal and at the same time help to solve the question of the heretofore believed high vacuum barrier as engendered by usage.

In fact, both objects are accomplished by reversal. If the discharge is made to go through reversed until the phenomena resembles in certain particulars that seen in a tube of low resistance. and if the tube then be properly connected, it will usually glow with most brilliant radiance; if it does not, by slight assistance, readily obtained by interrupting the negative discharge at pole with interrupter, and if necessary, further intensifying the discharge by interrupting it with the foil near cathode terminal wire,

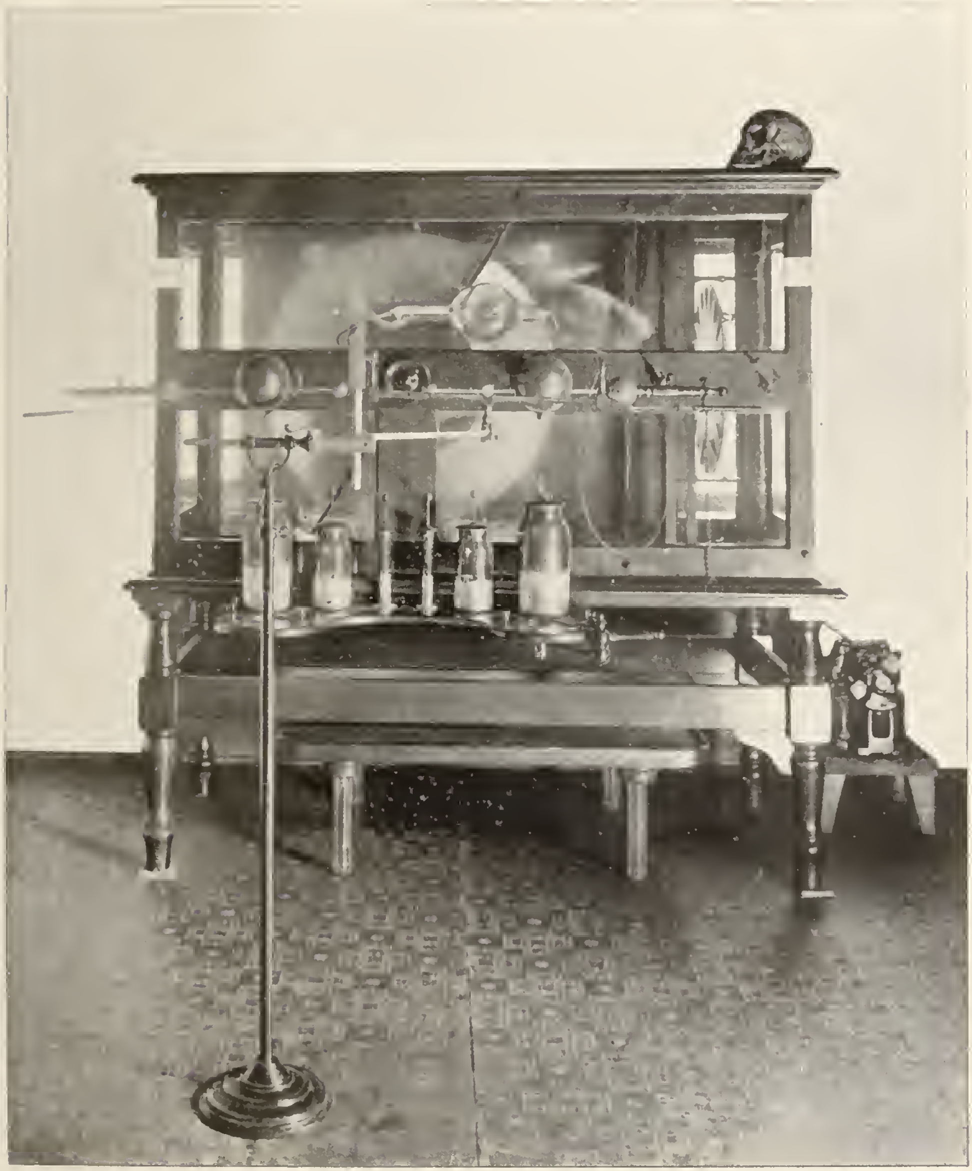


PLATE III

Author's apparatus in operation. Showing tin-foil on cathode portion of tube. Interrupting the discharge at negative pole with interrupter—as well as at cathode terminal wire with "foil"—to lessen resistance in the tube properly connected.

PLATE IV

Author's apparatus in operation. Showing Crookes' tube in "Reversal," and the use of interrupter at positive pole, interrupting the positive discharge to secure "the phenomena peculiar to reversal"—"to overcome in a satisfactory manner resistance in the tube reversed."

the tube will be rendered most docile and obedient.

It may, therefore, be stated as a working proposition: *It being possible to overcome in a satisfactory manner resistance in the tube reversed, it should also be possible to do so in the tube properly connected.*

If the tube in action presents an ideal condition, so does the tube reversed, and in both instances that ideal is *constancy*. The phenomena peculiar to a tube of ordinary resistance, in reversal, anyone may study for himself, and a description in words at this time is not necessary. Suffice it to say that in the overcoming of the heretofore believed unconquerable resistance as engendered by usage, the discharge should be made to pass through in the reversed manner until the glow is constant, and until the arrangement of striae in anode end of bulb resembles, as nearly as possible, that arrangement observed in a tube of ordinary resistance reversed, particularly until those spots which may often be seen in varying positions in bulb are driven back and are absorbed, so to speak, by the striae from which they may have originated. When these spots have been driven back, disappear and become a part of a normal arrangement of striae, when the glow has become constant, when in a tube of *advanced* development it shows steady radiance as may be demonstrated by the fluoroscope, the proper degree of reversal has been attained. *If the tube be now properly connected, and by the use of interrupter and foil, if necessary, the heretofore believed dead tube will demonstrate that it still lives. Remembering, as we must, its early radiance, and beholding as we do now its present degree of development, may we not believe we are one step nearer the maximum?*

From the difficulties encountered in attempting to overcome resistance in the tube reversed; from observing the phenomena peculiar to reversal in low as well as high resistance tubes, and by taking into account the preceding considerations, based upon personal experimental work, I am thus early in my investigations forced to believe, *that success in overcoming the heretofore believed high vacuum, as engendered by usage, will depend upon proper technique in current and tube manipulation; that the trouble is not in the tube per se; that a Crookes' tube which has once afforded radiance should continue to do so as long as its electrodes are not disintegrated or its vacuum destroyed; that the so-called high vacuum, as engendered by usage, is most likely a myth; that a tube which has once afforded radiance requires neither baking, boiling, rest nor re-exhaustion; that the longer a tube is used the greater it grows in efficiency; that usage is to the Crookes' tube what the crucible is to crude gold; that maximum radiance has never been seen, and that the way to maximum radiance may possibly be found in the overcoming of the heretofore believed impassable barrier of resistance, thus assuring continued development in tube life.*

I have purposely refrained from giving particulars as to the degree of tube development so far attained, nor is it, at this time, incumbent upon me to do so. If the user of x-ray apparatus will cast aside his tube of the adjustable vacuum kind, and will use only *one* tube until from development by usage it begins to approach the maximum, I shall be satisfied to let him tell the story.

How soon the maximum, the goal of all investigators, will be attained, no one knows. Then, as now, all honor be to him whose discovery is the crowning triumph of the age, to him who pointed out the way to use that unknown and as yet unknowable light, to him who gave mankind the power to view with human eye the heretofore invisible; all honor, all praise, all glory be to him—Doctor William Konrad Roentgen.

1943 North Eleventh Street.

The Relation Between the Outlines of the Internal Organs of the Body As Determined By the X-rays and By the Phonendoscope. The Laws Governing the Two Methods.

BY PROF. DR. AURELIO BIANCHI (PARMA)

Read at the XV Congress fo Internal Medicine at Berlin, 1897.

Those organs whose molecular vibrations in the form of light or sound make no sensible impression upon our sight or hearing without the use of specially constructed apparatus, are at the present time directly appreciable to the eye and the ear, on the one hand by the aid of the x-rays and fluoroscope, and on the other by the aid of the phonendoscope.

Skiascopy, therefore, the science of the x-rays and the fluoroscope, and phonendoscopy, the science of auscultation with the aid of the phonendoscope. are two new and far-reaching methods of studying the condition of the internal organs of the body both in health and disease; but these methods are still in their infancy.

Neither the vibrations of the cathode rays nor the sound-waves produced in the various organs of the body are appreciable to the eye or the ear, unless the eye be aided by the fluoroscope, and the ear by the phonendoscope.

While, on the one hand, the invisible vibrations of the x-rays penetrate the different viscera of the body with a facility which varies with the shape, density and mutual relations of the latter, and are then made visible in the fluoroscope, or are fixed upon a photographic plate, so on the other hand, the friction of the finger-tip across the surface of the body gives rise to vibrations which are inaudible to the most acute ear, but which are taken up and intensified by the phonendoscope, and so rendered distinctly audible. In this way the phonendoscope outline of any desired organ may be traced upon the surface of the body.

Skiascopy and phonendoscopy are therefore two new clinical procedures which give like results by different methods, the one rendering vibrations sensible to the eye, the other to the ear. Both methods may be made to give permanent results, the former by means of the x-ray photographs, the latter by means of the phonendoscopic chart.

The similarity of these results has led me to look for some constant relation between the two procedures in the hope of coming to some useful and definite conclusions. My efforts were rewarded with the most satisfactory results, and I can say without hesitation that both methods of procedure are governed by the same fundamental laws, and although each has its own peculiarities and variations the results of both are the same.

It was this consideration of the similarity of two methods of investigation so apparently different, one of which was discovered in Germany, the other in Italy, which has afforded me the opportunity of addressing this assembly today. I therefore beg to express my thanks to you for the honor of being present among you, and of being permitted to learn of progress, of new discoveries, of the fruits of investigation and experiment from the lips of the most prominent physicians of the German Empire.

You are well acquainted with the apparatus necessary for skiascopy; permit me to describe the instruments used in phonendoscopy. They are very few. consisting in fact of but one instrument, the phonendoscope. The tip of the finger is used to stroke the skin for the production of the necessary vibrations, and an ordinary lead pencil suffices to draw the outlines of the organs upon the skin.

The phonendoscope was invented at my suggestion about four years ago, and is the work of my colleague, Professor Bazzi. Since that time many imitations and modifications of the instrument have been made: these are, however, mere variations in the shape of the instrument and not in the principle of its construction.

The phonendoscope consists of the following parts: a large mass of metal having a small air-chamber on one side, which is closed by two vibrating discs; a localizer; rubber tubes and ear-tips;—and no instrument previously invented combined all these peculiarities.

With the aid of this instrument we can examine a large or a small portion of the body-surface with little difference in its sensitiveness. In fact it is just this power, afforded us by the use of the localizer, of examining one very minute portion of the body at a time, which has enabled me to develop a method of investigation which was never dreamed of before.

On account of the extreme sensitiveness of the instrument I have ceased using the forcible vibrations produced by the voice or by percussion, and have learned to utilize instead the very delicate vibrations produced by a gentle stroke of the finger across the skin.

The instrument is manufactured in Germany in the city of Cassel by the firm of Martin Wallach. This house not only manufactures a perfect instrument but spares no pains to distribute the same to all parts of the world.

We now come to the subject proper of our paper.

1. Neither skiascopy nor phonendoscopy cause the patient any pain.

2. Neither the passage of the cathode ray through the body nor the scraping of the finger by which the vibrations for the phonendoscope are produced cause the patient any pain, although the former occasionally gives rise to a burning or crawling sensation, in the skin the latter to an occasional tickling sensation.

3. Neither the fluoroscope, the sensitive photographic plate for the x-ray picture, nor the localizer of the phonendoscope give rise to any other sensation to the patient than that of mere touch. The eye of the observer is apt to become tired after a prolonged examination with the fluoroscope, as is also the ear of the physician using the phonendoscope; but in the latter case the exhaustion is by no means as marked as in the former.

4. In order to make the x-ray shadow in the fluoroscope clear and distinct the instrument must be applied to the body at the point at which the organ to be examined is most superficial. In like manner the phonendoscope must be applied to the surface directly over the desired organ, so as to bring it as far as possible into continuous contact with the organ itself.

5. As the intensity of the x-rays must be adjusted according to the distance of the organ from the surface of the body, so it is also important to regulate both the pressure exerted upon the localizer of the phonendoscope and the force of the strokes by which the necessary vibrations are produced, according to the position of the organ to be examined. Very powerful x-rays will pass through the superficial and less dense structures of the body without producing a shadow; in using the phonendoscope, if too much force be used in stroking the skin the pressure of the finger will increase the tension of the superficial structures and the vibrations will be transmitted to the deeper organs; and if too much pressure be made upon the phonendoscope, the superficial vibrations will be suppressed and only those coming from the deeper organs will be transmitted through the instrument.

6. In using the x-rays it is best to place the bulb opposite the viscus to be examined and the fluoroscope directly over it, or if the viscus be a large one the fluoroscope must be placed upon several different parts of its surface. In

using the phonendoscope, it should likewise be placed directly over the organ at one or more points according to the size of the organ, and the finger producing the vibration should move in a circular manner about the point of contact of the phonendoscope with the body.

7. With both the x-rays and the phonendoscope we may obtain either a temporary result or a permanent record.

8. In the case of the x-rays we may be satisfied with a simple examination of the viscera with the fluoroscope; in the case of the phonendoscope with merely outlining the organs upon the skin.

9. A permanent record can be obtained with either procedure by means of a photographic plate or a camera; but a phonendoscopic chart can be rapidly made if the outlines be drawn upon the skin with copying ink and a copy be made directly upon a sheet of paper.

10. In order to obtain clear and trustworthy results with either the x-rays or the phonendoscope, a thorough knowledge of the processes involved, an impartial judgment and technical skill are presupposed requirements.

11. The outline obtained by either of these two procedures is not an exact representation of the outline of the viscus itself; it represents, rather, in one case the shadow of the viscus upon the fluoroscope, in the other the projection of the viscus upon the surface of the body. The farther a viscus is removed from the surface of the body the more will its representation be modified in various ways. The position of the fluoroscope influences the shape of the shadow. If the fluoroscope is in contact with one part of the body surface, for instance, the anterior surface, the sides of the body and parts of organs situated within the sides will be separated from the fluoroscope by some distance, owing to the oval contour of the body; hence arises a certain amount of distortion of the outline, or a partial or general increase of its size. In the case of the phonendoscope also, the fact that it can be brought to bear upon the superficial surface of the organ only, and not even in actual contact with that, and the fact that the body surface is rounded cause the outline to assume a shape which is not the actual shape of the organ itself.

12. The solid viscera throw a dark shadow upon the fluoroscope, whose intensity depends upon the density and thickness of the viscus. With the phonendoscope it is found that these same viscera give powerful vibrations whose intensity is directly proportionate to the thickness and density of the viscera.

13. The shadow thrown upon the fluoroscope by a solid viscus situated in the posterior part of the body is darker in the center of the shadow and lighter around its margin. With the phonendoscope it is found that this same viscus gives rise to vibrations which are more powerful at the center, where the viscus touches the body wall, while towards its borders, where the viscus is separated from the body wall, the vibrations become less and less intense.

14. Viscera, consisting of one or more cavities containing gas give a brighter projection upon the fluoroscope if the tension of the gas is great; and the greater the pressure of gas in the viscera, the higher will be the pitch of the vibrations in the phonendoscope.

15. In a hollow viscus containing both gas and fluid, the part containing gas will throw a light shadow upon the fluoroscope, the part containing fluid, a dark shadow. In using the phonendoscope the part containing gas can be distinguished from that containing fluid by the fact that the pitch of the vibrations over the gas is higher than over the fluid.

16. Osseous structures throw a very dark shadow upon the fluoroscope, and their vibrations in the phonendoscope

are high pitched. The shadows which any part of the body containing bone throws upon the fluoroscope consists of the shadow of the bone plus the shadow of any organs lying behind the bone; the tone of the vibrations heard in the phonendoscope over a long part is a result of the blending of the vibrations peculiar to the bone with the vibrations from the underlying structures. The shadow thrown upon the fluoroscope by an organ enclosed in a bony cavity is almost entirely obscured by the darker shadow of the bone; in like manner the phonendoscope is unable to detect the vibrations due to such organs on account of the predominance of the more powerful bony vibrations.

17. The movements of the various viscera, whether physiologically or artificially produced, can be distinctly seen in the fluoroscope by the motion of their shadows, provided, of course, that the x-ray bulb and the fluoroscope remain stationary. In the case of the phonendoscope, if the point of origin of the vibrations and the situation of the instrument are fixed, any change in the position of the underlying viscera can be determined by a change in their outlines as traced upon the skin. But such movements can be seen in the fluoroscope in a limited number of organs only, such as the bones, the diaphragm, the heart and the lungs, whereas the phonendoscope can be used on any part of the body and upon any viscus or part of a viscus, and upon accumulations of fluid in the different cavities of the body.

18. If a viscus of a certain thickness and density lie directly behind another of the same density, their shadows will be superimposed upon the fluoroscope and the result will be a single dark shadow;—on the other hand, with the phonendoscope we are able to differentiate such viscera and to outline them separately upon the surface of the body with as much facility as if they were transparent. This is accomplished by examining the superficial viscus first and then the deeper one. It is important in this case to apply the phonendoscope at a place where the superficial viscus comes into direct contact with the body wall.

19. A solid viscus or a viscus filled with fluid, situated behind a hollow viscus, will throw a lighter shadow upon the fluoroscope in proportion to the thickness of the hollow viscus. In using the phonendoscope the vibration of the solid viscus will likewise be found weaker, the greater the thickness of the intervening layer of air.

20 If the wall of a hollow viscus be thickened at any point the shadow of the viscus will be less intense at the thickened point, for at this point the layer of air will be less deep or even absent altogether. In the phonendoscope the vibrations over the thickened area will be much more powerful than over the rest of the organ.

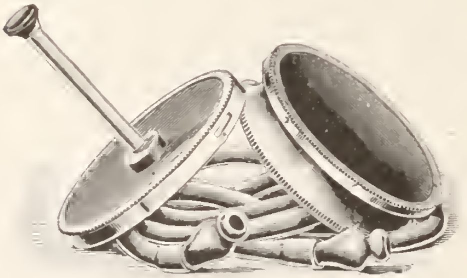
21. Finally, by using two Roentgen bulbs and two fluoroscopes, corresponding organs of two individuals can be examined and compared at the same time. In like manner, two observers using two phonendoscopes, can examine simultaneously and compare the vibrations of corresponding parts of two subjects.

From the foregoing it will be seen that these two procedures are not only closely related, but are even somewhat similar; yet the use of the phonendoscope has certain practical advantages which are of special importance to the practicing physician and which are not to be found in the present method of using the x-rays. These advantages are to be found partly in the nature of the apparatus and partly in the clinical application of the instrument.

The instruments required for phonendoscopy are very few. The compact little instrument itself, a lead-pencil, some copying-ink and tracing paper to make copies of the phonendoscopic chart. The tip of the finger produces the necessary vibrations. The apparatus is portable. and can be used at any time and place.

Clinically, we have already obtained results with the phonendoscope which could not be obtained with the x-rays.

Not only are we able to trace with the phonendoscope the outlines of all the viscera, whether they are situated near the surface or deep in the interior of the body, whether they are solid or hollow or filled with gas or fluid, or even if they are suspended in the interior of a fluid cavity, but it also enables us to locate the subdivisions and ligaments of viscera, to determine all kinds of movements of the organs of the body or alter-



ations of their positions as caused by their functional activity or through the action of gravitation.

Even an incomplete summary of the peculiarities of the phonendoscope, such as can be given at this time must impress both the practicing physician and the scientist with the fact that the instrument affords us a rapid, easy and harmless clinical procedure, by means of which a projection of all the viscera may be traced upon the surface of the body; and that the instrument will become popular and indeed indispensable to those who have studied its use carefully.

The application of the x-rays constitutes a most perfect method of controlling the results of the phonendoscope, and there is no doubt that the x-ray apparatus will be improved in the near future so as to render their application much easier and the results more complete.

We trust that Germany, the home of the x-rays will soon realize this hope, for no problem however complicated can long remain a riddle to German scientists who are ever mindful of the proverb of the Tuscan Academia del Cimento, "Provando e riprovando."

Illustration and translation furnished for publication in the AMERICAN X-RAY JOURNAL by George P. Pilling & Son. Philadelphia, American representatives of the genuine phonendoscope.

RADIOGRAPHY.—Kelsch found in examination of 124 young persons. none with clinical symptoms of pulmonary lesions, that fifty-one were affected with slight abnormalities, decreased transparency of bronchial adenopathy. He suggests fluoroscopy as a valuable aid in determining the pathologic future of the young. Its importance is evident in eliminating young men with a predisposition to tuberculosis in examining for military service. . . . . Vaillant places a sheet of lead between the sensitive plate and its support in radiography of the pelvis, which reduces the time of exposure one-half and renders the negative much more distinct.—*Bull. de l'Acad. des Med.*, Dec. 21.

THEORY OF X-RAYS. ADAM. *Elec. Rev.*, March 9.—An article advancing a theory in reference to the origin and character of x-rays. Accepting Perrin's theory of cathode rays, namely, that some of the molecules of the residual gases are torn into ions, the negative ones flying out with great velocity, the present writer extends the theory to explain x-ray phenomena; supposing the residual gas to be carbonic acid the carbon seek the cathode and the oxygen acquires an enormous velocity, the ions being electrified.—*The Electrical World.*

A BANK OF LAMPS.

BY JOHN T. PITKIN, M. D., BUFFALO, N. Y.

Of all the manifold apparatus placed at the disposal of the progressive electro-therapeutist, by the masters of the greatest branch of modern science, Electrology, not any can compare in point of general usefulness to a properly constructed and correctly manipulated bank of lamps.

Through its skillful employment in connection with the street electrical service and with few accessory instruments all desirable varieties or degrees of electricity both quantitively and qualitatively speaking are obtainable.

In the hands of the electro-medical expert it serves the three-fold purpose of rheostat, converter and galvanometer. Metaphorically speaking it is his "Vade Mecum", an Aladdine lamp, even the goose which lays for him the golden eggs

But before substantiating the foregoing statements which may seem extravagant and the ground taken in this preamble therefore untenable, let us stop for a moment and consider the manner in which the apparatus should be constructed and its modus operandi in order that we may manipulate it intelligently, knowing why and how it yields this great diversity of electrical currents, for inasmuch as we fail to fathom the intricacies of electrical mechanisms and understand the principles upon which they are constructed, just to that extent we become integral parts of machines, only supplementary to those which the makers see fit to furnish. We raise or lower a plunger, turn a switch or start a rheotome, like the nickel dropped into the slot, we start the apparatus and the machinery does all the rest, the patient is delivered an electrical treatment, so-called. instead of a stick of gum, a prize-fight exhibit or a reproduction of the latest opera; I ask you sincerely, which of them all in your opinion will prove the most beneficial to the sufferer?

RECEPTION ROOM OF BUFFALO ELECTRICAL SANITARIUM.

Assuming that the reader is familiar with the general principles or laws governing the application of electricity to the industries and arts of the present decade, also the manner of wiring buildings for electrical distribution so that he is thus able to trace in his mind's eye, to a given lamp fixture the wires which supply it, should he continue the two wires through a screw-plug placed in the socket usually occupied by a sixteen to thirty-two

The electric current which supplies the building, passes from the electrolier, through a bank of lamps on a table in the center of the room, to the various electrical devices.

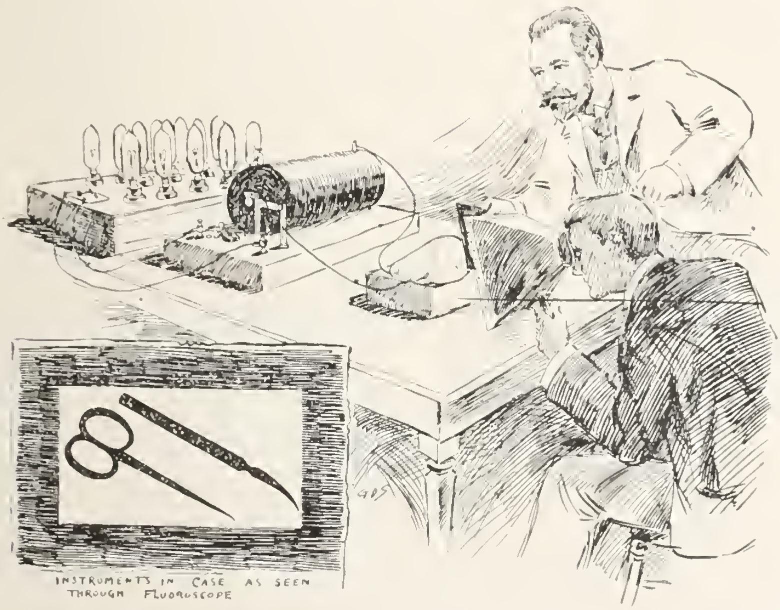
candle-power lamp, if one of these wires is bent into a loop so that it returns upon itself, that he cuts the distal end and that between the otherwise separated sides of this loop, lamps in their sockets are introduced, by this arrangement he has obtained all the essential features of a lineal bank of lamps.

In order to economize space and facilitate handling, the lamps and conducting wires are attached to a board or marble slab in a serpentine manner and a few accessory devices such as binding-posts, a make and break, a pole changer and a resistance coil are added to complete this most useful of electrical apparatii.

Descriptively the electrician would tersely explain that in the properly constructed bank of lamps, the lamps would be wired in multiple relation with each other, but that the whole group of lamps would be in simple series with the wall-bracket on the one hand and the electrodes and patient on the other.

To the binding posts of ingress to a bank of lamps the wires from a dynamo, wall-bracket or electrolie, (the source of electrical supply) may be attached, while from the posts of egress the properly modified and measured current is conducted to the patient by means of rheophores and electrodes either before or after still further modification by secondary instruments.

The electro-motor force or voltage of the current taken from a bank of lamps, if not otherwise altered beyond the board, always remains the same, irrespective of the number of lamps turned on, it will therefore correspond in pressure or potential to the electro-motor force of the dynamo which supplies the building with electricity. The amperage, current strength or volume on the other hand will raise or fall as each additional lamp is placed in or out of the circuit, hence it follows, if each lamp's resistance is known once for all, in accordance with ohms law, "The electro motor force in volts divided by the resistance in ohms will give the current strength or amperage, approximately speaking, each sixteen candle-power lamp modifies the current so as to deliver half an ampere, therefore twenty such lamps or ten of thirty-two candle-power each, would give ten amperes, i e. sufficient current to heat a platinum, German silver, iron or steel wire No. 22 to incandescence.



The author experimenting with the bank of lamps properly attached to a large Rhumkorff Coil soon after the discovery of the X-ray. The Crookes' tube employed is of the first pattern and contains no reflector. It was imported from Germany by his friend, Mr Edgar B. Stevens, Physicist and Chemist.

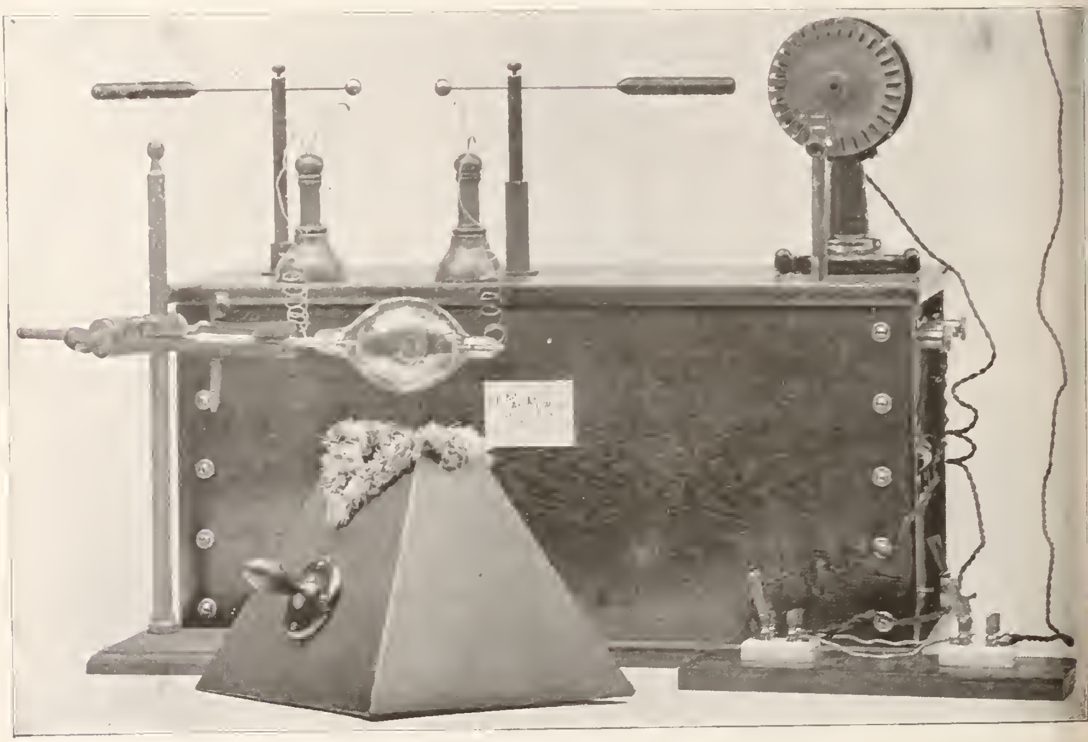
Cautery handles employed on the 110 volt current must be well constructed and the make and break of the circuit must take place at the bank of lamps, if attempted at the handle by the usual device, internal arcing will occur and the great amount of heat generated soon burn the vulcanite covering and sever the connections so as to unfit them for further usefulness.

For cautery electrodes a small piece of iron wire No. 22, such as book-binders and printers use to secure the leaves of calendars and booklets, variously bent to meet the exigencies of the case requiring treatment, will answer every purpose and the medical electrician will find it much less trying from a pecuniary standpoint than the purchase of platinum electrodes.

For superior x-ray effects from five to ten amperes from the alternating or sinusoidal dynamo, nicely adjusted by a bank of lamps, to the winding of the primary of a large Rhumkorff coil, without a rheotome, but placed in series with a Tesla oscillator and an adjustable vacuum, double reflecting Crooke's tube is earnestly recommended to the expert Roentgenian. (See Illustrations.)

The same strength of current from a direct dynamo is best suited to the charging of storage batteries, like poles of the board and battery being attached to each other, positive to positive, etc. The storage battery may be used while thus connected to the dynamo or after it has obtained its charge it can be dis-

pneumogastrics in the neck will relieve asthma, irregular or purturbed heart's action and atonic dyspepsia, the same strength of current is of great benefit in columnar and functional diseases of the spinal cord also for local medication of any portion of the body by the process of cataphoresis, in fact the manifold purposes for which a mild galvanic current is utilized in modern electro-therapeutics.



Two of the Tesla-Knott Apparatus are attached beyond a bank of lamps on the sinusoidal arc-light circuit.

connected and employed in the usual manner. (See Cut No. 4)

From two to five amperes can be utilized to cause electrolysis of benign or malignant growths, keloid tissue and fibro-plastic exudates.

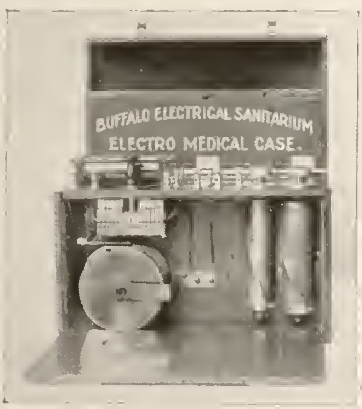
One-half to one ampere will often cure chronic rheumatism, gout and many other old disabilities of the extremities, strictures of the male urethra and atonic chronic inflammatory uterine diseases.

One-half an ampere applied to the

The galvanic current must, however, always be associated with voltage or pressure sufficient to drive it through the resisting epidermis but not so great as to cause burning or irritation of the exposed parts.

In order to vary the voltage but at the same time maintain a constant amperage it has been my custom to shunt into the current of egress from the bank of lamps and in multiple therewith a home-made coil of No. 28 copper wire, the tota weight of which is one pound. By tapping this coil at uniform intervals it delivers a current varying in potential from three to fifty volts, the pressure increasing in direct ratio to the length of wire introduced into the shunt.

The faradic induction coil may be attached beyond the board of lamps, one or two of which are turned on and with a varying amount of the resistance coil placed in the circuit, it will furnish the operator many degrees or qualities of induction from which to choose, in order to combat various pathological conditions. Much more could be written, "apropos" upon the importance and utility of A Bank of Lamps, but for the present it



A new Combination Faradic, Galvanic and Cautery Storage Battery, employed to remove Tumors, Unsightly Growths, Marks and Blemishes, and for the Cure of Rheumatism, Paralysis and Nervous Affections. When exhausted it may be re-charged with electricity beyond a bank of lamps.

must suffice to add, that through its proper understanding we are enabled to harness the strong currents of the industrial dynamo and render them subservient to all the requirements of the modern electro-therapeutist. It becomes for him the portal through which he may pass from comparative obscurity with an entailment of filthy, unreliable chemical batteries into the ever expanding field of usefulness made possible by the acquisition of absolute quantities and ample current strength, the most prominent combatant of chronic invalidism.

RESEARCHES BY MEANS OF X-RAYS ON THE ADULTERATION OF FLOUR.

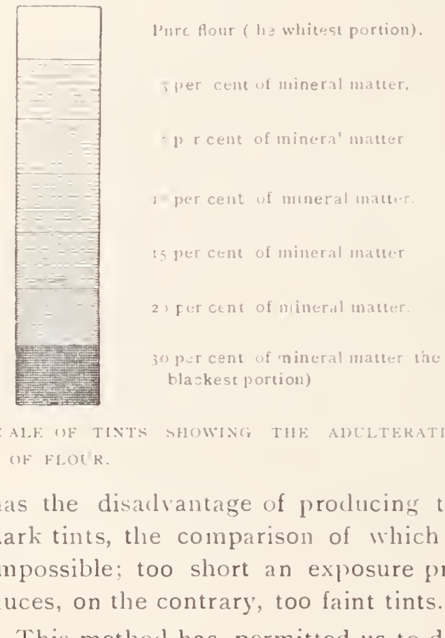
BY A. FLEUNARD

Dr. LaBesse and myself having had occasion to analyze flour containing as much as 40 per cent of foreign mineral matter, have tried to discover this adulteration by means of the x-rays, a research which has been made before, but which we wished to perfect and make as sensitive as possible. The nature of the mineral substances present in the flour, consisting of sand reduced to a powder, and insoluble lime salts, principally chalk, we decided a priori to look upon our experiment as one that could be easily performed successfully. The experiment was a complete success when the conditions exist as indicated below.

It is claimed to be difficult to compare the shades when they have great variation, and this is why, in the improvement made by Faucault on the Bouguer photometer, this scientist has obliterated all black or luminous lines, due to the separating screen between the two luminous sources to be compared. We thought of operating in the same manner and to superimpose, on the photographic plate or the fluorescent screen, without discontinuity, the two images of the flour to be compared, pure flour on one side and adulterated flour on the other. To this simple arrangement we owe all the sensitiveness of our method.

We placed on an ordinary photographic plate of gelatine-bromure, a small pasteboard box, of rectangular shape, from which the top and bottom are removed, retaining consequently only the lateral walls, of about one centimetre in height. We divided the box into two equal parts, by means of a small rectangle of convenient dimensions, cut from a visiting card. This done, we then filled one of the compartments with the pure flour, the other with the adulterated flour; we removed with precaution the separating partition, and we lightly tapped the box with the finger so as to fill up the small empty space which fills with flour, without sensible mixture. The whole is covered with a sheet of tin foil, with a quite narrow rectangular slit cut in it, and placed perpendicular to the section of separation between the two flours. It only remains to expose it to the action of the x-rays and to disclose the image.

The duration of exposure must not be too long, and naturally depends on the apparatus one employs. Two minutes was sufficient for that which we experimented with. Too long an exposure



SCALE OF TINTS SHOWING THE ADULTERATION OF FLOUR.

has the disadvantage of producing too dark tints, the comparison of which is impossible; too short an exposure produces, on the contrary, too faint tints.

This method has permitted us to disclose with certainty the presence of three per cent of foreign mineral matter in flour, this matter being composed of equal weights of very fine sand and chalk. The adulteration can be detected much easier when the proportion of mineral matter is greater.

Besides, it is possible, once the fraud is known, to tell with considerable exactness the quantity of mineral matter introduced. It suffices to compare the tint obtained with an increasing scale of tints, obtained by introducing into pure flour known quantities of foreign mineral matter. We further wish to remark that the tints vary with the nature of the mineral matter employed in the adulteration, and that this method of quantitative analysis can only be approximate. The accompanying engraving is an exact reproduction of a scale of increasing tints, obtained by placing in succession, in the same kind of a box and using the above precautions, successive samples of pure flour and of flour progressively mixed with mineral matter, such as sand and chalk.—*La Nature.*

PHOTOGRAPHING THOUGHT.—It is said that Thomas Edison, Jr, can photograph thought. Certainly. Nothing is easier. The world moves.

In New York a short time ago in a parlor of a hotel, a stranger told the company if some of them would think of anything and no one but the individual know what it was, he would tell what it was and he did not fail once. A plane was charged with the thought and his intuitive sense knew what it was.

Last Fall in Western Pennsylvania, a plane was shown that had been charged nearly twenty years with the appearance of a man imprinted on a plate, and all knew the picture. If a plane charged with a thought reaches a sensitive plate, that thought will be imprinted on the plate.

Probably by the use of these planes the artist will in the near future be able to take pictures of the inhabitants of the planets and sun. Already have people through these planes and the intuitive sense (clairvoyant) discovered that they are inhabited, and described some of the people. There is no end to progression in this life or the next. The only similarity of this to the x-ray is they both use these planes, only different ones.—*Philosophical Journal.*

THE APPLICATION OF ROENTGEN RAYS TO MEDICAL DIAGNOSIS.

Abstract of paper read before the Section on Practice of Medicine at the Forty-eighth Annual Meeting of the American Medical Association, held at Philadelphia, Pa., June 1-4, 1897

BY CHARLES LESTER LEONARD, A. M., M. D.
Pepper Laboratory of Clinical Medicine, University of Pennsylvania, Philadelphia, Pa.

The application of the Roentgen rays to medical science has already given to surgery a method of diagnosis the precision of which makes it of the greatest value; this value lies in the absolute pictures which we are able to secure by its means, and loses its pre-eminence as soon as we are compelled to substitute for the absolute picture in black and white, mental pictures which always involve the personal equation of the observer.

It is worse than useless to suppose that any new method of forming mental pictures, no matter how startling or radical, can equal in accuracy or approach in value those which the science of medical diagnosis has already taught us to form with well-nigh infallible precision. It would be supererogation on the part of any one to think that the mental pictures which he might form by the use of the Roentgen rays could replace or add to the pictures which modern physical diagnosis is capable of presenting.

The property which gives this new method of diagnosis its greatest value and helps it to add to the sum of our knowledge, is its power to form real images, to make tangible shadows where only mental pictures were before possible. These tangible shadows eliminate the personal equation of the observer from the resulting diagnosis, and thus remove a source of error common to all methods that depend on the senses of the individual for the accuracy of their results. To this advantage is added the fact that they produce permanent data which different individuals may study in various stages of the same case or compare with other cases.

The true value of the Roentgen rays and the advance made in their adaptation to medical diagnosis must be judged by the advance in our ability to replace or confirm by skiagraphs the mental images obtained by other methods. In cases where the lesion is extensive, where the symptoms and physical signs are pronounced, the skiagraph may only confirm the diagnosis, adding perhaps a few facts as to the exact shape of an aneurism or the extent of the diseased area. It is, however, in the early stages of disease during its inception, that it aids, chiefly by establishing a diagnosis which our most careful means of physical examination fail to make certain. This it does by differentiating between different areas of dullness, which by other methods present identical physical signs.

The application of this method to medical diagnosis is far more difficult than its application to surgery, for here we must deal with the relative opacities or structures which vary from one another by only slight degrees. To make this possible, the varying qualities of the x-ray must be under the control of the operator, so that he may employ more or less penetration as he may desire, and use at will the x^1, x^2 or x^3 rays. The results already attained in medical diagnosis are perhaps not as practical as those in surgery, but the possibilities which they open up are so great that this first insight gives promise of a future development of even greater value than in surgery.

After presenting skiagraphs which showed the entire trunk and upper extremities of a normal 5-year-old boy and the thorax of an adult male, the author draws a comparison between them and a series of skiagraphs of aortic aneurism. The series of intra-thoracic aneurisms illustrates the accuracy with which we may depict their extent and form, even in portions that are too deeply situated to permit of their difinite determination by percussion, or in aneurisms so small that their existence would be difficult to determine by other means of diagnosis. It is in the cases where our diagnosis is most wanting that the skiagraph gives the greatest aid, and differentiates between small aneursims of the aorta and mediastinal tumors. In a case where the symptoms and physical signs were not sufficiently distinct to warrant a diagnosis of aneurism and might have been accounted for by a spasmodic irritation, an asthmatic attack or some disturbance of the circulation, the skiagraph decided the question and the area of dullness, which might have been due to tuberculosis of the mediastinal glands as was the case in one instance studied, was found to be due to a deep-seated small aneurism. The relative opacity of tubercular glands in the mediastinum has been shown to be less than that of aneurisms.

Although deprecating the prominence which some would give to fluoroscopic diagnosis, the author realizes its possibilities and has confirmed by personal observation the results obtained by others. He believes, however, that its greatest usefulness is in the detection and study of motion, either normal or pathologic, in organs whose motion is beyond the field of ordinary vision. In the study of aneurisms and their pathological expansile motion as observed by the fluoroscope, there is, therefore, a definite addition to our knowledge. The author showed in addition skiagraphs of aneurism of the innominate artery, marked dilatation and hypertrophy of the heart and the condition within the thorax resulting from empyema and thoracotomy. By washing out the stomach and subsequently introducing an emulsion of bismuth in a case of gastroptosis, he was enabled to show the area of the stomach through the bones of the pelvis.

THE X-RAY IN MEDICINE AND SURGERY. *Medical Review of Reviews*, Feb. 25, 1898. —Dr. Samuel Lloyd, of New York, discussed the question of apparatus. He said that excellent results were obtained with the static machine, and that the physician already using static electricity would find that he required but few and comparatively inexpensive additions to enable him to carry on x-ray work. But there was the same unreliability about this method of generating the x-rays that there was about all static machines, and for this reason many preferred an induction apparatus. An important point in the technique was that the intensity of the x-ray should be adapted to the special case under examination.

Dr. Francis H. Williams, of Boston, gave an interesting discourse on the use of the x-ray in medicine. He said that for this kind of work the apparatus must be of the very best. To those who have not followed this branch of the subject, the wide range of usefulness of the x-ray in medicine comes as a sort of revelation. Dr. Williams detailed cases in which months before the physical signs, as usually obtained, indicated tuberculous involvement of the lungs, he had been able by means of an x-ray examination to detect evidences of such a disease process. He showed photographs in proof of his statement that in pneumonia the affected areas of the lung could be readily distinguished by the fluoroscope. The chief points noted by fluoroscopic examination of the thorax are: (1) the presence of dark areas in tuberculosis, pneumonia, carcinoma, gangrene of the lung, infarction, pleurisy, and empyema; (2) the occurrence of abnormal brightness in emphysema and pneumothorax; and (3) restriction of the excursions of the diaphragm, and the altered position of the latter.

Dr. Arthur L. Fisk, of New York, and William Hailes, of Albany, completed the presentation of this subject by a lantern exhibition of what had been actually accomplished by aid of the x-rays.

Bismuth Capsules.

BUFFALO, N. Y. Feb. 21, 1898.

TO THE EDITOR:—In your issue of February 19, you quote from a report of Boas and Dorn, in the *Deutsche Med. Woch.*, regarding the use of capsules of bismuth for location of lesions in the alimentary tract. As this is an important matter, in regard to which priority is, naturally, a matter of interest, will you kindly put on record the following data:

Feb. 9, 1897, I used gelatin capsules containing reduced iron for this general purpose, having had the matter in mind for some months. This experiment was a failure, on account of a lack of power of x-ray apparatus, so far as the stomach was concerned, though the capsules could be plainly seen in the mouth. July 13, 1897, this method succeeded with three or four patients, using both iron and bismuth in the capsules. These experiments are more fully reported in *Medicine*, February, 1898.

Very truly,

A. L. BENEDICT, M. D.

The Journal of the American Medical Association., March 5, 1898.

FOREIGN BODIES IN THE ESOPHAGUS.—At a meeting of the Paris Societe Medicale de Hopitaux (*La. Med. mod.*, VIII, No. 94, p. 752) Dr. Variot reported a case of a child who when ten months old swallowed a small metallic plate (2-5 by 1-5 inch in diameter) while playing with a rattle in his mouth. This foreign body remained imbedded in the esophagus for a year, when it finally came out by a violent fit of coughing.

During all that time the child had occasional fits of coughing, slight dyspnea, and could take nothing but milk; bouillon and eggs he could not swallow. Another case reported by the same author was that of an infant eight months old, who swallowed an O'Dwyer tube. It gave rise to no disorders, but the x-rays showed that it was imbedded in the duodenum. At the same meeting Dr. Rendu reported the case of a boy of ten years who swallowed a coin, which, as the skiagrams showed, became arrested at the middle of the esophagus. The only symptoms were occasional attacks of cough and dyspnea.—*Pediatrics.*

ROENTGEN'S discovery is daily applied to fresh purposes. Radiography has now become really practical. The use of the fluorescent screen, which is becoming more and more general, supplies a new method of clinical investigation, which already renders undoubted service and from which yet greater results can be expected. Anatomy, surgery, medicine, have abundantly profited recently by the new rays. They also seem likely to be employed with advantage in therapeutics.

M. Pean has utilized the Roentgen rays to determine the position of a coin swallowed by a child. He drew special attention to the difficulty of recognizing the presence of foreign bodies by the usual methods when children continue to imbibe liquids and do not complain of any pain. Their frail limbs and delicate bodies are easily traversed, and the osseous parts being nearer to the screen which receives the projection, the result is that the image is smaller, clearer, and more close to nature.—*Journal of Electro Therapeutics.*—March, 1898.

MM. E. DESTOT and L. Berard, of Lyons, by combining the use of the Roentgen rays with that of the stereoscope, have succeeded by a logically calculated system of metallic injections in throwing light upon the points hitherto obscure in the circulation of various organs.—*Journal of Electro Therapeutics,* March, 1898.

Progress Comes Only By Improvement.

In the treatment of pneumonia, in addition to an antipyretic, we must have an analgesic. Garofen is both an antipyretic and analgesic; and thus reduces the fever, relieves the pain, and quiets the restlessness so often seen.

The most thorough and careful clinical tests, both in health and disease, by some of the most brilliant men in the medical profession, have established beyond all doubt the value of Garofen as an analgesic and antipyretic. Added to this is the unprecedented and almost unexpected unanimity in the verdict of those who have and are using it. Letters of recommendation and testimonials, unsolicited, have come from all quarters, and that among them should not be a single criticism or complaint, seems almost incredible.

It is absolutely non-poisonous, and in every way reliable.

"The physicians of Missouri, Illinois, Arkansas and Texas are to be congratulated that St. Louis offers them in the St. Louis Physician's Supply Company, a house where they can get their drugs, instruments, tablets, fluid extracts, and surgical sundries. This house tries to fill all the wants of a physician. The president of the company, and also manager, is an experienced druggist, and superintends the manufacture of their specialties for physicians, for which they have a large sale among them.

"To the country doctor, who furnishes his own medicines, they are just the thing, being palatable, reliable and cheaper than the many proprietary remedies advertised.

"Their 'Quina Lyptus,' advertised on page x will no doubt have a large sale during the coming chill and fever months."

The recent circular on "X-rays and Electro-Therapeutics" issued by the L. E. Knott Apparatus Co., is worthy of careful inspection. Physicians who are looking for an effective outfit which will combine the advantages of an x-ray and electro-therapeutic generator will be interestedin the instrument there described.

Diphtheria and Diphtheritic Sore Throat.—Campho-Phenique, in the form of a spray is superior to all other remedies"—Drs. Collingham and Melton, Aurora, Mo. "I find Campho-Phenique remarkably effective in diphtheria and diphtheritic sore throat, used as a spray."—Dr. L. A. Roth, Springs Forge, Pa. "Campho-Phenique well diluted, and used as a spray, has great energy and effect in diphtheritic sore throat." F. H. Lutterbeck, Anthony, N. M. "I have met with such excellent results with it in the treatment of diphtheria that I would not undertake to treat a case without it. My formula is: Campho-Phenique, two parts; water, two parts; mistura acacia, four parts. Suspend the Campho-Phenique, in the mixture and apply with a probang,"—Dr. John E. Pritchard, No. 1010 Chesapeake St, Baltimore, Md.

Polk's Medical and Surgical Register of the United States and Canada is now undergoing its fifth revision. Physicians who have not given their names to the canvassers are urged to report to headquarters at once, giving full information. Address, R. L. Polk & Co., Detroit, Mich.

Pain in Otitis.—Dr. George H. Powers, Professor of Ophthalmology and Otology in the University of California, San Francisco, in an article in *The Medical News*, writes as follows, inreference to the treatment of pain in otitis: "At my first visit I found a copious discharge of bloody serum from the ear with hardly a trace of pus. He suffered from severe cephalalgia, but there was no special tenderness in or about the ear, and no swelling. Thorough cleansing of the meatus with dry cotton relieved the pain in the head remarkably, and with a dose of antikamnia, 10 grains, he slept some hours."

Garofen In Malarial Fever.

From Garofen I obtained full analgesic and antipyretic effect claimed for the agent. In malarial fevers, which are very prevalent in this district, produces the happiest effects. It reduced fever without the excessive sweats that the coal-tar group do, and it does not depress the heart's action as they do. As a pain reliever I consider it superior to any of the coal-tar products. I well remember a child whose fever and pain could not be relieved until Garofen was prescribed. F. R. WHEELER, M. D. Stottsville, Ark.

SOME of the prepared foods are advertised in newspapers and circulars on the cure all and "Save the doctor bill" plan. We have noticed some of their advertisements wherein the wonderful properties of the foods are extolled as cures for a long list of diseases. The Imperial Granum Food, however, is advertised only in the medical press and is sold only through the recommendation of the profession. It deserves the support of physicians on this account therefore, as well as for its merits as an ideal prepared food.—*The Wisconsin Medical Recorder*, February, 1898

THE TREATMENT OF DISEASE BY ELECTRIC CURRENTS.

A handbook of plain instructions for the general practitioner. By S. H. Monell, M. D., Brooklyn, N. Y. Published by William Beverly Harison, 3 and 5 West 18th Street, New York. 1088 pages.

Another extremely valuable work on electro-therapeutics has been launched by the same author as the recent publication, "Manual of Static Electricity in X-Ray and Therapeutic Uses," which has attracted world-wide reputation thus early for its clearness of description, and usefulness to the general practitioner

It would be impossible for us to specialize the headings of the 70 chapters in this volume in the space allotted for this review, therefore it must suffice to state that every known modern employment for faradic, galvanic and static electricity and their therapeutic indications are detailed in this volume with conciseness of language and minute directness of application, so that the general practitioner may read and understand.

Probably no book on electro-therapeutics, and we say it conservatively, has ever equaled this volume for value to those of the profession who would use electricity as a therapeutic agent, and he who does not use it at this age is certainly not up to the times in his profession.

We therefore heartily recommend this volume to our readers, believing that they will not be disappointed in adding it to their libraries.—*Medical Times and Register*, Phila., Pa., January, 1898.

Manual of Static Electricity in X-Ray and Therapeutic Uses,	$6 00
Treatment of Disease by Electric Currents,	$7 50

Eureka Springs, Ark.,

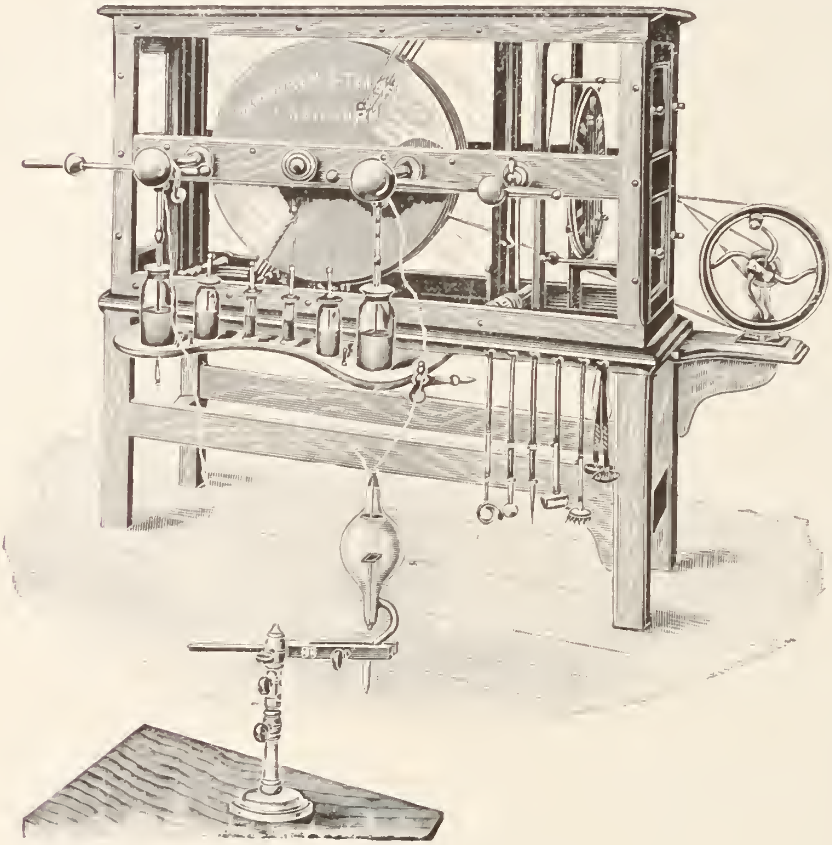
As a summer and winter resort cannot be surpassed. To this famous all-year-round resort round-trip tickets are on sale from all principal cities throughout the country at greatly reduced rates.

Double daily trains from St. Louis. A neat little pamphlet giving detailed description of Eureka Springs will be mailed free upon application to GEO. T. NICHOLSON, Gen'l Pass. Ag't., Frisco Line, St. Louis, Mo.

The Morton-Wimshurst-Holtz Influence Machine,

FOR THERAPEUTICAL AND X-RAY PURPOSES.

BEST IN THE WORLD



BEST IN THE WORLD

THE MONELL STATIC TUBE.

St. Louis, Mo., Jan'y 16, 1898.

Van Houten & Ten Broeck,
New York.

Gentlemen.—The machine is a model of *mechanical skill*, and is a source of constant delight and admiratiou to those who have seen it. Those who have experienced its *potency* in disease, are loud in its praise, and as for myself, there is no one agent in the whole realm of scientific medicine, that gives me so much satisfaction in its employment, as does Static electricity.

The tube you sent with the machine, has developed into one of high efficiency. Heart pulsations are plainly seen, and objects such as a watch-key, tin horse-shoe and star, such as found on "Horse-Shoe" and "Star" tobacco, are plainly visible through a ½ inch pine board, at a distance of about 28 feet. My friend Dr. . . . . witnessed this tube in operation January 13th, and he coufesses that he had never seen X-radiance before, such as was shown with my 8-plate machine, and Monell tube. I will say that Dr. . . . is one of a committee appointed by the Faculty of the . Medical College to buy an X-Ray outfit and he came to my office predisposed in favor of a coil.

I think there is now but little doubt that he will favor a Static machine.

I beg to remain very truly yours,

WM. W. GRAVES, M. D.

VAN HOUTEN & TEN BROECK, 300 Fourth Avenue, NEW YORK.

Makers of High Grade Electro-Therapeutical Apparatus.

THE AMERICAN
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CONSUMPTION of the lungs is the cause of nearly two-sevenths of all deaths due to disease. If consumption could be prevented the average life of the civilized races would be extended to beyond 48 years. The stamping out of any one other disease would make but little comparative change in the relative life of the human race, unless we should rate old age and drunkenness. When cholera suddenly sweeps over a country, mankind stands aghast and the wheels of society are profoundly disturbed, and yet the mortality over a large area of country from an epidemic was never known to equal the ever prevailing mortality of consumption. So undisturbed has mankind settled down to the seemingly inevitable that fear of such a disease scarcely more agitates the mind than the thought of old age. There is another aspect to this question that deserves the gravest consideration. I refer to the impoverishment consumption inflicts upon a community and a nation. The average worth of man in the United States is about $1,000.00. Since consumptives are carried away as a rule at the prime of life, the loss is immeasurably greater for this particular disease.

Up to within a few years ago consumption was considered an incurable disease; but within recent times cures are not uncommon. These results have been brought about by the improvements in our knowledge of the local conditions and in the means of treatment. But the greatest difficulty is in making a proper diagnosis in the early stages of this disease. The writer firmly believes that the mortality can be reduced to one-half or less by the means we now employ if used before cavities have formed or extensive lung infiltration has occured.

It is impossible to make a positive diagnosis of pulmonary phthisis at all times in its incipiency. In fact considerable impairment of the lung may exist without physical signs to warrant a diagnosis. The changes sometimes go on for a long time with increasing infiltration of the lung without a noticeable change in its sonority or modification of the vascular murmur.

Laryngeal symptoms often obscure these signs of early disease. The most skilled diagnosticians fail in these cases when they rely upon auscultation and percussion.

The need of a more satisfactory method for diagnosing pulmonary tuberculosis has been seriously felt. The introduction of the x-rays as a diagnostic agent has widened our knowledge in this direction to the point at least that early infiltrations can be detected in the lungs when no known physical signs could. This has been proven time and again. Even where cavities have existed and could not be detected by the usual methods they were pointed out unerringly by the Roentgen light. Probably the most exhaustive study in this line has been made by Dr. J. Edward Stubert, of Liberty, N. Y. Others have confirmed his observations. In the doctor's reprint from the *Yale Medical Journal* he recapitulates as follows:

The results of investigations made by Dr Stubert at the Loomis Sanitarium, by Williams, of Boston, and others prove that

1 The fluoroscope is an accurate agent for corroborating and extending diagnosis made by the ordinary methods.

2 It is capable of demonstrating foci of tubercular infection earlier than they can be distinguished by the ear

3 It shows either uni- or bilateral enlargement of the heart and all displacements of that organ

4 Emphysema, asthma, pleurisy hydro-pneumo-thorax, pyo-pneumo-thorax, hydro-thorax and pneumonia, are all easily recognized and their limits demonstrated. In the last-named disease it has been claimed that a more certain prognosis may be assured by the use of the fluoroscope

5 Thoracic aneurisms are recognizable in their early stages.

A summary of the diagnostic signs are as follows

1 Slight haziness indicates the beginning of tuberculous infiltration and may or may not be accompanied by dullness.

2 Decided shadows indicate consolidation, the extent of which is in direct relation to the comparative density of the shadow thrown on the fluoroscope.

3 Circumscribed spots of bright reflex, surrounded by narrow dark shadow rings, or located in the midst of an area of dense shadow, indicate cavities

4 Intense darkness, especially at the lower part of the lung indicates old pleuritic thickenings over consolidated lung tissue.

5 Pleural effusions are shown in black shadow the upper level of which may be agitated by succussion

6. There is no reason to doubt that the effusion of pericarditis would throw a like shadow which would be distinguishable from the heart shadow above by its greater blackness.

7 Shadows thrown in the first and third stages of pneumonia probably resemble those of tubercular infiltration The shadow of the second stage of pneumonia is identical with that of tubercular consolidation.

8. In emphysema and asthma the reflex is abnormally clear and the movement of the diaphragm is restricted

A great deal depends upon the intensity and steadiness of light and the amount of muscular and adipose tissue intervening between it and the fluoroscope At Loomis Sanitarium an eight-inch spark coil has been found most satisfactory The motor generation gives a steadier light than a vibrator, and the flickering of the latter is very trying to the eyes and confusing as to the relative intensity of shadows.

Considerable practice is necessary before the eye can appreciate perfectly the fine differences of shade and outline

Examinations in this line are not confined to this country, and I do not know that we can make just claim to priority in the use of this aid to diagnosis. The French have from an early date used the x-rays as an assistant in the study of thoracic disease. The outcome of this research was a confirmation of the x-rays as a diagnostic agent for confirming or disproving incipient phthisis. The German physicians are making more universal use of the x-rays than any other nationality. It is to be expected that they would since it was their discovery. The English use of the x-rays is about in line with the practice of this country.

Ever since the introduction of the chemical test of urine for the fairly accurate diagnosis of kidney disease, a standing request has been made by the medical profession to the public to have the kidney's excretions analyzed at repeated intervals throughout life. This would give an opportunity to detect a serious disease in its earliest attack, and at the time it might be cured. The diseases of the kidneys are infinitely less numerous than those of the lungs when mortality is considered. The means now offered for detecting lung involvement at the earliest period, is accurate and safe, but entails some considerable expense and study of technic, but its relative importance outweighs all difficulties. No generating apparatus for the productions of x-rays should be employed that require noticeable time for the light to cast shadows through the body, and the position of the patient should never be nearer than six inches from the tube. The light should be as steady as an incandescent lamp. The fluoroscopic screen should be made of the finest fluorescent crystals. With an outfit of this kind it is possible for every physician to detect consumption, the greatest enemy of the human race, before the ravages of disease have destroyed the hope of repair. As physicians, it is our duty to encourage x-ray examinations of a wide class of suspects with the view of lessening the progress of this disease. Especially should this encouragement be given to all persons with a hereditary dyscrasia, those who are induced to cough from slight changes in the temperature and humidity of the weather, and the catarrhal class. It is well known that caseous phthisis following catarrhal pneumonia is often rapidly fatal, but if prolonged to a period of chronicity can be cured. The particular form of chronic caseous consumption is so gradual in its onset that the early symptoms evade all hitherto known methods for diagnosing the disease. The x-rays will early reveal that which it was formerly impossible to know. When the pre-tendency to tuberculosis has come by way of inheritance, every symptom of ill health not accounted for, until the patient has arrived at 40 years of age, should be examined with the x-rays. That so called fibroid phthisis, although the most chronic form of the disease, is the most amenable to treatment in its earliest attack and the most rebellious when arrived at an advanced stage.

There is no region of the earth equal to the United States for adaptability of climate, and no nation of the earth equally prepared to lend assistance to this class of unfortunates. The efforts shown already by the medical profession to take advantage of the x-rays for purposes of early diagnosis of phthisis pulmonalis, is a guarantee of less suffering with this particular disease and an assurance that there is a lease to be given to the average longevity of man.

A NEW machine has just been made for generating x-rays which weighs only 25 pounds and is about the size of a Webster's unabridged dictionary. This apparatus, according to the *Electrical World*, will send enough rays through the body to illuminate the fluoroscope. The machine was gotten up for the Cuban war and is the invention of Prof. R. A. Fessenden, of the Western University of Pennsylvania.

The importance of the x-rays as an assistant in military surgery is recognized by the Surgeon General who has ordered the several divisions of the army to be equipped with the machines. We are a little behind in this matter, for every first-class nation have long since provided themselves with this machine as one of the necessary adjuncts of the army.

The small apparatus above mentioned is worked with a dynamo which may be driven by a gasoline motor or a gas turbine.

X-ray machines of low generating capacity are of little use, very disappointing if not actually harmful. The interior light causes the operator to approach the tube for greater radiance. It is here where the electricity is passing and human tissue brought into the electrical field and exposed for any considerable time will likely suffer alteration. This effect is what has been called x-ray burns, although the x-rays played no part in the pathological change. A poor x-ray apparatus is not to be relied upon. The distortion of shadows are observed which may pervert the true diagnosis. Failures of this kind have a tendency to bring discredit upon the most useful discovery of the century. Articles in journals have recently appeared in which the experiments related clearly indicate the inefficiency of the apparatus used. For army service there should be nothing used short of the best. Radiance incapable of revealing a good view of the hip joint at twelve inches is an unsafe and unreliable light for other regions of the body.

Mr. Lynde Bradley, of Milwaukee, according to the *Pittsburg Dispatch*, has been employed by the Government to assist in equipping the army with x-ray machines. Mr. Bradley has invented a carriage for the safe conveyance of the machine in the field and a separate conveyance on wheels for the engine, boiler and dynamo. For field use the spark will be about 12 inches and for hospital and for the navy from 12 to 20 inches. These machines cost about $700 each, but great saving of life and deformity will amply repay the Government. The Spanish authorities have ordered x-ray machines from a manufacturer of this country. It is argued that it would be patriotic to fill the order, since the use of the machine for our captured wounded would be in their hands a commensurate blessing.

In the February issue of The American X-Ray Journal we reproduced two radiographs one each of an adult man and woman both of whom were fully dressed at the time the picture was taken. In one, the clothing was very indistinct and mostly invisible, while in the other the clothing showed remarkably clear. The particular reason for this phenomenon elicited inquiry from many sources.

We therefore offered the following: The American X-Ray Publishing Co. offers a premium of $10 for the most instructive article explaining the reasons for the difference in appearance of the two radiographs.

The award was promised in May on the day of going to press with this issue.

The committee after carefully reviewing the manuscripts of the several contestants have given the premium to Walter W. Johnson, M.D., of Pittsford, Monroe Co., N. Y.

Radiostereoscopy.—Hedley. Lond. *Elec. Eng.*, March 11. *The Elect. World.* —A brief abstract from the London *Lancet*, in which he gives a formula for the lateral displacement which should be given to an x-ray tube when taking two negatives for use with the stereoscope, when the distance of the object and its thickness are known. The formula is that the relative displacement of the tube and object is equal to the distance of the tube from the object plus the thickness of the object, then multiplied by the former distance and divided by fifty times the thickness of the object. When the displacement is equal to the distance apart of the eyes, say 6.6 cm., the virtual image appears at the distance that the object has been photographed from, and is the proper size. Therefore, when practicable, the displacement should be 6.6 cm.; when this is known, as also the thickness of the object, the same formula can be used to calculate the distance of the object from the tube. He has verified the accuracy of the method experimentally.

TWO RADIOGRAPHS.

The radiograph, No. 1, in the February number of *The American X-Ray Journal* was made entire, I believe, on a celluloid film.

The tube was placed four and one-half feet above the subject and the exposure, I have seen stated, as one-half hour and in one journal as one hour.

The composite radiograph No. 2, on the opposite page, is much superior in sharpness and definition.

In analyzing the difference between the two radiographs it is necessary to have some understanding of the photographic film and the action of light and certain chemicals on the same.

The film is composed of an emulsion of gelatine and chemicals of which the bromide and iodide of silver make it sensitive to light.

Light in some manner affects the silver salts so that various chemical solutions called "developers", oxidize or bleachen the film in proportion to the amount of light striking any portion, from the faintest gray to a jet black.

If a fresh, unexposed plate be placed in a developer, not too strong, no change will take place; but if any portion of the plate be exposed, even the shortest time to active light and then placed in the developer, the exposed portion will quickly begin to darken, while the unexposed portion will remain light.

The amateur photographer eagerly makes his preparation for developing his first negative—a landscape, let us say. He gently lays the exposed plate in the tray, pours the developer over the film and slowly rocks the tray. The fluid swashes back and forth across the face of the plate a few times and all at once the anxious watcher sees a change come over the film. He sees the tops of the trees and roofs of houses like white silhouettes against a dark background. He sees that this dark background is the sky portion of his negative. He no sooner discovers this than he notices that he is getting those beautiful fleecy clouds he admired so much. There they are, mass on mass, as sharp and clear as anything he ever saw.

He pats himself on the back. This is a triumph. No amateur of his acquaintance gets such beautiful clouds in their picture and here at his first attempt is a gem.

But hardly does the foreground, the trees, buildings and figures begin to show any detail before the beautiful clouds begin to grow dim and sink into the general blackness of the sky portion and when the negative appears properly developed they have entirely disappeared. To be sure, he can see them faintly through the finished negative; but they do not appear in the print and he learns that so far as the clouds are concerned his plate has been exposed much too long. His picture may be fine but the clouds will not appear.

The x-rays or Roentgen rays act on the photographic film similar to light, blackening it in proportion to the amount of rays striking the film.

Any object, cutting off all rays from the film, leaves that portion unaffected.

When nothing interposes, the film is affected most and between these two points, the affected and unaffected, we have every shade of gradation.

Radiograph No. 1, is like the first negative of the amateur photographer. The clothing of the subject is like the fleecy clouds. The negative was very much overexposed so far as the clothing was concerned and though it can probably be seen when looking through the negative, it disappears in the reproduction the same as the cloud from the print.

It will be noticed that the pelvis in No. 1, is very well shown. This portion of the body demands a longer time for a good radiograph than any other and the ratio of difference is so great that not only the clothing but even the flesh of the hands and all muscular detail are lost.

Radiograph No. 2, is a composite, that is made up from a number of smaller plates. The distance of tube from plate and time of exposure varied according to the size and thickness of the parts taken. The result was that no part was overexposed and the thinner portions of the anatomy and the clothing did not suffer in the development and reproduction.

The length of exposure has much to do with the resulting sharpness of outline. An overexposure produces a "fuzziness" which, in ordinary photography, would be called "out of focus."

Compare the nails and eyelets in the shoes of No. 1, with those of No. 2 and you will see what I mean.

The negatives of such radiographs as No. 2, seem to show the very texture of the bones and one can hardly realize that the outline of the several parts appears in a single plane.

In ordinary photography there have been several kinds of special plates made to overcome the trouble of photographing very light and dark objects on the same plate without overexposing the one and underexposing the other. The "non-halation", or multiple coated plates are used for interiors where there are windows and most violent contrasts. It has never been my privilege to work these plates, but I would suggest that they seem to me peculiarly adapted to x-ray work where some part is very much overexposed in order to give another portion proper time. The isochromatic and orthochromatic plates are used in photographing colors, paintings, landscapes, &c.

With these plates the clouds are most beautifully shown in the landscapes and as they are more sensitive to the red end of the spectrum they might be found in some respects superior to the ordinary plate in x-ray work.

As St. Louis is the headquarters of several of the largest plate manufacturers, would it not be a good thing for the editor of *The American X-Ray Journal* to give us a report of the efficacy of these special plates compared with the ordinary?

WALTER W. JOHNSON, M. D.
Pittsford, Monroe Co., N. Y.

DISTORTION MEASUREMENTS IN SKIAGRAPHY. Schmidt and Fuchs. *West. Elec.*, March 26.—A short article on the distortions of the shadows, which it is claimed are well known to all experimenters with x-rays; they give the results of experiments "to determine the limits of this variation for practical purposes" (but what variation is meant is not clear); these limits are said to give appropriate information on the distortion when the distance on the tube and the thickness of the object are known; they also speak of a focus point and focus line, the meaning of which is not quite clear. They found that the distortion is directly as the distance of the object from the focus line, and directly as the distance from the focus plate; the results are given graphically and enable the distortion to be found for different conditions.

RECENT APPLICATIONS OF RADIOGRAPHY. Goodspeed. *Elec. Eng.* March 24.—*The Electrical World.* N. Y.—A brief abstract of a recent Franklin Institute lecture; the abstract contains very little information. Regarding the nature of x-rays, he states that at present the consensus of the best opinion is that these rays are produced by transverse vibrations in the ether, similar in nature to ordinary light, but of a vastly greater frequency; a quotation from the opinion of Stokes is given.

SKIAGRAPHS.

BY DR. OTTO L. SCHMIDT, OF CHICAGO, ILLS

(Kindly furnished for reproduction in THE AMERICAN X-RAY JOURNAL.)

Fig. 1 represents a skiagraph of a patient referred to Dr. Schmidt by Dr. F. W. Rohr, to whom indebtedness was acknowledged for permission to print it. The patient was fifty years old, presented the typical signs of aortic aneurism. There was a large dull area over the upper part of the sternum and to its right; this was pulsating, but did not project. There was a systolic bruit, different pulses, and cardiac hypertrophy. The skiagraph was taken by placing the sensitized plate on the chest with the discharge tube behind the patient. The time of exposure was seven minutes. The picture shows the inner ends of the clavicles, the sternum, the diaphragm

FIG. 1.

and upper border of the liver. The triangular shadow of the heart occupies a space lower than in normal skiagraphs of this region. The large round shadow taking up the greater part of the centre

FIG. 2.

of the picture is the aneurism, which in the picture is larger on the right side. Another picture where the plate was on the back showed an extension downward of the aneurism, on the left side of the vertebral column.

About one month after the skiagram was taken the patient died. The postmortem examination by Dr. H. E. Sauer showed the aneurism almost the same size as shown in the picture. It was saculated and formed of the transverse portion of the aorta. In addition there

FIG. 3.

FIG 4.

FIG. 5.

was a smaller cylindrical tumor on the descending aorta, which was indicated in the second skiagraph. The accompanying skiagraph shows the size of the tumor accurately, as the sensitized plate was very close to it and the Crookes' tube only twenty inches away.

Fig. 2 shows a normal knee in flexion at 90 degrees. The large knee-cap in this position is very noticeable. This picture was taken for comparison with the skiagraph of a knee that contains a so-called "floating cartilage" not shown in this issue.

Fig. 3 is a skiagram of an old fracture of the elbow joint. In the original picture the dark lines are in course of the brachial artery. Since this has been shown in a number of skiagraphs it is without question a picture of the artery itself.

Fig. 4 represents the same elbow joint as shown in Fig. 3, but from a different point of view.

Fig. 5 shows 26 shot in the forearm but in the negative 40 shot are plainly seen. The half tone does not reproduce all there is in a negative, the latter, of course, is therefore the more valuable for the surgeon.

EXISTENCE OF ROENTGEN RAYS IN CATHODE RAYS. Roiti. *Acc. Lincei*, 6-2, 1897; abstracted in *Science Abstracts*, Jan. *The Electrical World*, N. Y. He describes experiments confirming the result that Roentgen radiation is due to transformation of cathode rays and not to a simple subtraction; there probably do not exist cathode rays which can not be deflected, or if they exist, they can not be transformed into Roentgen rays; eliminating the effects of occluded or adherent gas, it is found that different pure metals emit Roentgen rays under cathode ray impact, which increase regularly with the atomic weight.

Is There a Relationship Existing Between The X-Ray and the Luminating Power that Obtains in Telepathic Vision?

(Concluded from page 217.)

BY J. J. FLY, M. D.

In a former communication, we showed from experimental investigation, that ordinary light force through a process of trajections could be followed from the ordinary to the inordinary; from the visible to the invisible, and when sufficiently reinforced through proper mediums could be utilized in illuminating opaque bodies, that had hitherto been considered impervious to light.

We also sighted the fact, that this finer modification of light, not only appeared or seemed to originate in a more attenuated atmospheric medium, but that it seemed peculiarly adapted to it, and, that it exercised its function in that medium, and did not seem to come within the visual range of normal perception.

It was through the happy thought or accidental interference of the phosphorescent screen, that these more rapid vibrations were coaxed and tempered into a coalition with the slower rate of motion operating in ordinary vision.

It was Crookes, and not Roentgen, who supplied conditions for the x-ray; it was Crookes who made it possible for the accident that fell to Roentgen, yet, Roentgen and Crookes were operating along the lines of the natural forces, and could not help but discover more, as they advanced along hitherto untrodden paths.

It is for one man to note a part of the environments surrounding a thing, and for another to see another, and it is the data that all have discovered, that leads to all legitimate conclusions.

Now, since it has been proven that there is a finer light, whose function does not apply to the ordinary uses of man, and as man is supposed to be a representative, or epitome of all the forces of the universe, it is natural to conclude that there is a chord within his nature, that vibrates in unison with every force in the universe around him; that he is an intelligent, conscious, receiving station, acting as a relay for the reinforcement and gradual accumulation of facts pertaining to the laws and principles of all cosmic action.

There is an external and an internal side to every expression of nature. and man forms no exception to the rule. Man has his functions that bring him into relation with the external expressions of nature, and allows him to study them, and become conversant with them; and, he has found that there are deeper lessons to be learned than appears on the surface of things; he has found that he possesses attributes of greater penetrating power that are equal to, and quite as mysterious as the ordinary senses.

The faculty that constitutes this extraordinary sense has been demonstrated the "sixth sense."

It matters not that such a sense has been disputed; it stands to reason from the foregoing argument that it does exist, and thousands of men and women can affirm it from data coming from their own experience.

Every one possesses it; some realize it, while many do not; all could, and many have, while at the same time they did not, or would not recognize it.

It is a property of the subjective mind, and not a function of the objective; it is of the inner, and not of the outer man; it belongs to the immortal and is of the infinite spark that has kindled man's individuality into existence. Therefore, its function is to bring the soul into closer relations with the infinite. It is not bound down by time and space any more than a ray of light from the radiant sun: it is the motor of the soul, or the resultant motion of the vibrating elements of the soul whose nature is attuned to a soul ether, whose atoms shiver and oscillate at the same rate of motion. It is a thought realm, and the motion of a desire is caught up by the circumambient ether, which flash the thought vibration from pole to pole, or from planet to planet without regard to time, matter or space.

The force by which a thought is transferred, must be an entity, and the medium that carries the thought, becomes itself resolved into a series of motion that may be caught again by the sounding-board of another mind, and by it, be translated like the rays of the telegraph line are made to tell the thoughts of the operator. It may be better illustrated in the words of an able exponent who says: "As a lamp gives light because it is able to set the light ether in motion, giving off waves therein, so the brain gives waves or pulsations in the psychic ether. These waves go outward and form a sphere of the individual as the waves of light around an incandescent body."

There is not only such an aura surrounding every individual, but his every thought takes on the image of the things thought of, and occupies a place in his particular atmosphere.

To make our conception more plain, we will illustrate by giving an example: Two harmonious persons conclude to try an experiment of thought reading.

A, after being blindfolded, takes a seat at one side of a room, while B; lays down an object—a card—a knife, a paper weight, or anything he chooses to think of, and concentrates his mind upon it.

A proceeds to put all thoughts out of his mind and determines to pose in constant expectancy of seeing the picture, or image of the object. B is thinking about what is drawn in detail before him. Sooner or later, A feels himself entering into a quiet, easy state, bordering on to numbness; foggy, vapory looking clouds come and go before his face, which he appears to see just in the same manner as he would see with his natural eyes, the sensations being the same.

He is now lost to everything except the vapory looking clouds before him, and, while he watches them, they suddenly disappear, and he sees a brilliantly illuminated firmament, which at times is painted with its entire spectra of colors, which commingle and blend into each other in the most beautiful fashion.

While he is watching this beautiful play of colors belonging to this inordinary realm of sight sensation, the atmosphere of diversified colors begin to disappear, and finally they have resolved themselves into a clear screen or background of blue upon which appears a clear and clean cut object—a knife—a card—a person, or animal; it remains for a moment only, and disappears as he finds that he is exerting himself to see it more particularly. He then remembers that passivity and concentration are the conditions that allows a conscious recognition and success in the experiment; consequently he again brings the pulsations of his mind back to that uniformity of motion that beat in sympathy with the motion of the image, and it reappears again; it appears and disappears, under such exact similarity of mental condition that he not only learns that there is a meaning in the occurrence of the special psychics formation, but that a particular state of mind is a necessity which he now realizes more than ever.

Now, if B thinks of a knife, and A sees the image of a knife floating before him; if they try this experiment an innumerable number of times with various objects, and A is universally successful, or successful in a majority of instances in obtaining a mental image of the thought that B concentrates upon, they can come to no other conclusion than that A can really see what is in B's mind.

It matters not, if they are both surprised at the power of B's mind being endowed with the skill of an accomplished artist in painting his thoughts upon this ordinarily invisible firmament, to which A's conscious mind has become attuned; they must admit that it is true. If it were not true, the image would not be there, and, as it is there, it is formed by some intelligent activity; and, as the thought originated in B's mind, he must have been the builder of the image.

Now, if A and B occupy different rooms, and succeed in this experiment in the same manner as before, it signifies that material walls are not an obstruction; if they allow miles of space to intervene, and they still succeed, we conclude that space, and all forms of material obstruction is no barrier against this projected atmosphere bearing the records of every human life.

Again, we will say, that B is miles away, and that A concludes that he wishes to know his whereabouts, &c.

B at this time is not conscious of any attempt on him by A; yet, A quietly settles down, concentrating his mind upon him, and presently sees him, and notes what he is doing. By repeated trials he finds that "coincidence and imagination" will not explain, and he concludes that here is another power added on that is above the ordinary; he carries his experiment further: he wishes to determine the result of a disease, the sex of an unborn child, the result of a political contest, the cause of a "Maine" disaster prior to tangible developments, or any other thing that he is particularly interested in, and he finds at each trial. or nearly so. that a picture or image, showing an action or expression which he afterward verifies by actual discoveries or reports, unerringly comes before him. After this, his faith becomes renewed in the claims of biblical prophesies, and that ancient seers and dreamers were not wholly fraudulent and imaginary creatures.

We have mentioned the power that obtains to the individual who has cultivated the deeper faculties belonging to the human mind, to show the similarity of results arising from its use, and that which accrues from the application of the x-ray.

It is true that the x-ray can not, and never will do, what the development of the minor reservoir of the human mind can do. The mind is an intelligent automatic machine, that is furnished with every attribute necessary to an entity endowed with eternal life; the sensation of sight is one of these attributes; that there may be sight, there must be light; light is a force that conduces to transparency; it renders the atmosphere, common glass and many other substances so transparent that the natural eye sees objects through them as though they were not. The same power of light is obstructed in proportion to the degree of opacity found in different material objects. As the power of the light is increased, it has been shown by science that opaque bodies become more and more transparent until they seemingly disappear, and we feel as though they were not.

From these demonstrated truths, the clairvoyant or telepathist finding his supernormal senses making the same impressions upon his mind as his normal senses do, concludes that the light that illuminates the former is only a higher degree, or greater intensity of the force that operates upon the natural organs. This is conclusive from the fact that we can conceive of but one light force, and though there may be many modifications of it, many degrees of illuminating power, yet the same law pervades the entire range of its varied phases.

By means of a Crookes' tube an invisible light has been demonstrated through the interposition of a medium, the screen; the telepathist brings his own objective nature into a hyper-sensitive condition where it takes the place of the x-ray medium (the screen,) and his deeper so-called subjective being reflects some of the activities of the transcendent light that illumines the invisible world upon his normal consciousness; and thus, he is enabled to realize a foretaste, through this intuitive process, of some of the activities belonging to a supernal world.

ROENTGEN RAY NOTES. ROLLINS. *Elec. Rev.*, Feb. 16.—In this continuation of his very long serial he states that another reason why the vacuum rises is that the residual oxygen molecules are "smashed" and that the molecules therefore contain more atoms and become less in number, increasing the vacuum; they are then decomposed by heat. He claims that the wave length depends upon the molecular weight of the bombarding molecules and that therefore the gas and metal should be tuned to strike the target with the same velocity; this gives a method of determining the molecular weight. He shows why hydrogen and argon are not suited when the cathode is aluminum; also that bad definition is caused by the dancing of the radiant point.

FLUOROSCOPY OF PLEURITIC EFFUSIONS.—Bergonie and Carriere report that the fluoroscope shows the displacement of the liquid as the patient assumes various positions, and with the motion of the diaphragm. Purulent effusions seem less opaque than the serous. But its principal value consists in the information derived in regard to the condition of the lungs above the effusion. It completes Grancher's schemas, reveals bacillary lesions and has a great prognostic value. In one case the clinical data were at fault owing to adhesions, which prevented the "sou" sound considered by Pitres pathognomonic.—*Semaine Med.*, Dec. 15.

X-RADIANCE AND THE LAGGING DOCTOR.

BY FRED O'HARA, M. D., SPRINGFIELD, ILLS

"Doctor, will you please examine my boy's elbow? He sprained it some time ago and our family physician bandaged it. It does not seem so useful as before." Then the physician, thus addressed, after examining the arm carefully, subjects it to inspection by the light of the x-ray, which apparatus he has in his office. "Madam, your son's arm was not sprained, but broken. See for yourself." And he hands the woman the fluoroscope and the Roentgen ray proves that he tells the truth. Five minutes has sufficed to prove that which never would have been demonstrated without the all powerful x-ray, and the doctor has a new name on his rapidly growing list of patients.

The above is not a fancy drawn picture. It is a fact—happening day after day in our land.

Little more than two years ago, the medical world was startled to hear that a new variety of light had been found; to which light, flesh was transparent. The gray bearded vender of sugar coated specifics shook his head and stroked his beard in a self-complacent manner. The medical scientist awaited with impatience the development of this wonderful machine—for he saw how infinitely valuable it would be to the medical world.

Now, things are changed. Our sugar coated friend lives in constant apprehension that the "new-fangled thing" will show up some of his botched work. The "up-to-date" medical man rejoices in his x-ray apparatus, for it saves him many a fretful hour.

"We are rapidly approaching a point, where the doctor who has not equipped his office with an x-ray apparatus, will not be considered 'up to date'." So states a prominent medical journal. and truly, even now in France, England and Germany, such is already the case. The progressive physicians in those countries have taken "time by the forelock", and have not waited to be forced by the educated public into buying the Roentgen ray apparatus. But how about the United States? Pardon. As patriotic Americans we shall not discuss anything calculated to depreciate our idea of our medical world.

"But I don't need it. I made my diagnosis before the x-ray was heard of". That is perfectly true, doctor. But, my dear sir, "seeing is believing." Is there any surer guide to the brachial artery than seeing it spurt?

Doctor, wouldn't it be a source of comfort to know that in the painfully swollen limb of Mr. B., the fractured bones are in perfect apposition? What else could give you this pleasure, besides the x-ray? Your highly developed sense of touch can not do it; the limb is too sensitive for such manipulation. Would it not be balm for your troubled mind to know that a "sprain' is really a sprain and not a fracture? The x-ray will tell you, and you can believe it every time. Candidly now, doctor, wouldn't you be willing to give Mrs. J—'s child a chance for its life, and operate to remove that safety-pin, if you knew where it was? You can not feel it, nor can you see it unless by the aid of Prof. Roentgen's great invention.

The statement that the Roentgen ray is infinitely valuable to medicine, does not need argument. The physicians of the United States are gradually supplying themselves with such machines, and the time is bound to come, when the Roentgen ray apparatus will be by necessity used by every doctor.

Let us be up-to-date physicians—twentieth century physicians if need be. The time is not far distant when our patients will not be content to believe our unproven statements. The public is becoming better educated. The days of magic and mystery in medical practice are numbered. Let us take a step forward toward diagnosing our cases with greater certainty before our patients begin to leave us or before the public drives us to use an x-ray machine. Let us welcome the dawn of public enlightenment (and our own) with an x-ray illumination.

EXTRAORDINARY CASE OF STONE-SWALLOWING.

BY CARTER AND GREENWOOD.

The patient was a man aged 24, who passed under the stage name of "The Human Ostrich." He was admitted to Queen's Hospital, September 29, 1897, complaining of severe pains in the abdomen and vertigo. His mother had lived to be 74 years of age, and his father died at 94. Both had earned their living by stone-swallowing. The patient had four brothers and five sisters, alive and healthy, one of the brothers being a professional stone-swallower. The patient himself was accustomed to give a number of performances daily, and at each performance is careful not to take more than about a handful of pebbles. In selecting his stones he avoids all cornered ones, preferring, if possible, to obtain oval smooth stones, averaging in section, about the size of a half-penny. Within 24 hours he is able to take about 8 pounds of stones, and is careful not to go beyond this limit. At each performance he further swallows pieces of brick and glass, both of which he masticates before swallowing. Occasionally he varies his programme by giving exhibitions of watch and sword-swallowing. For the latter trick he uses a straight twenty-four-inch sword; while it is down in the esophagus he fires off a revolver or balances a 28 pound weight on the hilt. Before passing the sword he shifts the larynx bodily to the left side of his neck, apparently beneath the sterno-mastoid muscle, so that the gullet can be distinctly felt from the front, and leaves a straight course for the sword. In swallowing a watch he selects a lady's watch and pulls it back by means of a string or chain attached to the ring. The stones and other articles which he swallows are passed daily per rectum, and, as a rule, without the least inconvenience. He does not remember when he first learned his performance, having been trained to it from earliest childhood. He states that he once tried to train another person to do the same tricks, but the results were disastrous and soon ended in an operation for intestinal obstruction. He takes an extremely regular and moderate diet, which he never varies: thus, his breakfast consisted of two eggs (swallowed whole, minus the shell), together with "two-pennyworth" of brandy, and a pint and a half of milk. As a rule he takes nothing for dinner, or if he does have anything it is a little porridge, milk-pudding or bread and butter with milk. On examination, the patient was well-developed and healthy in appearance. His tongue was slightly coated. The abdomen was lax; and on succussion, sounds could be distinctly heard, which the patient attributed to the knocking together of the stones inside him; and he was accustomed to demonstrate this to his audience after a performance as a guarantee of good faith. There was marked tenderness with some increased resistance at about McBurney's point. There was nothing abnormal in his heart and lungs.

He remained in hospital for about four days, and then had to leave to look after business matters. While in bed he complained of occasional attacks of severe colicky pain, but in the intervals was quite comfortable. An enema was given with a very good result, and after that he was much easier, and the tenderness moved from the cecal area to the lower epigastric region. Whilst in hospital he passed no stones in the stools, although he had swallowed a large number on the day previous to his admission. With an idea of testing the Roentgen's rays on the case, a skiagraph was taken, but it was not successful inasmuch as the patient was too nervous to keep still.* It is worthy of note that, despite his extraordinary habits, he enjoyed very good health, stating that he had never previously been ill in his life. Further, that although he took quite sufficient food for a practically sedentary life, it was quite inadequate to allow of any manual work. Thus he stated that if he attempted to work in any form with his hands he was very soon tired and had to give it up.

Dr. Carter's opinion was that at the time of his admission one or more stones had become impacted at the ileo-cecal valve, setting up slight local peritonitis; and that the enema having dislodged the obstruction in that quarter, the onward passage had again been delayed in the transverse colon.—*Birmingham Medical Review*, November, 1897, 300.

TRANSPLANTATION OF BONES FROM A DOG.—In 1891 Dunbar removed five of the small carpal bones from a ten year old girl with tuberculosis of the right wrist, curetting the ends of the bones of the fore arm and metacarpus, and substituting five pieces taken from the lower end of the femur of an eight day-old dog freshly killed. The wound was sutured and drained; it healed rapidly and perfectly. He never expected to see those bones again, but when he met the patient recently he had a radiograph taken of the wrist, which showed the implanted bones, exactly as first placed, connected by new connective tissue, a third larger in size, and grown into the matacarpal. The joint is movable, painless, and no inconvenience is experienced in sewing or knitting. The favorable results secured should encourage others to follow the same plan.—*Bull. de l'Acad. de Med.*, *Deu. Med. Woch.*, December 23.

*Undoubtedly the best radiographs are obtained when the subject is in a state of complete repose, but it is not absolutely essential for a fair picture. The failure to produce a radiograph of the above was probably due to an inferior generating apparatus. ED.

X-RAYS IN ACCIDENT INSURANCE.—The Roentgen rays promise to be of much help in determining the extent of injuries to policy-holders in accident insurance companies. One dishonest claimant injected irritants in his arm not long ago, and asked the company for a considerable sum for a broken wrist. A surgeon was employed by the company, and although the member was swollen considerably, presenting much the appearance of a fracture, the x-rays showed the bones to be in perfect condition. The patient was naturally chagrined at the discovery, but still thought he was entitled to $25, which was of course refused.

A still more interesting case was that of a New Orleans man who was thrown from his bicycle, fracturing his forearm. After considerable treatment a physician pronounced the bones united and the patient doing well. The latter, however, thought differently, experiencing sensations in his arm which caused him much pain and uneasiness. The Roentgen rays were resorted to, showing clearly that the bones had never united, and had not even been properly set. A splinter of considerable size was also found to be irritating the skin. The defect was soon remedied, and the period of disability for which the patient could make claim against the company consequently shortened. These cases are thought to have an important bearing upon such matters, since accident companies are constantly having suspicious cases to deal with, in which it has been heretofore almost impossible to determine accurately the justice of the claims made.—*The Electrical Engineer.*

RADIOGRAPHY WITH ITS RECENT APPLICATIONS.

BY PROF. ARTHUR W. GOODSPEED

The first step toward the x-ray tube was made many years ago by Geissler, who produced many curious and beautiful effects by exhausting the air from fantastically shaped glass tubes, and passing a high voltage current of electricity through the rarefied air within. A spark which can travel only nine or ten inches in the air, may in a Geissler tube, pass over a distance of thirty or forty feet. In the Geissler tube only about one-thousandth of the air is allowed to remain. Subsequently Crookes, of England, carried the exhaustion to a much higher degree than Geissler, allowing only about one-millionth of the original quantity of gas to remain in the tubes. On passing an electric discharge, the results were so different from anything ever observed before that Crookes felt compelled to speak of a gas in this state of rarefaction as the "fourth state of matter." It was while experimenting with Crookes' tubes that Roentgen made his wonderful discov ry.

The best authorities say that one cubic centimeter of air under standard conditions contains 100,000,000,000,000,000,000,000 separate molecules flying around with inconceivable velocity in all directions, bumping against their neighbors and the inner surfaces of the containing vessel. By dividing this number by 1,000,000 we find that there are yet remaining in each cubic centimeter 100,000,000,000,000,000 molecules. This then represents the state of things within the tube where the x-rays are generated. Ordinarily the molecule of a gas can move only the smallest fractional part of an inch before striking its fellow molecule, but in the x-ray bulb, the mean free path of the molecule is several inches. When the discharge is sent through the tube, the molecules are projected with enormous velocity from the negative terminal, or cathode. The cathode is a spherical concave aluminum projector which directs the moving molecules against a small rectangular piece of platinum foil, placed at an angle of 45 degrees, in the centre of the tube. The molecular bombardment heats the platinum foil white hot, and if care is not exercised the foil may be melted, although it has a melting point far above that of most other substances. It is here at the surface of the platinum that the x-rays are produced.

As to the nature of the x-rays, the consensus, at present, of the best opinions is that they are produced by transverse vibrations in the ether similar in nature to ordinary light, but of vibration frequently vastly greater.

According to Sir G. G. Stokes, in a paper read before the Manchester Literary and Philosophical Society last summer, "the Roentgen emanation consists of a vast succession of independent pulses, starting respectively from the points and at the times at which the individual charged molecules projected from the cathode impinge on the target. At first sight, it might appear as if mere pulses would be inadequate to account for the effects produced, seeing that in the case of light we have to deal with series consisting each of a very great number of consecutive undulations. But we must bear in mind how vast, according to our theoretical views, must be the number of molecules contained in the smallest quantity of ponderable matter of which we can take cognizance by our senses. Hence, small as is the quantity of matter projected in a given short time from the cathode, it may yet be sufficient to give rise to pulses, the number of which is inconceivably great."

The lecturer then showed a number of lantern slides illustrating the practical application of Roentgen ray photography.

Abstract of a paper read before the Electrical Section of the Franklin Institute.

WHAT IS ELECTRICITY? "*Amer. Elec.*, April.—Comments by Steinmetz, Trowbridge, Webster, Macfarlane, Kennelly, Swinton, Reed, Wolcott and Elihu Thomson on the article noticed in the Digest" March 26, the conclusions of which are favorably criticised. Macfarlane states that those who, in attempting to understand electricity seek for an agent or a force, do not understand the modern doctrine of energy. Kennelly believes it quite possible that an electrical charge is an entity in addition to and apart from the electrical energy which accompanies it; a charged insulated metallic sphere may, perhaps, not only be the focus of electrical energy in the surrounding ether, but may be, possibly, the seat of an entity even if this entity be not a substance; if it could be shown that electrostatic flux consisted of a particular kind of stress or displacement in the ether, then the charged sphere would be surrounded by a distribution of this displacement, which might be called electricity, the energy contained in the displacement being electrical energy. Swinton does not despair of the possibility, not only of light without heat, and of the electrical transmission of power on a large scale without wires, but also even of the obtaining of energy by other means than oxidation of carbon; as, for example, directly from the radiations that come to us from the sun or from other sources internal or external to the earth. E. Thomson thinks that if the truth were well known to us, we should find that electrical actions are far more simple than what we regard as purely mechanical ones; he is led, as a matter of philosophy and speculation, to think that if we could see far enough we should find that gravitation, cohesion, inertia and other mechanical forces and properties, as well as chemical attraction, are in some way dependent upon the electromagnetic properties of ether, and if we really understood the meaning, or could form in our minds an image of electrical actions, we should have the key to nearly all others.

X-RAYS IN DIAGNOSIS OF DISEASES OF THE STOMACH AND INTESTINE. By Drs. J. Boas and M. Levy-Dorn (*Deutsch med. Woch.*, 1898, No. 2.)—The authors found a method of showing, by means of Roentgen rays, the position of the fundus ventriculi, stenosis of the pylorus and probably also stenosis of the lumen of the intestine. By means of this method, the tonus of the muscles of the stomach and intestine can be demonstrated. Gelatine capsules are filled with some mass which is impermeable for x-rays (bismuth); the capsules are coated with some mass which is insoluble in the alimentary tract (celluloid). Capsules thus prepared are swallowed. The fluoroscope gives a dark shade of the capsule, seen as it is descending through the stomach and intestine; even the excursions of the capsule with every inspiration and expiration are observed, as is also the effect of the peristalsis of the stomach. Calculations can be made to establish the anatomical point of the capsule at a given moment: as, for instance, whether it lies in the fundus ventriculi or in the coecum, and how long it remains at each place. The authors are experimenting to find a substance to take the place of celluloid for cases in which it appears desirable to dissolve the capsule at will.—*The Post-Graduate.*, N Y.

LUMINESCENCE BY ROENTGEN RAYS. Roiti. *Rendic dei Lincei*, Feb. 20; abstracted with the illustration in the Lond. *Elec.*, April 1.—He investigated the invisible luminescence produced in metals by the impact of Roentgen rays; he calls it crypto luminescence.

PROPERTIES OF X-RAYS.

ROENTGEN.

A long abstract from the reports of the Berlin Academy of Sciences, 1897, being his third contribution; he gives the results of further observations of the properties. If an opaque plate is placed between the tubes and the screen, covering the whole of the latter, some fluorescence will still be seen even when the plate is directly on the screen; he showed that this is due to the fact that the air around the tube gives forth x-rays; if our eyes were sensitive to these rays as they are to light, then such a tube would be like a light in a room filled with smoke. The brightness of a screen illuminated with rapidly intermittent rays depends on a number of properties which he enumerates. The x-rays from a platinum focus plate which are most active for showing images (perhaps he means for photographic purposes) are those which leave the plate at the greatest angle, but not much greater than 80 deg.; thick plates have a relatively larger transparency than thin ones, that is, the specific transparency of a body is greater the thicker the body; when two plates of different bodies are equally transparent they need not necessarily be so when similarly increased in thickness; the relative thickness of two equally transparent plates of different materials is dependent on the material and its thickness, through which the rays have passed before they reach those plates; the same body has different transparencies with different tubes, "soft tubes" being those requiring a small potential and "hard tubes" those requiring a high one; he states that all bodies are more transparent for rays from hard tubes than from soft ones, and in obtaining images this must therefore be considered, the quality of the rays from the same tube depends on: The way in which the interrupter works; the Deprez form acts more regularly, while the Foucault form utilizes the primary current better; on the spark length in series with the tube; on the insertion of a Tesla transformer; on the vacuum; on other processes in the tube which are not yet fully investigated. A spark gap in series acts like a Tesla transformer, both giving more intense rays which are less easily absorbed; the smallest pressure at which x-rays are produced is very likely below 0.0002 mm. of mercury. The hardening of a tube is not produced only by continuing the exhaustion· to soften a hard tube, air may be admitted; it may be warmed, or the current reversed, or very strong discharges sent through it, but the latter generally changes the character of the tube; good results were produced with a tube containing a piece of charcoal of linden wood. The composition of the rays from a platinum anode depends largely on the time element in the current; the quality of the rays does not change with the changes of the primary current, or at least very little, but the intensity is proportional to the strength of the primary current between certain limits. He draws the following conclusions: The radiation consists of a mixture of rays of different intensity and absorbability; the composition depends greatly on the time element in the current; the rays produced by the absorption of bodies are different for different bodies; as x-rays are produced by cathode rays, and as both have common properties, it is probable that both processes are of the same nature. If two screens are illuminated with two tubes, of different hardness, the illumination being made equal, and if then being replaced by photographic plates, the one illuminated by the harder tube will be blackened much less than the other; rays which produce equal fluorescence can be photographically quite different; the usual photographic plates are very transparent for x-rays; in a pile of ninety-six filaments exposed for five minutes the last one showed photographic action. That the eye is not entirely passive to x-rays is shown by an experiment; in looking at a slit in a metal screen with the closed eye covered with a black cloth and by moving the head, a very weakly illuminated slit will be noticed: this may be explained by assuming that fluorescence is produced on the retina.—*Elek. Zeit.*, March 24.

ROENTGEN RAYS IN THE TREATMENT OF LUPUS.—The *Archives d'electricite Medicale, Experimentales et Cliniques* for January, contains an account of two cases which came under the observation of M. Schonberg. The first case was that of a young man who had been perfectly healthy up to the day on which he had been attacked with the disease. This was in January, 1895, and he was treated in the ordinary manner with scraping, iodoform, cauterization, nitric acid, etc. In 1896 the patient was treated with tuberculin in small doses without any appreciable results.

In March, 1896, the Roentgen ray treatment was begun, and carried out in the following manner: The patient was stretched out on a table, and a tin mask was put over the entire portion of the face which was not affected by the disease. A cap of the same metal also covered the head. The tube was placed at a distance of twenty-five centimetres [about a foot] from the face, and the bobbin received a current of twenty volts and five amperes. The duration of the exposure every day was from twenty to thirty minutes. On the 4th day of April, seventeen days after the beginning of the treatment, the exposed surface showed a very distinct reaction and redness, and on the 8th the dermatitis was generalized. From this moment the ulcerated portions yielded gradually and recovery regularly occurred.

In the second case, that of a woman forty-eight years old, the treatment was carried on in the same manner with equally satisfactory results.

The writer thinks that these two cases are interesting not only because of the results obtained, but also because they demonstrate what a satisfactory therapeutic action the Roentgen rays may produce when they are wisely employed.

TRANSFORMATION OF X-RAYS BY MATERIALS. Sagnac. *L'Eclairage Elec.*, March 12. *The Electrical World.* N. Y.—The beginning of a long article discussing secondary rays, their emission, and the propagation, diffusion and luminous action of x-rays. He had previously shown that a comparison of x-rays with luminous rays does not lead to any positive analogies, but when material intervenes there is a diffusion or dissemination, and he shows that this is a transformation of the x-rays by the material into a species of new rays, which approach the ultra violet rays, and which form a sort of prolongation of the group of known x-rays somewhat as the Hertzian or calorific rays constitute an extension of the luminous spectrum.

VELOCITY OF CATHODE RAYS. Majorana. *Acc. di Lencei*, August; abstracted briefly in the Lond. *Elek. Zeit.*, March 17.—He describes a method which he used to measure the velocity of these rays, and obtained the figure 600,000 metres, although the error is such that it may be 150,000; Thomson, in 1894, gave the figure 190,000; the present author is inclined to believe that the rays vary in their velocities between 100 and 600 km. per second.

MOTOR CARS IN THE ARMY.—It is stated that the Royal Engineer Committee of the War Office has appointed a sub-committee of its members to consider the adaptability of motor cars for purposes of army transport.—*The Electrical Review*, London, March 10, 1898.

FORMS OF ELECTRICAL TREATMENT.

The memorable crusade against electrical quackery some five years ago was immediately followed by a distinct weakening of faith in electrical treatment. Unfortunately, the public memory is a short one, and we have for some time noticed a distinct revival at the hands of quacks of that blessed word, electricity. The claims of the Electrical Hospital of Notting Hill have not, until recently, met with the consideration which they merited; indeed, had it not been for the advertising medium of a coroner and his jury, there is a large probability that the institution would have long remained comparatively unknown. It is unnecessary to detail the whole of the circumstances, but the main facts are that John Salter, an artist, aged 71 years, was found dead at 51 Peel Street, Kensington. The Coroner said "the deceased had received treatment at a so-called 'hospital,' by electricity, but the people being unqualified could not give a certificate, and an inquest was necessary. In some cases electricity was beneficial, but in others might aggravate a disease and accelerate death, which made it a serious matter. He could not understand why people did not go to a proper hospital for treatment." The evidence revealed the hospital to be an institution at Notting Hill, presided over by Prof. D'Odiardi, a name familiar to our readers, who claims to be a medical electrician. Certainly to our own knowledge this gentleman has been associated with medical electricity for a considerable period. It was admitted that the "Professor" had no medical qualifications, but that proved no obstacle to his treatment of consumption, throat affection, blindness, short sight, internal diseases, tumors, influenza, and special treatment of the voice for public speakers, &c. In the case of the poor aged artist he was treated at the Electrical Hospital for muscular paralysis and numbness of the legs, but according to medical testimony the cause of death was syncope. Apart from the very strong rider of the jury and the Coroner, the evidence given was remarkable, most striking developments in electro-medical treatment having apparently arisen at Notting Hill. Our readers are fairly well acquainted with the action of x-rays, yet, "Prof." D'Odiardi is actually using them in the treatment of disease. The Coroner, in his examination of one of the nurses, asked the following questions:—

Nurses are sent out with apparatus, including that for the x-rays?—Yes, for diseases; they did not take photographs.

With what object?—We use them for the eyesight.

For people who are blind?—Yes.

The "Professor," in his testimony, said he "found x-rays useful in many diseases which caused a weak circulation. It re-animated capillary circulation." The cutaneous troubles arising from the application of x-rays have been commented upon in these columns, and it has been necessary to devise methods to avoid them, yet here is an unqualified man pretending to treat blindness and other complaints by x-rays, with probably disastrous results. The warning of the Coroner came not a moment too soon, and in the interests of genuine electrical treatment it is to be hoped that Mr. D'Odiardi will bear it in mind.—*The Electrical Review*, April 15, 1897, London.

Elmer L. Gates, of Washington, is said to have devised a microscope that is destined to revolutionize microscopy. It is said that its magnifying power exceeds the present microscope as much as the latter exceeds the naked eye; that it has readily magnified 3,000,000 diameters, and by increasing the power of the objectives images will ultimately attain a magnification of 100,000,000 diameters.—*Md. Med. Jour.*

J. J. THOMSON'S THEORY OF ROENTGEN RAYS.

An important contribution to this subject is made by J. J. Thomson. He bases his theory upon known laws concerning the generation of an electro-magnetic field by a moving electrified particle. Such a particle "is surrounded by a magnetic field, the lines of magnetic force being (as in the case of an ordinary current) circles having the line of motion of the particle for axis. If the particle be suddenly stopped, there will, in consequence of electro-magnetic induction, be no instantaneous change in the magnetic field, which for a moment compensates for that destroyed by the stopping of the particle. The new field thus introduced is not, however, in equilibrium, but moves off through the dielectric as an electric pulse." The electrified particle in question is the "cathode ray;" the pulse generated by its sudden stoppage is the Roentgen ray. The author calculates the magnetic force and electric intensity carried by the pulse to any point in the dielectric, and arrives at some most suggestive and, indeed, corroborative conclusions. When the velocity of the particle approaches that of light, two pulses are started when it is stopped. One of these is a thin plane sheet whose thickness is equal to the diameter of the charged particle; this pulse is propagated in a direction in which the particle was moving; there is no corresponding wave propagated backward. The other is a spherical pulse spreading outward in all directions, whose thickness is again equal to the diameter of the charged particle, and thus, if this particle is of molecular dimensions or smaller, its thickness is very small compared with the wave-length of ordinary light. In vacuum tubes, the particles, whatever they are, are stopped by the walls of the tube, possibly after rebounding several times. The greater their velocity, and the smaller their mass, the more instantaneous will be the stoppage, the thinner and stronger will be the pulse, and the less of it will be absorbed in its passages through substances. The Roentgen rays are therefore not waves, but a rattle of irregular but intense impulses, something like bad musketry.—*Phil. Mag.*, February, 1898.

THE SO-CALLED ROENTGEN LADY.—Latest among the marvels of French origin is *La Femme Roentgen*, a woman who is described as being able to read with ease through opaque bodies. Such, at least, is the story. We are told that Dr. Ferroul of Narbonne has found and has introduced this phenomenal lady to his colleague at the Medical Faculty at Montpellier. "All this is quite impossible," exclaimed Dr. Grasset when he was informed of the new wonder. "Well, you will see," was the reply. Then the demonstration was made. The woman succeeded in reading, at a distance, a letter, the envelope of which had been covered with seals and also posted as an additional precaution, and so Dr. Grasset was converted. Some skepticism on the subject is still permissible, nevertheless; yet what a vista of queer possibilities does not this open out, even if *La Femme Roentgen* possesses only a moderate share of the extraordinary qualities thus attributed to her.—*The Parisian.*

CATHODE RAYS IN AN ALTERNATING FIELD. Ebert. *Wied. Ann.*, No. 2; abstracted briefly in the Lond. *Elec.*, March 18.—He proves that the deflection of the cathode rays by electric oscillations takes place in a well-defined manner when the current producing the cathode rays is quite independent of the deflecting current. It is thought the experiments indicate a valuable and sensitive method of investigating the secondary E. M. F. of open transformers.

FOREIGN BODIES IN THE ESOPHAGUS.

A great variety of foreign bodies have been removed by surgeons from the esophagus and the use of the x-ray in determining their location has proved very valuable and greatly simplifies their removal. Many children have been brought to the clinic who have swallowed pennies, safety-pins or other small objects. Among these was one child three months of age, who had just swallowed an open safety-pin. Examination with the finger revealed the pin with the point turned upwards and imbedded in the wall of the pharynx. The pin was seized with the pharyngeal forceps, and being steadied with the finger, it was turned over without moving the point until its position was reversed, when it could be easily withdrawn. The case is instructive in showing the advisability of making a digital examination in these cases at the very first moment.

Another child, six months of age, was brought who had swallowed a penny, and the esophageal bougie met with some obstruction about the level of the cricoid cartilage. The instrument passed by this obstruction, but on its withdrawal up came the coin along with it, having been dislodged by the bougie.

In two children, four and five years of age, who had swallowed large flat objects, in one case a badge with a pin, and in the other a large brass check, each being circular and about an inch and a quarter in diameter, the skiagraph showed these objects located just below the cricoid cartilage in the esophagus. In one case the foreign body had been impacted for some days, and in the other for three weeks, and it seemed dangerous to attempt their removal with the forceps for fear of extensive laceration of the esophagus or possible hemorrhage from the great vessels. External esophagotomy was therefore performed in both cases and the foreign bodies removed. In one case the edge of the foreign body had ulcerated through the esophagus and lay outside of its walls, in close contact with the carotid artery, and a fatal hemorrhage would probably have occurred before long. Both children recovered.

The operation of external esophagotomy is performed through a three-inch incision at the anterior border of the sterno-mastoid on the left side of the neck, because the esophagus lies slightly to the left of the trachea. When the deep fascia has been divided the sterno-mastoid and the great vessels are drawn to the outer side, while the trachaea and larynx are drawn to the inner side. By blunt dissection carefully conducted, the edge of the esophagus is exposed behind the trachea. The great danger of the operation, apart from hemorrhage from the vessels, is injury to the recurrent laryngeal nerve. With a good light the nerve can often be seen in the wound if the latter is kept free from blood.

The esophagus is recognized by its consistency, and the pale color of the muscular fibres, but it can be made prominent in the wound by passing a curved instrument, such as a pharyngeal forceps or a urethral sound, down into it from the mouth. Before the esophagus is opened two stout silk threads should be passed through its walls by curved needles, and the incision made between them. They serve as retractors and do not take up space in the wound. The foreign body is then removed with forceps. If the foreign body should lie in the thoracic portion of the esophagus it might be impossible to remove it, but there is generally very little difficulty when it is within reach of the finger and it can be carefully picked out with the forceps.

The mucous membrane of the esophagus is then sutured with fine silk and the external wound lightly packed, in the hope of obtaining complete or partial union of the esophageal wound, and so lessening the size of the sinus. When, as in both of the cases just mentioned, the stitches give way, at least the discharge from the esophagus was prevented from reaching the external wound until forty-eight hours after the operation, when the surface was covered by granulations and the danger of infection was much reduced. In a case of esophagotomy recently performed on an infant only three months of age, who had swallowed an open safety-pin, I secured absolute primary union of the esophageal wound by this method of treatment. The external wound should never be sutured, but must be packed with gauze because of the great liability to leakage from the esophagus. It is all-important in these cases that the operation be done early, before ulceration of the esophageal walls and sloughing takes place, because of the danger of septic infection as well as of hemorrhage. The patients are usually poorly nourished, as the swallowing of food is interfered with by the presence of the foreign body, and this is an additional reason for avoiding delay. It is seldom difficult to locate the position of the foreign body with the esophageal bougie, but the x-ray is of great assistance.—*The Post-Graduate*, N. Y., March, 1898.

X-Rays in Medical Practice. Williams. "*Medical and Surgical Reports of the Boston City Hospital*," Jan., 1897; reprint under separate cover.—A long article, accompanied by illustrations and records of a large number of cases. He describes a part of his extended work at the Boston City Hospital; it is chiefly of interest to the medical profession. He found static machines to be the most satisfactory for generators; numerous other results of experience are given, and the various forms of apparatus used are described; the greater portion consists of descriptions and records of cases; the relative advantage of the fluoroscope and radiograph are considered: a number of his conclusions are the same as those in the article above.

Disinfection of Books.—It is gratifying to note that the experiments of Dr. J. S. Billings in relation to the disinfection of library books have demonstrated that the application of formaldehyde to the books, in a proper receptacle, will destroy not only every germ which may have been deposited on the books by persons suffering from infectious or contagious maladies, but also any small insects which may have attacked the leather bindings. This method ought to be applied to all books received in the circulating libraries and similar institutions before the books are allowed to go out a second time.—*Modern Medicine and Bacteriological Review*, Jan., 1898.

The sterilizing effect of the x-rays as reported by Rieder may be effectually employed to disinfect books.

Circulation of Gaseous Matter in a Crookes' Tube. Swinton. Lond. *Elec.*, *Elec. Rev.* and *Elec. Eng.*, April 1.—An abstract of a Physical Society paper. He investigates the stream lines by the direction and speed of rotation of a mica radiometer mill mounted on a sliding rod so that it could be moved along a line at right angles to that joining the electrodes. A point was reached when the rotation ceased, and beyond this it was reversed. It seems to establish the existence at high degrees of exhaustion, of a true stream which travels from the anode to the cathode quite similar to the cathode stream. At very high vacua, with a large free path, there may be a complete circulation of positive and negative atoms passing from the anode to the cathode and vice versa, delivering up their charges by direct convexion. The discussi n is given briefly: Appleyard suggested having the veins of the mill of some light-conducting substance which does not retain the charges, as this would give simpler results.

Nature of Roentgen Rays. *Am. Jour. of Sc.*, April.—A brief abstract of an article by Stokes from the *Manchester Memoirs*, 41, Part 4.—He believes that these rays are transverse vibrations of the ether, and that the cathode rays are streams of rapidly moving particles; the apparent transparency of aluminum plates to cathode rays is thought to be the result of a process similar to that which happens to a copper plate immersed in a copper solution which is undergoing electrolysis, and is being dissolved on one side, having copper deposited on it on the other. The deflection of cathode rays by magnetic and electrostatic forces he regards as a greater objection to considering them as light rays. He believes Roentgen rays are impulses and not vibrations. This is followed by a brief abstract of a paper by J. J. Thomson in the *Phil. Mag.* for February, which has already been noticed, and in which he elaborates the impulse theory from the view of the electromagnetic theory of light, concluding that in the x-ray phenomena there are two waves from the electric impulses, one of which is a spherical wave and the other a plain one, the dimensions of the latter being extremely small; x-ray effects are therefore produced at the surface where the electrified moving particles are stopped.

Roentgen Rays in Thorax Diseases. Williams. *Journal of Medical Science.* Dec.—Reprinted in pamphlet form with numerous good illustrations. A long paper, in which he outlines some of the results of the work of the past year (prior to May 5, when the paper was read before the Association of American Physicians), during which time he has examined with x-rays more than 500 patients; he points out the advantages resulting from careful study of radiographs. The paper is chiefly of interest to the medical profession. Some of the results are as follows: No harmful effects were perceived by any of his patients; the varying opacity of all the tissues depends upon the difference in bulk and chemical composition; the difference in permeability of air and water is of great importance in thoracic diseases; the fluoroscope gives a better assurance that the lungs are in a healthy condition than other methods; it gives earlier evidence of lung disease and more accurate information concerning their extent; the heart may be outlined more accurately than has hitherto been possible.

Theory of Connection Between Cathode and Roentgen Rays. J. J. Thomson. *Phil. Mag.*, Feb.—A mathematical article in which he calculates the magnetic force and electrical intensity carried by an electrical pulse to any point in a dielectric, and he concludes from the effects of the sudden stoppage of electrified particles that Roentgen rays are produced by a very thin pulse of intense electro-magnetic disturbance, and that Roentgen rays are not waves of very short wave length, but impulses.

The Relation of High Tension Sparks to X-Ray Tubes.—One of the most difficult points to master in x-ray working is the relation of the spark to the tube. There is almost as much range of variety in sparks as there is variety in the models of tubes, and, amid the confusion, the profession hesitates when the value of these rays as a diagnostic means is of daily demonstration. Early in the spring of 1896, at the meeting of the Michigan State Medical Society at Mount Clemens, I proved, by the use of a static machine, that the true value of the spark in the production of rays was, beyond a certain point (depending on the form of the tube) not in the length of the spark, but in its calibre, and rate of interruption; something that, in all my experiments since, I have not had occasion to change.—J. C. Landon, M. D., in *Leonard's Illustrated Medical Journal.*

Rieder investigated the effects of the Roentgen-rays upon bacteria from freshly developed cultures and upon colonies growing in cultures. Fresh plate-cultures of the cholera vibrio, the colon-bacillus, the Eberth-bacillus, the diphtheria bacillus, and others, were partially covered with sheets of lead and the rays directed upon them for from 40 minutes to one hour. In all cases colonies developed in those portions covered by lead, while those portions exposed to the rays remained sterile. When developed colonies of the bacteria were exposed to the rays, these old colonies were not destroyed, but no further colonies developed from them. The growth of tubercle-bacilli was not prevented, but it was much less extensive. This limitation or cessation of growth was not due to the heat of the rays, as but little heat was given out and gelatin was not liquefied; nor was it due to chemic action, as the same bacteria grew well in portions of the culture not exposed to the rays, and other bacteria grew well subsequently in the areas that had been sterilized by the rays. Contaminating cultures did not prevent the growth, as no contamination occurred when the cover was placed in the Petri dish immediately after using the rays.—*The Phil. Medical Journal.* 2-26-'98

Cut Flowers, says a prominent London physician, should not be kept longer than a day in the sick room, and it is best to allow only those that are in pots. Artificial flowers must be entirely proscribed; they are very dangerous on account of the dust which always clings to them. Flowers should be chosen with reference to their perfume; those of a strong odor should never be allowed in the sick room. On the other hand, the presence of flowers should in no wise be forbidden, for manifestly the sight of a violet or a forgetmenot may have a pronounced good effect on the patient, and garlands and green twigs should always be kept in hospitals, especially twigs of eucalyptus, which have disinfectant properties.—*Hospital Life.* 3-'98.

Effect of X-Rays on Germination. Maldiney and Thouvenin. *L'Eclairage Elec.*, March 5.—An abstract of an Academy paper, in which they show that x-rays have a beneficial action on the germination of seeds. Three seeds of several plants were subjected to the x-rays for an hour a day, while three others were subjected to exactly the same surroundings, but were screened from the rays; the former, in one case, germinated in three days, while the latter required seven; these were the seeds of the bindweed; others gave similar results; care was taken to maintain the temperature of both sets of seeds alike. He concludes that x-rays hasten the germination at least with the seeds with which he experimented; it appears, however, that the rays had no influence in hastening the formation of the chlorophyl.

Roentgen Skiagram in Persistence of Ductus Botalli.—In a case presented a short time ago at the Berlin Society for Internal Medicine, the diagnosis of a persistent ductus botalli was confirmed by the x-ray picture of the case. Gerhardt has pointed out that there is in such cases an area of dullness, above the base of the heart to the left of the sternum. This is considered to be due to the dilated pulmonary artery. In this case a distinct shadow was found in this situation in the Roentgen skiagram. This, too, is typical of the zeitgeist in Germany, for while scarcely a surgeon makes a diagnosis of a fracture without a skiagram, no internist concludes definitely as to the presence of an aneurism without the same aid, and even evokes it at times for tubercular infiltration of the lungs and other intra-thoracic conditions.—*The Phil. Medical Journal.*, Mar. 1898.

NEW THEORY OF ELECTRICITY. GROSS. *Electricity*, Feb. 16.—A brief mention of a recent newspaper article in which he claims to have revolutionized the method of producing electricity; he intends to "capture" and utilize the "earth-seeking electricity"; he claims that the earth in revolving generates a powerful current and that his apparatus for generating it will have proportionately greater centrifugal force than that of the earth. He does not pretend to be an electrician.

MM. CH. REMY and G. Contremoulins have shown before the Paris Academy of Sciences a series of radiographs of a corpse, in which anatomical details it had not hitherto been possible to obtain are observable; in particular, the disposition of the arterial system in its minutest divisions. In one figure, showing the hand, wrist, and part of the arm, the divisions of the arteries and their penetration into the osseous tissue can be traced.—*Journal of Electro Therapeutics*, March, 1898.

X-RAY. Oliver *Annals Oph.*, Oct., 1897.—The author advocates the use of repeated exposures in the use of the Roentgen ray, for the determination of foreign bodies in the orbit. His plan is to take two exposures from different points and deduce the position of the foreign body by geometrical calculation-—*The Post Graduate*, N. Y., April, 1898.

ALTITUDE OF THE AURORA. Abbe. *Terestrial Mag.*, March.—The beginning of an article in which he collects some of the numerous observations, calculations and opinions bearing on the nature and altitude of the aurora light.

The Proper Treatment of Headaches.

J. Stewart Norwell, M. B., C. M., B. Sc., House Surgeon in Royal Infirmary, Edinburgh, Scotland, in an original article written especially for *Medical Reprints*, London, England, reports a number of cases of headache successfully treated, and terminates his article in the following language:—

"One could multiply similar cases, but these will suffice to illustrate the effects of antikamnia in the treatment of various headaches, and to warrant the following conclusions I have reached with regard to its use, viz.:—

(*a*) It is a specific for almost every kind of headache.
(*b*) It acts with wonderful rapidity.
(*c*) The dosage is small.
(*d*) The dangerous after-effects so commonly attendant on the use of many other analgesics are entirely absent.
(*e*) It can therefore be safely put into the hands of patients for use without personal supervision.
(*f*) It can be very easily taken, being practically tasteless."

Polk's Medical and Surgical Register of the United States and Canada is now undergoing its fifth revision. Physicians who have not given their names to the canvassers are urged to report to headquarters at once, giving full information. Address, R. L. Polk & Co., Detroit, Mich.

THE TREATMENT OF DISEASE BY ELECTRIC CURRENTS.

A handbook of plain instructions for the general practitioner. By S. H. Monell, M. D., Brooklyn, N. Y. Published by William Beverly Harison, 3 and 5 West 18th Street, New York. 1083 pages.

Another extremely valuable work on electro-therapeutics has been launched by the same author as the recent publication, "Manual of Static Electricity in X-Ray and Therapeutic Uses," which has attracted world-wide reputation thus early for its clearness of description, and usefulness to the general practitioner.

It would be impossible for us to specialize the headings of the 70 chapters in this volume in the space allotted for this review, therefore it must suffice to state that every known modern employment for faradic, galvanic and static electricity and their therapeutic indications are detailed in this volume with conciseness of language and minute directness of application, so that the general practitioner may read and understand.

Probably no book on electro-therapeutics, and we say it conservatively, has ever equaled this volume for value to those of the profession who would use electricity as a therapeutic agent, and he who does not use it at this age is certainly not up to the times in his profession.

We therefore heartily recommend this volume to our readers, believing that they will not be disappointed in adding it to their libraries.—*Medical Times and Register*, Phila., Pa., January, 1898.

Manual of Static Electricity in X-Ray and Therapeutic Uses, - - - - - - - -	$6.00
Treatment of Disease by Electric Currents - -	7.50

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Crookes tubes or tubes containing only the "fourth state of matter", as described by Crookes, is attracting more attention now than at any previous time. The generating apparatus of an x-ray machine is improved to a most satisfactory degree. This is the case with both the coil and static machines. It is equally true that the discharge tube is brought up to a high state of development and probably to a greater efficiency than the generating apparatus, but the bugbear of high vacuum has retarded progress and kept the x-ray operator from getting out of his tube the service it should have rendered him. It now appears that instead of a tube losing its efficiency from use it actually gains in penetrating power the longer it is used in the proper manner. Heating or resting the tube are simply temporary expedients; re-exhaustion is a method to moderately renew the tube and in no way improves its former condition, but rather diminishes its former penetration and endurance.

Dr. Wm. W. Graves, of this city, has shown in his most excellent article "A Preliminary Report on a Method of Overcoming High Resistance in Crookes Tubes: A Possible Step Towards Maximum Radiance," published in the April issue of The American X-Ray Journal, "that the greater the resistance as afforded by the vacuum tube the higher will be its efficiency when the resistance is overcome." If resistance is wholly determined by the vacuum within the Crookes tube then the vacuum can be changed a dozen times in a minute—lowered and raised at will. It does not seem possible that so great egress and ingress of the elements of air could take place through the glass at one time, without displaying rapid modification in the vacuum at all other times when intense discharges are passed through the tubes. Constancy is the ideal condition and is observed when the full output of a machine is passing through a tube which silently glows, noiselessly as an incandescent lamp. It is thinkable that the elements or ions within the tube are disarranged by electrical discharges in such a way as to diminish the x-ray output. Proper manipulation of the tube rearranges and adjusts the elements in such a way that former efficiency returns and even greater penetrating power is obtained. The accomplishment of a method for obtaining greater radiance is fully set forth in Dr. Graves' article. It has been my pleasure and fortune to witness the doctor develope a tube that had been "worked out" and abandoned as worthless, to a state of producing x-rays superior to its former penetration. With such tubes of great resistance, capable of backing up a spark of ten inches reversed, very powerful x-radiance is engendered. A good tube recently from the maker showed the heart in a large man ten feet distant through a closed door. A tube which formerly produced equally as good radiance as this one, but in which the resistance from usage was too great under all ordinary methods to obtain a responsive glow, was by the Graves' method of reducing resistance, worked up to a state of excellence capable of showing the heart distinctly through a closed door 16 feet distant from the tube. Through the upper third of the forearm the bones of the hand could be seen 28 feet from the tube—the wall of the room limiting a more distant test.

Such penetrating radiance as the above engendered in a tube that had been considered worthless or exhausted from long usage claims our admiration and inspires us to inquire for an explanation of the internal changes which take place in a tube in action. For this particular knowledge we instinctively turn to Tesla, Thomson, Roentgen or other physicists.

We are now concerned with a method for getting the best and most enduring radiance from an x-ray tube. If the claims of Doctor Graves are correct, x-ray tubes can be used for an indefinite time with ever increasing value. Dr. Monell, of Brooklyn, has used one tube for one year without any impairment in its usefulness.

With such tubes and with a proper generating apparatus every part of the interior of the body can be explored. There is no distortion of shadow in the sense of casting a deceptive image; time is not considered since the denser tissues as the head of the femur are instantly seen in very large subjects; and there should never be such a thing as burns since the electrical discharge is confined in close proximity to the tube, probably at no greater distance than 15 inches. The fright that has gone out and been accepted by some as true, of "x-ray burns" should be stilled. The scare has a tendency to retard progress and the medical profession are not warranted, neither is it their wont, to spread false information. The use of the word x-ray to the word burn is a misapplication of the term and conveys a false impression. No one has ever demonstrated that the x-rays burn. Effort has been made to destroy animal tissue with the x-rays with failure in every instance. Dr. Carl Beck made an exposure of four hours without any ill effect and this has been repeated in a number of instances in Europe and America with like results. In the neighborhood of the tube and in the field of the wasting electric discharge injuries will occur and they will occur also if exposed for a considerable time anywhere along and near to the conducting wires. "Potential injury" would more nearly express the meaning.

"Whether for fluoroscopic or cathodographic work, approaching maximum radiance is always to be desired. A tube which gives only fair radiance has little practical value other than from development it may attain high efficiency."—Graves. This is true. Every operator with efficient generating apparatus has been able to demonstrate this fact. A deeper shadow and denser, it is true, is seen when the highest generation of x-rays is not attained, but the detail is less and the relation of parts obscured. The observer standing in a valley and seeing animals on the crest of mountain spurs at dawn of day, is always impressed with the size and distorted prominence of the figures as they seem to lay against a lighted screen. The rising sun with greater light fades away the distortion and makes a true picture of what was seen, and so it is in the fluoroscope. When shadows are seen as if set in the screen they are very dense and prominent, but are void of detail and can be of but little value to the diagnostician. These are the conditions for distortions because varying conditions of density in the subject cast shadows which may be mistaken for fragments of bone or foreign matter. A bright screen with abundant x-radiance will throw the picture out and offers a perspective as if projected from the background. The detail is very apparent in contrast with the former picture.

The tube should have a constant glow. If the radiance is fluctuating and not constant examinations can not be satisfactorily made. The rising and falling of penetrating rays cast movable clouds across the screen and in a degree, change the aspect of the subject under examination into a doubtful diagnosis. A tube that is irregular in its action or flickers should not be cast aside. It is now in condition for the operator to acquire knowledge of technique in tube manipulation. With labor and perseverance the difficulty will probably be mastered. When we compare the advantages of the x rays with other adjuncts to practice we find the former to be less difficult to acquire and always accurate in results. If results are obtained which are inaccurate it is because the operator has neglected his part, provided always that the tube and generating apparatus is up to the standard.

When it is desirable to make radiographs the same rule should obtain as in fluoroscopic examinations. The best possible light will in all cases make the best possible picture. Detail in the picture will be good only along the line of superior radiance. With the best light, skin, fat, muscles, bone, cancellated tissue and marrow are seen interposed one above the other. In some instances the tendinous tissue is plainly shown and the larger veins and arteries are very distinct. The art is rapidly approaching a condition for the separation of all the human tissues in one picture. The excellence of this work depends upon improved method of tube manipulation. When this has been acquired we can then ask for still better generating apparatus and better fluorescent material for the screen.

AT the fourth annual meeting of the American Academy of Railway Surgeons at Chicago, Ills., Dr. W. J. Mayo, of Rochester, Minn., read a most instructive paper on "The Pathology and Diagnosis of Oblique Fractures" in which he refers to the use of the x-rays as a diagnostic expedient in the following language:

"At this time we are in the midst of a most splendid advance in the diagnosis of fractures, due to the impetus given by the x-ray, and to the wider scope of the diagnostic incision which modern wound treatment has made possible.

"The Roentgen rays, as an aid to the diagnosis of fractures, is one of the marvels of the day and the ability by this means to accurately map out fracture without removing the dressing has revolutionized the diagnosis. So common is its use that almost every issue of our periodicals contain skiagrams of bone traumatism. It is a matter of regret that only in the large hospitals or cities can it be utilized and unfortunately its revelation at a late date are apt to prejudice a jury in the possible malpractice suit. In the very excellent skiagraphic work of Dr. Cross, of this city, I have noticed that the ultimate result is often good even when the bones are not accurately in place.

"Leonard Freeman in the 'Annals of Surgery' for April, 1897, says in this connection: 'It must often be true that when we imagine we have placed the fragment of broken bone in perfect apposition they may not be so after all, and yet the result be good, nature being capable of soothing off many inequalities.'

"Until we can better estimate nature's capacity for repair the skiagraph may cause much needless anxiety, and still more unfortunately for our peace of mind, show us errors in position which the condition of soft parts will not allow us to safely correct, or the process of repair may in the occasional case develop rather than prevent deformity. The x-ray may be made to exaggerate the existing deformity or displacement, from carelessness or purposely, and in suits for damage, no skiagraphs should be accepted unless made by a disinterested operator."

In the discussion which followed, the x-rays were referred to as follows:

Dr. J. P. Lord, of Omaha—While I believe that different skiagraphs of the same case will show very differently, yet I do not know that we can set them down as being inaccurate. I think it does show us that the conditions are exaggerated, and that the x-ray will teach us that there is a possibility for a great deal of deviation of bone fragments, although it must be admitted that it gives us a better idea than we ever had before of the extensive separation of the fragments, and this is the point that I wish to make, that we should collect a number of skiagraphs, as we soon will be able to do if we make comparatively general use of the instrument, which we all should do, and with the cheapening of the apparatus it will be within the means of those who practice to any considerable degree, and then we will have something to fortify us against x-ray pictures which might prejudice a jury. We might bring skiagraphs to show that a certain condition was common, and even though there is not a great deal of deformity, a great deal of callus and deviation of the fragments, yet comparatively good results followed treatment, and that this need not necessarily influence the result unfavorably. If the skiagraph influences the result unfavorably it is only what is to be expected, and the good results that are gained, perhaps in an individual case under dispute, are as favorable as could be expected under the circumstances. I believe that we are unnecessarily alarmed about the damage the x-ray may do us, and when we consider the strong advantages it has for us we will make the proper use of this sort of evidence. We may use it as a boomerang to counteract the influence which possibly may be used against us. We should consider this and use the x-ray with that end in view.

Dr. Fred. J. Hodges of Anderson, Ind.—Since the discussion has tended toward the consideration of the skiagraphic phase of the subject it is important to know that existing fractures do not always show and that there are undoubted cases on record in which the radiograph seems to show a fracture when it does not exist. These are two points of extreme importance. It is also important to know that a slight deviation in the angle of the bone to the plate will make a difference and a distortion of the resulting skiagraph. It has occurred to me that the only logical and legal way of bringing this matter before a jury would be to bring the apparatus into court and show the condition of the case with either the fluoroscope direct or with the screen. Not long ago I examined a radius, in which there was no doubt, from an ordinary physical examination, as to the existence of a fracture, and yet it took half an hour with the fluoroscope to find it, and authenticated radiographs of that case, taken in half a dozen different positions, would have failed to show the fracture, so that a great deal of refinement in operating these pictures is necessary, as well as a great deal of certainty in the identification of them, and a description of the relative position from which they were taken, is going to be necessary in courts of law before the whole truth is brought out about these cases. *It is a well-known fact that impacted fractures do not show by the x-ray process, and it is also well known that in perfectly united fractures the new bone is not opaque to these rays, so that in perfect union there is still the appearance of non-union. Those are matters which particularly affect oblique fractures.

Dr. W. L. Smith, of Streator.—In regard to the x-ray I will say that it depends very much on the distance of the tube from the fracture what picture you get; also how fine you may cut the lines with the tube. I believe that if you have a funnel made of lead and allow the tube to sit on the top, then you can define very clearly the parts that are shown underneath. It does not take any longer with a funnel made of lead, which the x-ray will not penetrate at all, and you have nothing on the outside showing. So if you have a funnel about six inches high, and eight inches around, it will show very clearly what you desire to see. I believe the surgeon is the only man to place the limb so as to show what he wants to see. If a bullet is on top of a bone it will not show; if it is in the bone it will not show; if it is on the side it will show and in my case I found the bullet behind the head of the tibia. If you will try a funnel made of lead, I believe you will find the foreign body every time.

*When Dr. Hodges uttered these words technique in the use of the x-rays had just commenced. There is no difficulty now in skiagraphing impacted fractures showing plainly the limitation of bony tissue imbedded in and beneath bone. New bone in united fractures and also provisional callus is also observed in the fluoroscope and shown in the sensitized plate. Ed.

Dr. C. K. Cole, of Helena, Mont., also read a most excellent paper before the Academy in which he said:

"Even in cases of compound comminuted fractures with considerable injury to the soft tissues, with the aid of anesthesia, the x-rays and surgically clean methods, why should not each spiculum and fragment be replaced, the torn periosteum carefully attended to, the wound left in an aseptic condition and a satisfactory issue anticipated?

"I believe that the present generation will see the x-rays and fluorescent screen in practical every day use to such an extent that the surgeon will, with the aid of these adjuncts, together with the use of progressive aseptic and antiseptic methods, obviate many of the terrors formerly attached to the practice of bone surgery."

In the discussion Dr. W. Grant, of Denver, Col., said:

"In a case that has recently come under my care I have taken three or four pictures with the x-ray to see the position the bone was in, and I defy anyone in examining the arm with the eye and hand to show a particle of malposition; the result is a good one. The x-ray showed the upper fragment overlapping the lower, which was caused in not being able to flex the arm perfectly. The fracture involved part of the fossa of the olecranon and the coronoid process. How to meet those indications and the action of those muscles is a question the future must determine."

The Surgeon General of the U. S. Army has approved the purchase of eighteen x-ray apparatus to be used for field and hospital service. Two of the machines are to be sent to Manila.

Preliminary Observations on the Treatment of Congenital Dislocation of the Hip by the Lorenz Method of Forcible Correction, With the Report of a Successful Case.

BY ROYAL WHITMAN, M. D., NEW YORK
Instructor in Orthopaedic Surgery in the College of Physicians and Surgeons, Chief of the Orthopaedic Department of the Vanderbilt Clinic, Assistant Surgeon to the Hospital for Ruptured and Crippled.

The Lorenz treatment is based upon the theory, that if parts about the joint may be sufficiently stretched to allow the head of the bone to be brought into direct contact with the rudimentary acetabulum, and if it can be held in this position, the weight of the body, in walking, constantly forcing the bone against the substance that partly fills it, will gradually enlarge it to its normal capacity; thus it is called the "functional weighting" method, and this is its es-

FIG. 12.
Skiagram of congenital dislocation of the right hip, age 3½ years. Shows the elevation and displacement of the femur and the secondary depression on the pelvis, formed by the head of the bone.
After two unsuccessful attempts by the forcible method, the open operation was performed in July, 1897. The patient is cured, but is still wearing a protective brace.

sential and vital distinction from the forcible correction of Paci, with which it is often confounded.

[The first section of this valuable contribution to congenital hip joint surgery was printed in the April issue and concluded in the May number of *Pediatrics*, New York, one of the most instructive monthlies published in the English language. The article is illustrated with thirteen beautiful half tones. We reproduce herewith electros Nos. 12 and 13, which were kindly furnished by *Pediatrics*. Ed.]

LUMINESCENCE AND X-RAYS. Sagnac. *Rev. Gen. des Sc.*, April 30.—An article in which he gives a summary of his researches on the transformation of x-rays by substances which absorb them, thereby transforming them into new rays which are closely related to x-rays and at the same time approach the characteristics of extreme ultra violet rays.

FIG. 13

Skiagram of congenital dislocation of the left hip (from behind). Shows the effect of an unsuccessful operation, in which the dislocation has been transformed from a posterior into an anterior displacement.

X-RAYS IN TIME OF WAR.

BY FREDERICK STRANGE KOLLE, M. D.

Radiographer to the Methodist Episcopal Hospital; Member of the Kings' County Medical Society, the Brooklyn Pathological Society, the Long Island College Hospital, and Kings' County Hospital Alumni Association, of Brooklyn, N. Y.

Now that hostilities have begun; when the eagles of war scream all around us, when sons of liberty and right, lay maimed and bleeding, let us not forget the humane addition of an x-ray apparatus to the field surgeon's armamentarium, for here and here especially can we utilize the rays of Roentgen to an extent never dreamed of in time of peace.

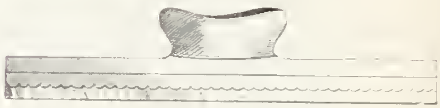
At first glance, we heave a sigh,—the impracticability of conveying the delicate machine strikes us with piteous force; but let us stop to think and to devise a ready means of transportation and util-

ity! There is still ample time for deep contemplation and soon, "Mother Invention" comes to our aid, and nothing seems impossible.

The induction coil if properly made is a strong instrument, one that can readily stand the brunt of knocks and shocks without seriously affecting it, therefore we pass on to the possibility of producing a current necessary for it. Batteries seem to me to be the proper source. For this purpose cells made of stiff (not hard) rubber and fitting one into the other could be safely used; they require little room in such form and will not be injured. The elements can be safely carried in the form of carbon and zinc plates. Solutions can be made with water: the chemicals require little room and can be carried as part of the apothecaries' stores.

The construction of a fluoroscope, perhaps as important as the tubes, need not bother us, and for this purpose I suggest a telescope body of leather, as used in the camera with a metal (aluminum) base mounted with the fluorescent chemicals as usual. If protected on its inner side with a thin film of transparent gelatin or celluloid. The eye-piece may be made of heavy dark felt. In this form the fluoroscope can be carried in a surprisingly small space, indeed. It is peculiar that such form has not been as yet devised. The tubes should be of the long type, not spherical as they require more room, and be packed in light wooden cases, a protective layer of cotton will prevent injury with safety. Two or three focus tubes can be carried in small space. Wire can be coiled up and stowed away, inside of the cells, perhaps even with the chemicals.

I would suggest flexible cord for bat-



tery wire, so as to allow the moving about of the connected apparatus away from the cells, from place to place as required.

The necessary connections, solutions, etc., could be made in less than half an hour, at the highest, depending of course, in the solution used, and lo! we have the valuable addition quickly produced, ready to aid the busy surgeon in the location of ball or fracture and fewer men to come home from battle, decked with glory and proud scars, better united fractures and little cold lead, scattered mysteriously about the tissues of the body to remind the victim, forever in life after of the dark side and scenes of the battlefield!

THE EFFECT OF X-RAYS IN OPHTHALMOLOGY.

Presented at the Fourth Annual Meeting of the American Academy of Railway Surgeons, at Chicago, Ill., Oct. 6-8, 1897.

BY A. G. THOMSON, M. D
Assistant Oculist, Pennsylvania Railroad
Philadelphia, Pa

In December, 1895, Professor Roentgen gave to the world his great discovery that an invisible ray, now known as the x-ray, produced by sending a current of electricity through a vacuum tube, had the power of penetrating solid and opaque materials and leaving its impress on a sensitive plate. Aside from its great scientific value, this event marks an epoch in the history of medicine comparable to such discoveries as anasthesia and of antisepsis. Although there are experiments being made throughout the world, and apparatus being perfected in every way, the new force, so far as its scientific or practical value is concerned, may be considered in its infancy and, as in the case of the discovery of ether and antisepsis, it has so far given its greatest aid to surgery, yet I am sure it will onlybe aquestion of time when, as we gain further knowledge of this power and effect further improvement in the apparatus used, we shall see that it will give equally valuable aid in medicine in determining the diagnosis of obscure pathologic conditions. The practical utility of this wonderful force was first demonstrated in surgery. Experiments were concurrently being made in all branches of medicine, and ophthalmologists especially watched the early developments with great interest.

As nobody knew the extent of the new, wonderful force, as with all unknown things, there was a vast field for speculation. Many of the enthusiasts claimed, and the claim was taken up by the newspapers of the country, that the new discovery would confer upon suffering humanity one of the greatest boons conceivable; it would give to the thousands of inmates in blind asylums vision to their sightless eyes. On the other hand, from a diagnostic point of view, for which we had hoped so much, we experienced immediate disappointment. All experiments showed that owing to the unfortunate position of the eyeball, surrounded by the bony walls of the skull, which were at that time thought impenetrable to the rays, the value of the x-ray in determining the presence or in locating foreign bodies in the eye, was practically negative. As regards the hope of producing vision in the blind, these experiments, so far, have shown that for any practical benefits the x-ray is useless. Dr. Brandt[1] stated, at an early date, that by removing the lens, the retina becomes sensitive to the x-rays. This was immediately contradicted by Bullot,[2] who showed that the lens was also transparent as other neighboring tissues of the eye, the difference being due to their densities.

Experiments made by Dr. Hansell and Dr. Max Stern,[3] at the Philadelphia Polyclinic, on patients with defective vision, as leucoma of the cornea, capsular and lenticular cataract, central scotoma, due to a large patch of central retinal choroditis and atrophy of the optic nerve, showed that patients were unable to see any more clearly through the fluoroscope than before the production of the rays. This is confirmed by the report of Dr. Wilkerson, of the California School of the Blind. He selected six patients for testing, one with destruction of the anterior portion of the eye from an old traumatism, one with complicated congenital cataract, one with partial phthisis bulbi from ophthalmia neonatorum and three with optic nerve atrophy. In none of these cases did the

1 Revue general des Sciences de Paris. No. 21. tome VII. p. 897. Nov. 15, 1896.
2 Revue d'Ophthalmologie. February, 1897.
3 Polyclinic, Philadelphia, 1897.

rays assist the vision in the slightest degree.

Boch[4] suggests that persons blind from the loss of transparency of the media might be able to read letters painted on a card varnished and dusted with a powdered metal, if these were subjected to the action of the x-rays. This is impracticable unless a fluoroscope or some other fluorescing screens, by which the shadows are rendered visible, be placed back of the opaque lens or cornea. Otherwise the source of illumination is no more available than before. All these experiments, I think, show conclusively that the x-ray, as it is known today, will be of no practical value to the blind; and this would seem also theoretically correct, as we know our retinas are only able to perceive a very small portion of the spectrum, namely, (1-20) that portion where the vibrations in the ether extend from four hundred million millions to eight hundred million millions of light. Vibrations of lesser frequency, although not seen, are demonstrated by certain instruments of precision, while vibrations above this number are known as the ultra-violet rays, invisible to the eye but demonstrated by a photographic plate. Now, as the rays are emitted from the tube at a very high rate of vibration, they may be conceived as analogous to the ultra-violet rays which are not perceived by our retinas, and no matter how much they are capable of penetrating obstacles to vision, they could not make the blind see when they are invisible to the normal retina.

As time progresses and as one series of experiments after another confirm the want of value of the ray in helping the blind, we are agreeably surprised to see the advances made in the other direction, from a diagnostic standpoint, which at first thought appeared so discouraging.

Among the most serious complications in the practice of ophthalmology and one that always gives the surgeon the greatest anxiety, is the severe traumatism of the eyeball produced by a foreign agent, causing the coats of the eye to be penetrated, and where the presence or absence of a foreign body in the eye is not known. The traumatism may be great enough to destroy the eyeball for all practical purposes of vision, but the anxiety of the surgeon does not end here, for if a foreign body remains within the eye there is always the danger of the dreaded sequelae of sympathetic ophthalmia.

In the majority of cases of this kind, we are able to satisfy our minds as to the presence or absence of a foreign body by the history of the case, subjective symptoms and theoretic considerations leading us to a positive conclusion: but there are many times when owing to the obscure history. lesions of transparency and great destruction of the eyeball, our previously known methods of diagnosis are not available. That a positive means of determining the presence or absence of a foreign body would be of the greatest benefit in such cases is unquestionable, and I thoroughly believe we have attained the ability of not only determining the presence of the body, but exactly locating it in the eye by means of the x-rays. This does not pertain to particles smaller than the one thirty-second of an inch. The experiments at first were discouraging, and this was most probably due to the incomplete apparatus. Dariex[5] conceived that the low degree of permeability of the eye by the x-rays would undoubtedly be ineffectual in producing a radiograph. By others who worked with tubes of low penetrating power it was found that the eye, surrounded as it was by the bony walls of the skull, would be an insurmountable obstacle to the production of a radiograph. Van Duyse[6] stated that

4 Mincr abelin, February, 1897.

5 Annal d'Oculistique; t. 115. p. 218.

6 Archive Ophth., Tes., 1896.

the anterior portion may be radiographed and suggests the procedure of injecting a salt solution under Tenon's capsule to make the eye protrude. Lewkowitz[7] showed that he was able to make a radiograph of the lids and summit of the cornea, and to determine, by an elaborate method of figuring, the position of a gilt spangle placed in the conjunctival sac.

Harnisch[8] says, as the eyeball is almost entirely surrounded by bone, which is practically impenetrable to the rays, we could only hope to discover a foreign body as far back as the ciliary region or, in particularly prominent eyes, a trifle further.

The first cases reported that were of any practical diagnostic value were by Williams[9] and Clarke.[10] Both these gentlemen by their results, show that the ray will penetrate the bones of the skull, and, if a foreign body is in the eye it will throw a shadow on the plate dense enough to be seen. Williams placed his patient on a table, with the cheek of the injured side resting on the sensitive plate, and allowed the rays to pass through the nasal bones and through the external wall of the orbit; while Clarke inserted a sensitized film into the nose and placed the tube to the outside of the temple. The reports of this case were followed during the next fall and winter by those of Hansell, De Schweinitz and Oram Ring,[11] assisted by Max J. Stern, who bandaged the plate to the side of the temple. Friedenburg[12] allowed the rays to be passed from behind the head and to strike a small sensitized plate which was cut to fit into the margins of the orbit. In all these cases the foreign body was successfully removed from the eye. These cases are exceedingly interesting, as they show a decided step in advance. They not only demonstrate that the bones of the skull can be penetrated by the ray, but the whole extent of the eyeball can be radiographed, although they all fail in giving us an accurate means of locating the position of the foreign body.

The methed of not only showing the presence of a foreign body, but at the same time definitely localizing its position in the eyeball, was shown by the case recorded by Dr. Oliver,[13] assisted by Dr. Leonard, and by Dr. William Thomson,[14] assisted by Dr. William Sweet of Philadelphia. Dr. Oliver's plan is opposed to that brought forward by Exner,[15] in the fact that the base line for triangulation is made anterior to the cranial shadow, and the exposures are repeated sufficiently often at fixed distances and set situations so as to give a multiple series of relational sides and angles from which the exact position of a foreign body can be accurately determined. This is a very good method and has been successful in several cases, by Dr. Oliver, although not as clear and practical for the surgeon as Dr. Sweet's method.

As I have had the advantage of personally studying the case reported by Dr. William Thomson, from entrance to leaving the hospital, and also of using the method devised by Dr. Sweet in localizing the foreign body in cases of my own up to this time, I think that it is the most successful method known to insure the required degree of accuracy. The details of the case can be seen in the report of the proceedings of the American Ophthalmological Society, but it is sufficient to say here that the patient was struck in the eye by a piece of steel, some eight months before presenting

7 Lancet, 1896, II, p. 452, and Centralbl. f. Prakt. Augenheilk., January, 1897.

8 Annal. Oph. and Otol., 1896.

9 Trans. American Ophth. Society, 1896.

10 Ibid.

11 Am. Oph. Transactions, 1897.

12 N. Y. Med. Rec., 1886.

13 Am. Oph. Transactions, 1897.

14 Trans. American Oph. Society, 1897.

15 Deutsche Medicinische Wochenschrift, Jan. 7 1897.

himself to the hospital with an exceedingly painful eyeball. The wound of entrance was plainly visible to the outside of the cornea, and an ophthalmoscopic examination showed a dense band of lymph extending from the wound of entrance to the retina, slightly external to the disc. The important diagnostic point to determine in this case was whether the steel was present in the eyeball or had penetrated and lodged in the orbit, in a benign position.

The case was radiographed by a series of pictures, each one of which showing the exact position of the foreign body. Dr. William Thomson operated, making an incision in the sclerotic and inserting a magnet, but without any result. However, having great confidence in the method, he picked up the band of cicatricial lymph with a strabismus hook, following it to its final insertion, the retina, excised it and, to his great pleasure, found the foreign body in it at the exact position as demonstrated by the radiograph. The magnet was not successful, as the steel would not attach itself owing to its partial covering of lymph.

The other point illustrated by this case is that it showed accurately the foreign body, inside the eye instead of the orbit. I had an opportunity of seeing a case a short time ago where the eye was enucleated for a supposed foreign body. After enucleation a piece of steel was found to be lodged in the orbit, having completely penetrated the eye. An x-ray picture would undoubtedly have demonstrated this and saved the patient a serious operation and allowed him to retain the eyeball without danger. The case of Dr. Thomson not only shows the x-ray as an important means of diagnosis in these cases, but also as a great help to the operator in removing the foreign body after its exact localization.

Another case which has come under my care recently, although too early to state positive results, will help to show the advantage of the x-ray in diagnosis, in a negative way, by excluding the presence of a foreign body. A man some seven weeks ago was struck in the left eye by a small piece of flying steel from a rivet. He immediately went to a hospital in New York, and was told by the surgeon that he thought the steel to be in the eye, but preferred treating him conservatively for a few days. After a treatment of a week, as a traumatic cataract was probably forming, preventing observation of the interior of the eye, and symptoms increasing in severity he advised the removal of the ball. The man declined and consulted another surgeon with the same result. He presented himself before me with the following appearance: The eye slightly red, cornea clear, linear scar three millimeters, in the upper and inner periphera of the cornea, also wound of the iris, immediately back of the wound of the cornea, this having the appearance of being dragged in as if it had been punctured, and a small synechia of the pupillary margin, dense, traumatic cataract, ball painful, fields good. I had the eye radiographed and six plates taken on the first day. These showed no signs of foreign body, but owing to the great heat of the weather, the developing was unsatisfactory. Thinking heat might have affected the plates, another trial was made the next day, and this time eight plates were taken. These were all good radiographs but no sign of the foreign body was visible. I therefore decided to be governed by the radiograph in the treatment of the case, and thereafter regarded it as punctured wound without the presence of a foreign body. As the lens became somewhat swollen I did a cataract extraction combined with an iridectomy, incising the iris at the point of injury, thinking I might find the foreign body at the lens or iris. This also proved fruitless. The case recovered from the operation and is doing exceedingly well, and I firmly believe, although too early to state positively that as there is no foreign body present in the eye, the man will retain not only his eye but his vision.

Ophthalmology is undoubtedly indebted to the x-ray, as it has added another accurate method in diagnosis of the injuries complicated by presence of foreign bodies.

As regards the deleterious effects of the x-ray, they are small in comparison to the great benefits derived. I have seen several instances of the hair falling out and slight dermatitis, but this is always due to the fact of the vacuum running down and the rays not penetrating, and to long exposures. I have never seen any serious damage to the eye.

[Dr. Thomson then showed the apparatus and demonstrated Dr. Sweet's method of localizing from the charts made in the case of Dr. William Thomson. The following description being given by Dr. Thomson from "Transactions of the Ophthalmological Society" for 1897:]

For this purpose an indicating apparatus is used, carrying two steel rods, each with a rounded end. The indicators may be supported by a head band, and the plate held to the side of the head by an ordinary bandage. The balls of the indicator are at a known distance apart, one pointing to the center of the cornea, and at a known distance from the eyeball, while the other is parallel to the first, toward the external canthus. The visual line is parallel to the indicators and to the plate. The balls should also be perpendicular to the plate.

In making the negatives the tube is in front, about thirteen inches from the plate and at an angle of from 15 to 40 degrees, with a vertical plane passing through the apex of each cornea. The plate is at the opposite side of the head, and the rays pass through the eyeball and the external orbital wall before reaching the sensitive film. Two exposures are made, one with the tube in a horizontal plane, or nearly so, with the two indicators, and the second at any distance below. The angle of the tube below the horizontal is unimportant, so long as the two exposures give different relations of the indicators on the negatives.

In determining the position of the foreign body in the eye, two circles,

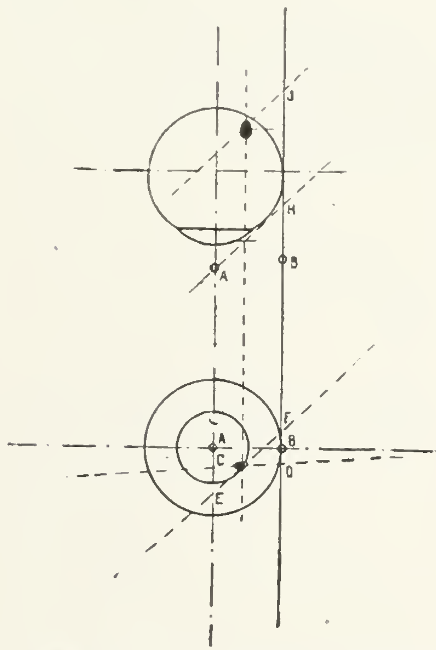


FIG. 1.—Diagrammatic circles of the eye upon which the measurements are made to show location of foreign body. Upper circle horizontal section; lower circle vertical section of eyeball.

twenty-four millimeters in diameter, equivalent to the size of the globe, are drawn upon paper. One circle represents a horizontal section of the eyeball, and the other a vertical section. Upon the vertical section a spot (A) is made at the center of the circle, indicating the position of the central indicator of the apparatus. The distance between the two indicators is measured toward the temporal side, and a spot (B) made to show the position of the external indicator.

On the circle representing a horizontal section of the eyeball, a spot (A) is made anterior to the center of the cornea, and at the same distance that the center indicator was from the eye when the radiograph was made. Another spot (B) to the temporal side, measured by the distance between the two balls of the apparatus, marks the situation of the external indicator.

Taking the first negative with the tube nearly horizontal to the two indicators, we measure the distance of the foreign body below to the two balls of the apparatus. These measurements (B to D and A to C) are indicated on the circle representing the vertical section of

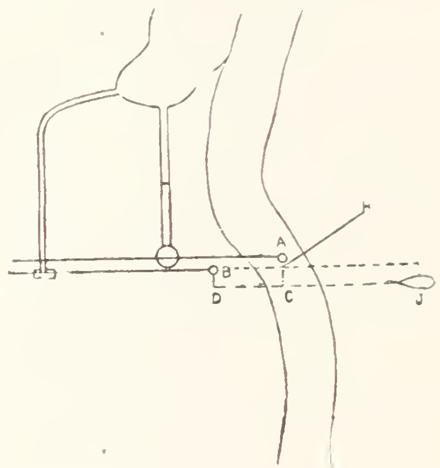


Fig. 2. Outline drawing of negative made with tube nearly horizontal.

the eye, and a line is drawn through the points (C, D). At some point along this line is situated the foreign body. From the second negative (Fig. 3), made with the tube below the plane of the two indicators, the measurement is taken of the distance (A, E). The shadow of the foreign body is below the center indicator, and this point (E) is indicated on the first circle. The distance the foreign body is above the external indicator (B, F) is measured, and the point indicated on the circle at (F). Where a line drawn through these two points crosses the line of measurements made from the first plate is the situation of the foreign body, as respects its horizontal and vertical position in the eyeball.

To determine the distance of the foreign body behind the apex of the cornea, the negative made with the tube nearly horizontal is taken, and a measurement made of the distance the shadow of the center ball is posterior to that of the external ball (B, H). The distance is entered directly above the external ball on the diagram representing the horizontal section of the eye. From this point (H) a line is drawn through the ball (A)

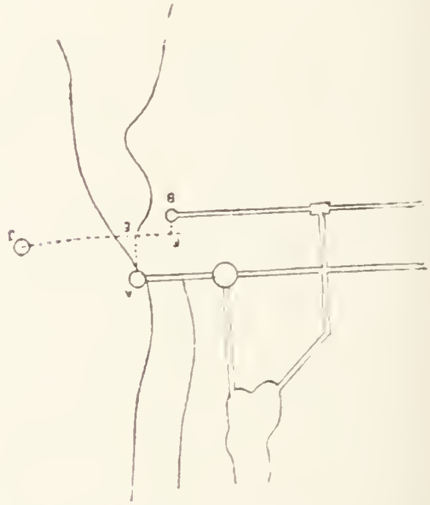


Fig. 3.—Outline drawing of negative made with tube below the plane of the two indicators.

of the center indicator, which indicates the drection of the rays from the tube when the exposure was made. Taking the negative again, we measure the distance that the shadow of the foreign body is back of the external indicator. The distance (B, J) is marked perpendicularly to the spot representing the ball of the external indicator on the diagram, and a line is drawn parallel to the direction of the rays from the tube (A, H). Where this line cuts a line perpendicular to the position of the foreign body shown on the vertical section of the eye-ball is the distance the foreign body is behind the anterior portion of the cornea."

DISCUSSION.

DR. D. C. BRYANT, of Omaha.—On account of the location of the eye within its bony cavity, it is difficult to find a foreign body with the x-ray or anything else in many instances. It is exceedingly difficult to locate the exact position of the foreign body. The use of the x-ray, so far as the eye is concerned, will always be somewhat limited in those few cases where we need help. If in a few cases it does help us to locate foreign bodies, or to prove that there is or is not a foreign body in the eye, it will be of great advantage. Outside of the eyeball itself, in the orbital cavity where we have larger foreign bodies, we know it is of great value.

DR. ARTHUR D. BEVAN, of Chicago.—I imagine that this method of locating a foreign body in the eyeball might be enlarged and applied to the location of foreign bodies anywhere in the orbit, and I think it is very valuable because of the recent experience I had in removing a bullet from the orbit, which I reported six months ago to the Chicago Medical Society. In this case a thirty-eight-caliber bullet struck the temporal bone. Probing could not locate it. There were no cranial symptoms. A blood clot, evidently in the orbit, protruded the eye. There was complete blindness for some days in the eye on that side. Within a couple of weeks the eyesight began to return. I had an x-ray picture taken and it located the bullet from one plane, but it was impossible to obtain good x-ray pictures at right angles in order to locate exactly its position. However, I determined from an analysis of the data at hand, with the x-ray picture, that the eye had been blind for some days afterward and pushed out of the orbit, and that the bullet must be somewhere in the orbit behind the eyeball. With that conclusion I operated and removed the bullet, but it took me an hour and a half. I had the general location of the bullet, in one plane, sufficiently accurate in my mind, but I was certainly three-fourths of an inch off in my position in the other plane, and in operating in the posterior portion of the orbit, in the position of the nerves and optic artery, I found it was slow work. I feel satisfied that the work could have been much simplified by an apparatus such as Dr. Thomson describes, and I can readily understand its great value.

As to the statement made in the paper that the disadvantages of the x-ray, using it in a wide sense, are very small and do not at all weigh against the advantages; there are disadvantages in the x-ray that we, in Chicago, are very familiar with, and I think from the reports of cases tabulated and published in the *Johns Hopkins Bulletin*, in regard to the injurious effects of the x-ray, should be very generally known.

I know of some cases in which great injury has been done by the x-ray. We are all familiar with the dermatitis which follows the use of the x-ray. I have seen two cases in which this effect has been extreme, followed by total destruction of skin, the superficial and deep fascia, and the existence of an ulcer for months after the use of the x-ray. I have also seen total destruction of the eye from the use of the ray and absolute loss of the ear from it. These are points which we should keep prominently in mind.

At the meeting of the American Surgical Association, held in Washington this year, Dr. White, of Philadelphia, read a paper on the same subject which seemed to belittle the possibilities of doing damage with the x-ray. I think we should all be very cautious of this. These serious effects are not so apt to occur now as they did heretofore, because the exposures are much shorter, and serious damage rarely follows exposures of fifteen or twenty minutes. So much is thought of the injurious effects following the x-ray, in Chicago at least, that the majority of men do not, themselves, take x-ray pictures. They throw the responsibility on the photographer, so much so, that one whom I know, practically compels patients to sign a contract to assume all responsibility of injury when he takes an x-ray picture. I feel quite positive that the days of serious dermatitis and injury from the x-ray are numbered, because it is better understood and the exposures are shorter. But these injurious effects should be kept in mind and be widely known. They should be known to the patient who undergoes the x-ray exposure. We have no right to expose a patient without informing him of the possibilities. It should be done in order to protect surgeons from malpractice suits, and the photographer should be cautioned to exercise great care in the use of the ray.

Dr. R. Harvey Reed, of Columbus, Ohio.—I think the idea of using "triangulation" for the purpose of locating an object is a very valuable one, and it will undoubtedly aid us in locating bodies in the eye as well as in other parts of the body. But there is one point I will speak of, and that is the possibility of damages accruing from making an operation when the x-ray fails to locate what the surgeon is looking for. Here is a medico-legal point which is of no small importance, because, if the radiographist says that a foreign body of some kind is located thus and so and advises me to make an operation for its removal, and I make the operation and fail to find the foreign body, supposing it did not exist, then where would I stand from a medico-legal point of view? In the use of the fluoroscope and the x-ray in the bullet case which I reported this afternoon, the track of the spot was located nearly above the ear and a little above and back of the eye, and the radiographist, although not certain that was the point at which the bullet was located, felt quite sure that was the point at which we would find the bullet. I was not convinced and resorted to the ordinary methods that I would have used had I not had a radiograph taken, and the consequence was I trephined over the point of entrance and found the bullet in the skull as I had located it. Had I made the opening as indicated by the radiograph I would not have found the bullet, and the operation might have been followed by bad results. By using triangulation for the purpose of locating foreign bodies we can thus avoid, to a large extent, the possibility of making operations where no foreign body exists, or where we are mistaken as to its actual location.

Dr. S. C. Baldwin, of Salt Lake City, Utah.—Reference has been made to the paper read by Dr. Willard before the American Medical Association, and in all of his experience the tube has been placed not closer than from twelve to fifteen inches from the body. As a result he has never seen any dermatitis, sloughing of the skin or anything of that kind. It is a point that might be considered in using the x-ray for this purpose.

Dr. James Burry, of Chicago.—Where crude methods have been tried in the location of foreign bodies in the body, they have not been successful in a great many instances.

The tabulation of errors by the x-ray process is valuable for us. Dr. Reed would have been in the same position if he had trephined for the bullet where the skiagrapher thought it was, as the man that cuts into a foot for a needle that is in there and does not find it. The needle is there, perhaps, but not where it is located by the x-ray process. If we report such cases it will have value in giving the process its true standing, and I think its medico-legal relations will soon be settled. I imagine that the greatest difficulty Dr. Thomson would experience in these cases is to get correct pictures. I have tried many times to get pictures of the eye, and through the nose, and have not been very successful.

Dr. Thomson.—I think our results in the use of the x-ray are largely due to the apparatus that we use. It is perfectly evident that the tubes formerly used were so small and imperfect that it was extremely difficult to take a good picture of the orbit such as I have described.

I am not sufficiently familiar with the pathologic conditions in fractures, etc., to say much about it. However, I should think that if a series of pictures were taken with a good apparatus, they would be valuable both from a diagnostic and medico-legal point of view.

I have seen cases where the hair has come out, and again where the patients have had a slight dermatitis. Some gentleman has devised a scheme which prevents dermatitis, or any deleterious effects, by allowing the x-ray to pass through a small film of gold leaf.

Rayleigh on Stokes.—Sir G. Stokes, about two years ago, suggested a theory of the Roentgen rays, according to which the Roentgen rays were regarded as aperiodic electro-magnetic waves caused by the impact against the anticathode of the charged particles in the cathode stream. This theory has recently been developed by J. J. Thomson (*Phil. Mag.*, Vol. 45, p. 172, 1898), and has come much into favor with other authorities. In *Nature*, April 28, however, Lord Rayleigh raises a protest against the acceptance of this theory. He says it has certainly much to recommend it, but he can not see that it carries with it some of the consequences which have been deduced as to the distinction between Roentgen rays and ordinary luminous and non-luminous radiation. The conclusions of its supporters "that the Roentgen rays are not waves of very short length, but impulses," surprise Lord Rayleigh. From the fact of their being highly condensed impulses, he would conclude, on the contrary, that they *are* waves of short wave length. He asks what becomes of Fourier's theorem and its assertion that *any* disturbance may be analyzed into regular wave? The view that the vibrations of ordinary light are regular, and thus distinguished from disturbances made up of impulses, he says, is an exploded idea, in the theory of light. A curve representative of white light, if it were drawn on paper, would show no sequence of similar waves. Rayleigh favors the view that Roentgen rays differ from ordinary light only in the shortness of their waves.—*Electrical Review*, London.

Experiments With X-Rays.—The stomach movements of a cat have been studied by Dr. W. C. Cannon, by means of Roentgen rays. Subnitrate of bismuth mixed with the food caused the wave-like movements of the pyloric portion of the stomach to become clearly visible, about 2,600 of the waves being counted during the seven hours a cat was digesting soft bread. A Frenchman, M. Bleunard, uses the x-rays for measuring the adulteration of flour with chalk and sand. Comparing the shadows of the sample under investigation and of others of known adulteration, it is easy to determine the proportion of foreign matter when as small as three per cent.—*London Electricity.*

The latest use of the Roentgen ray is for the diagnosis of cerebral tumors. One case of sarcoma of the dura has already been successfully located by this means.

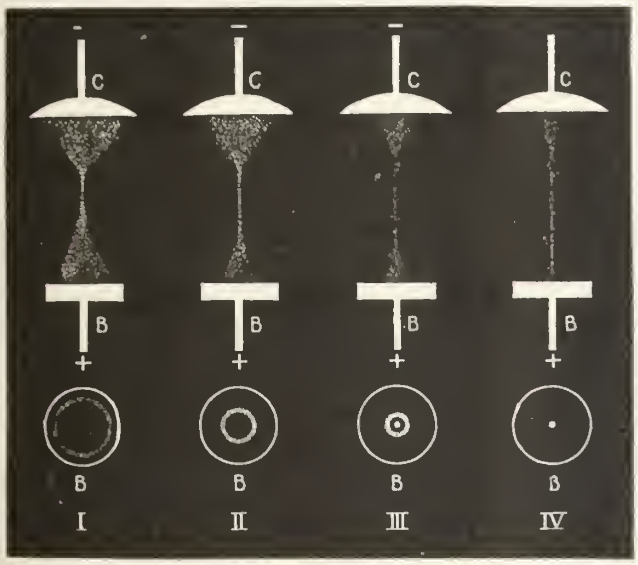
ADJUSTABLE X-RAY TUBES.

BY A. A. C. SWINTON.

The Crookes radiant matter tube, in some form or other, affords the only known means by which the Roentgen rays can be generated, and it is, therefore, perhaps not altogether inappropriate that the first ordinary paper communicated to the Roentgen Society should deal with the design of tubes of this description. As most of those who worked with the various forms of tubes originally employed for producing Roentgen rays will not readily forget, these had many imperfections, and there can be little question that the first real advance after the announcement of Roentgen's discovery, was Mr. Herbert Jackson's adaptation of Crookes' focus tube to x-ray purposes. The focus tube gives a quantity of x-rays not obtainable with the older forms. It is much less liable to be cracked or injured by the heat of the discharge, while as the x-rays all proceed from a very small area, a degree of sharpness is attained in the resulting screen-image, or photograph, that was previously quite unobtainable. The focus tube as originally introduced, though a vast advance on all previous arrangements, is not without its imperfections. Dr. MacIntyre was, I believe, among the first to call attention to the importance of using electric discharges of great electrical quantity in order to produce the best results. These heavy discharges give a much brighter screen, or what is the same thing, they enable photographs to be taken with much shorter exposures. They also cause the x-rays to be more penetrative, but at the same time they are very hard upon the tubes. With the focus tubes of the original form, heavy discharges will frequently twist up or even melt the platinum, and will usually make it red or white hot. This leads to blackening of the tubes, and to a gradual increase in the resistance, till eventually no discharge can be got to pass.

Recognizing these defects, I set myself some little time ago, in conjunction with Mr. J. C. M. Stanton and Mr. H. Tyson Wolff, the task of investigating the action of the focus tube, with the idea of, if possible, improving the design, so as to admit of heavy discharges being employed, with the view of obtaining easily and continuously the most active and penetrative x-rays possible. At the same time, seeing the great variation of the character of the x-rays that occurs with very small changes in the degree of exhaustion, and the practical difficulty of obviating such changes in practice, I endeavored to discover some ready method of adjustment more certain and more easily worked than the auxiliary pumps, potash tubes, and other similar appliances that had at that time been used or suggested for this purpose.

When a focus tube is carefully examined while under the process of exhaustion on the mercury pump, the form of the cathode discharge is found to alter from the initial appearance shown between the cathode C and the anti-cathode B, in Fig 1, at a low vacuum, through the appearance shown in Figs. 2 and 3, to that illustrated in Fig. 4, which shows the appearance when the vacuum is high. As will be observed, the cones of cathode rays in each case converge from the cathode cup to a focus, and then diverge again on the other side of the focus to a less and less extent the higher the vacuum. Finally, at a high degree of exhaustion the cathode discharge does not appear to diverge again very perceptibly, at any rate, within a moderate distance, but continues in a thin line. It is when this stage of exhaustion is reached that Roentgen rays are given off in their most active and most penetrative form. Experiments show that both the convergent and divergent cones of cathode rays are hollow, and not solid in section. When the concentrated cathode rays are allowed to fall upon a disc of ordinary electric light carbon, the latter exhibits surface luminescence. Except, however, when the disc is exactly at the focus, in which case it shows a bright luminous spot, the intersection of either cone by the disc gives not a solid spot of luminescence, but a hollow luminous ring, which decreases in diameter the higher the exhaustion, as shown in the lower portion of Figs. 1 to 4. It appears further that the cathode rays are not given off from the whole surface of the cathode cup, but only from a ring-shaped portion, the diameter of which is less and less the higher the exhaustion. This, perhaps, explains the reason why very large cathodes give no better results in producing x-rays than comparatively small cathodes. Indeed, at the degrees of vacuum necessary to produce penetrative x-rays, the greater portion of a very large cathode is apparently ineffective, as the discharge seems to come off entirely from a very small part of the central portion. This is not readily seen with the usual cathode cups of aluminum, but with cups of carbon it is easily observed. Full details of the experiments from which the above facts are derived, will be found in "The Proceedings of the Royal Society," Vol. LXI., pages 79 to 95.



FIGS. 1, 2, 3 AND 4.

Cathode rays are generally believed in this country to consist of atoms of molecules of residual gas, which being similarly electrified to the cathode, are repelled by the latter, and travel at an average velocity not much less that one-twentieth that of light. It is obvious, however, that upon such a theory the precise average velocity must depend both upon the exact potential of the cathode and molecules at the moment the latter leave the former, and also upon the degree of exhaustion of the tube, upon which depends the free path of the molecules—that is to say, the distance a molecule can travel before coming in contact with another molecule. Years ago Crookes showed that the deflection of a cathode beam by a magnet depended upon the excitation of the cathode, and upon the degree of exhaustion—that is to say, the deflection was less the higher the velocity of the molecules. More recently Birkeland has produced what he calls "the cathode ray spectrum," from which it appears that the cathode rays are not homogeneous but heterogeneous, some being more easily deflected than others, so that when the cathode stream, passed through a slit, is deflected by a magnetic field, and is then allowed to fall on the glass and cause fluorescence, the result is a series of bands. These bands are in a perpetual state of movement, and the conclusion is obvious that the molecules that form the cathode stream are not all moving at the same rate, but owing to the pulsatory and oscillatory nature of the electric discharge and the varying electrification of the cathode are divided up into groups, which have different velocities, and, being for this reason differently deflected, strike the glass and cause fluorescence in separately localized bands.

Now, as Prof. S. P. Thompson first pointed out, and as all who have since observed the effects produced on a fluorescent screen while a focus tube is in process of exhaustion, and is at the same time being excited, are aware there are several different stages as regards the x-rays produced. First of all, at less than a certain vacuum there are no x-rays ; next, as the vacuum increases, x-rays show themselves, but of a quality that will do little more than penetrate the backing of the fluorescent screen. As the vacuum is further increased the rays become more penetrative and show the bones in the hand. Next, a point is reached, when the flesh of the hand seems to be almost completely transparent, while the bones are almost entirely opaque ; at still higher vacua, the bones becoming more and more transparent, the contrast between bones and flesh becomes less and less, till at length, at the very highest vacuum at which the discharge will pass, the bones scarcely show at all, owing to their having become almost as transparent as the flesh, and the whole hand throws but a very faint shadow on the screen.

Again, what I have termed the "penetrative value" of the rays is found to be dependent upon the applied electromotive force, that is to say, the difference of potential between the cathode and anode, and the conclusion seems to be irresistible that on the assumption that the cathode rays consist of rapidly moving molecules, which by bombardment of the anticathode cause x-rays to originate, that the penetrative value of the x-rays depends upon the velocity of these molecules at the moment they strike the anticathode, and to the difference of potential between molecule and anticathode at the moment of impact, or to one or other of these conditions.

I must again refer to Prof. S. P. Thompson's experiments as to the value of different materials for the anticathode, as he was, I believe, the first to discover that the higher the atomic weight of the material the better the result. Further experiment, however, shows that while what I may call the quantity of x-rays produced as measured in terms of the brightness of the fluorescent screen, or in inverse terms of the length of exposure necessary to impress to any given degree a photographic plate, is largely dependent upon the material of the anticathode being greatest with anticathodes of the highest atomic weight, the penetrative value of the rays—that is to say, their powers of penetrating opaque substances—is independent of the material of which the anticathode is constructed. For further particulars on this subject I may refer inquirers to "The Proceedings of the Royal Society," Vol. LXI., pages 222 to 226.

To come now to more practical matters, metallic uranium, which is the element with the highest atomic weight, (240) is commercially unobtainable at present. It is to be hoped that this state of affairs will not continue, as in addition to uranium being probably the most efficient emitter of x-rays, it is also stated to have the great further advantage of not blackening the glass, even after prolonged use. Thorium (atomic weight 231) and thallium (203) being also commercially unknown, and bismuth (208), lead (206), mercury (199) and gold (197), being too easily fusible, platinum with an atomic weight of 194, and a very high fusing point, is the best obtainable material for the anticathode surface.

As platinum is, however, expensive, and thin sheets are apt, if unsupported, to be fused, pierced, or deformed under the bombardment and intense heat, I have found it desirable to mount the platinum disc on a larger and much thicker disc of cheaper metal, which not only supports and prevents mechanical deformation of the platinum, but also acts as a dissipator of heat, in addition to lessening the blackening of the glass, owing to there being only one platinum surface exposed.

In the tube I have now in my hand, which was the first constructed in my laboratory on this plan, the platinum is simply a piece of foil soldered with silver solder upon one side of a penny. Copper or bronze are, however, not good materials to introduce with a high vacuum tube, for as will be observed from this specimen, which has been a good deal used, they are apt, even more than platinum, to cause considerable blackening of the glass, and this blackening tends to increase the resistance of the tube to the electrical discharge.

A much better backing for the platinum is undoubtedly aluminum, but here the difficulty arises that it is very difficult, if not impossible, to solder platinum on to aluminum, and a good contact between the two metals is necessary. A simple plan, and one that has been found very efficacious, is to make the platinum in the form of a disc—say, about 0.4 inch diameter, and about 0.02 inch thick. The aluminum may be 1 inch diameter and 0.25 inch thick, and upon the face of it there is turned a shallow circular depression, just of sufficient diameter to receive the platinum, but rather deeper than the thickness of the latter. The platinum is tightly wedged into this depression, the edges of which are slightly riveted over the platinum by hammering.

It has been thought by some that there is an advantage in making the anticathode and the anode of an x-ray tube separate, the idea being that in this case there is less blackening. This idea I believe to be erroneous, provided the suface of the electrode which performs both of these functions is sufficient to prevent heating, and provided, as is always best, a small spark gap is introduced into the circuit so as to stop out entirely the make current of the induction coil or any reverse oscillation in the discharge which otherwise would during their continuance make the anticathode the cathode for the time being. There can be no doubt, however, both for the permanence of the vacuum and also for the prevention of blackening, of the importance of preventing the overheating of the anticathode, and though the mass of aluminum I use and recommend is very efficacious in this direction, I am of the opinion that as more and more electrical power is employed in order to obtain better and better results, some other arrangement for taking away the heat—say, in the direction of water or mercury circulation through the anticathode—will be found advantageous.

As already mentioned, one of the results of a red or white hot anticathode is a rapid deposition of platinum and blackening on the glass. This finely divided coating of platinum occludes the residual gas and causes the vacuum to become too high. Heating the glass will to some extent restore matters to their proper condition temporarily, but, apart from the degree of vacuum, the blackening seems also to have an effect in increasing the resistance of the tube, which is very probably analogous to what Crookes discovered when he found that a non-fluorescent coating on the inside of a tube increased the resistance of that tube to the passage of the electric discharge.

The precise distance between the

cathode and the anticathode is not of great importance, provided the degree of exhaustion is suitable, and provided the anticathode is beyond the focal point at which the convergent cathode rays meet together at low exhaustions. It is well, however, not to fix the anticathode too far beyond the focus, as this necessitates a higher exhaustion in order to obtain penetrative x-rays, and as too great a distance also impairs the sharpness of the resulting image.

The distance between cathode and anticathode has, however, a considerable effect upon the resistance of the tube, and upon the character of the x-rays it generates. In fact, adjustable tubes with which x-rays of any desired penetrative power can be obtained at will without altering the degree of exhaustion, or in which the unavoidable variations of vacuum which are found to take place in practice, can easily be compensated for, can be arranged with a movable anticathode mounted on a sliding rod, so that the distance betwen cathode and anticathode can be varied by gently tapping the tube.

In air at ordinary atmospheric pressure, the nearer the discharge points are together the more easily the spark takes place between them ; that is to say, the shorter the distance the spark has to leap, the less is the difference of potential required to make it leap. Curiously enough in high vacua the exact contrary is the case, and the discharge passes with much greater difficulty over a short gap than over a long one. This may be readily seen with an adjustable tube such as I will now show (Fig. 5), and in which I can alter the distance between cathode and anticathode by moving the latter. As will be seen when the distance is very small inside the tube, say only one-quarter of an inch, the spark prefers the alternative gap outside of about four inches, while if the internal gap is increased to about three inches, the discharge then prefers this path, and the exterior gap must now be shortened to about half an inch before the spark will travel that way. It is further

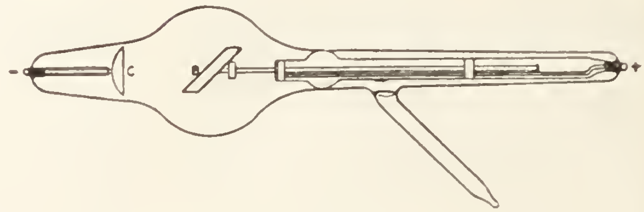


FIG. 5.

found that, in a tube of this description, exhausted to a constant vacuum, the nearer the anticathode is moved up to the cathode and the higher the consequent resistance, the more penetrative are the x-rays; while moving the anti-cathode in the opposite direction, and thus making the distance greater and the resistance less, makes the x-rays less penetrative. This form of tube was the first adjustable tube designed and made in

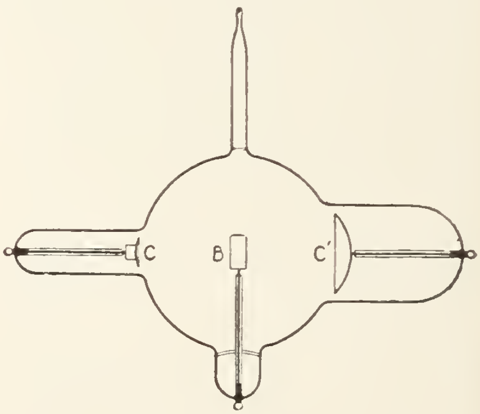


FIG. 6.

my laboratory, but this has now been superseded by others which have a greater range of adjustment, and are consequently to be preferred. One disadvantage that it possesses, is that the origin of the x-ray is moved for each adjustment. It has also the defect that, if the distance between the cathode and the anticathode is made very great, so as to obtain much range, there is a tendency to a want of sharpness, owing to the x-rays being given off, not from a point, but from a considerable area. This, which has been observed in experiment, seems to show that, contrary to

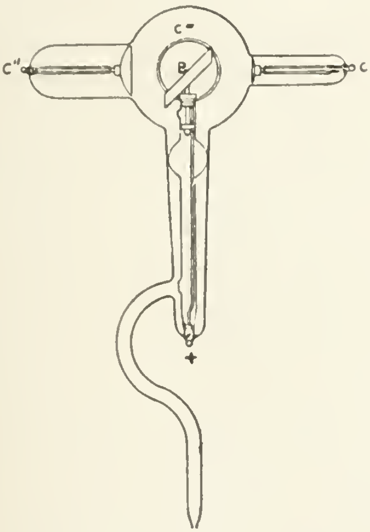


FIG. 7.

what has been stated by others, the cathode rays always do diverge again to some extent after passing the focus, though they do so at a greater and greater distance beyond the focus the higher is the exhaustion.

I have here an adjustable tube made by Messrs. John J. Griffin & Sons, which depends for its action upon the principle that I have just enunciated, namely, that the greater the distance between cathode and anticathode, the less penetrative, and the less the distance the more penetrative are the rays. In this tube, however, the anticathode is fixed, and it is the cathode that is movable, while the adjustment of the cathode is effected by the magnetic means, according to an ingenious suggestion of Dr. Dawson Turner.

The size of the cathode cup itself is also found to have a very great effect upon the penetrative value of the x-rays produced in any given vacuum. I have here a tube (Fig. 6) which is furnished with two cathodes, both of the same curvature (0.75 inch radius), but one of much greater area than the other, the larger being 1.125 inch, and the smaller 0.375 inch diameter. Both cathodes focus upon opposite sides of the same anticathode, which is placed midway between them. All are in the same tube, and consequently in the same vacuum. If I connect the larger cathode, leaving the smaller one for the moment idle, you will see that the x-rays produced are of a very poor penetrative quality, the result giving the appearance of too low an exhaustion. I now disconnect the larger cathode, and connect the small one. I now have an abundance of highly penetrative rays. I may further point out that the resistance of the tube as measured by the length of the alternative spark in air, is much less when the large cathode is in operation than when using the small cathode. Further, if this tube is more highly exhausted, so as to give rays of good penetration with the large cathode, the resistance with the small

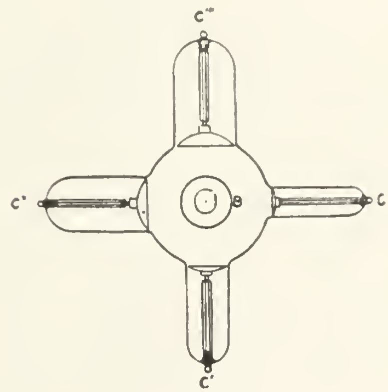


FIG. 8.

cathode is so high that the discharge will hardly pass at all.

I have here another tube shown in elevation and plan in Figs. 7 and 8, fitted with four cathodes of 0.5 inch, 0.75 inch, 1 inch, and 1.125 inch diameter respectively. They all have the same radius of curvature, i. e., 0.75 inch, and all focus upon the same point on the anticathode, which is mounted upon a spindle, so that it can be turned round so as to face any one of them. With this tube, as with the last shown, it is found that the larger the cathode the less penetrative, and the smaller the cathode the more penetrative are the rays produced. There appears to be no advantage in employing extra large cathodes, even when the exhaustion is made to suit them. Experiments with various sizes, from 2 5 inches diameter down to 0.125 inch diameter, go to show that even with the full power of a 10-inch induction coil with mercury break, there is no advantage in making the cathodes more than 1.125 inch diameter. For use with a 10-inch coil they should not be smaller than about 0.375 inch diameter, as, if less than this, they are apt to become overheated, and their surface and form destroyed. For use with 6-inch and smaller coils, very small cathodes, even down to 0.125 inch diameter, will work very well, and will not require such high exhaustion as larger ones. Small cathodes should, in proportion, have a less focal length than large ones for the best results. Probably, a good average size for ordinary work is about 1.125 inch diameter, and 0.75 inch radius of curvature. It is important for the best work that the surface should be well polished, and to be of quite even curvature.

Another simple and, in my opinion, altogether superior form of adjustable tube, which has the advantage of a fixed point of origin for the x-rays, and which has a great range of adjustment, depends for its action upon the fact that the resistance of the tube and the penetrative value of the x-rays that it generates can be greatly varied by altering the radius of the annular space between the edge of the cathode and the glass of the containing bulb. In this tube (Fig. 9) the anticathode is fixed, but the cathode is mounted upon a steel rod, held in guides, so that by gently tapping the tube the cathode can be moved to a small extent—say, about one-half an inch—in and out of an annex, blown on one side of the glass bulb. The shape of the walls of this annex are such that when the cathode is at one end of its travel, and as far as it can get from the anticathode, the edge of the cathode is very near the glass all round; while as the cathode is moved nearer to the anticathode the annular space between the cathode edge and the glass becomes larger and larger, until at the other end of the travel the cathode emerges from the annex into the bulb itself. With a tube of this construction, the greater or less proximity of the glass to the cathode is found to have a much larger effect in increasing or decreasing the resistance of the tube and the penetrative value of the x-rays than the contrary result that would be occasioned by the alteration in the distance between cathode and anticathode. A travel of one-half of an inch is sufficient to alter the x-rays from the highest to the lowest penetrative value. and between the limits of travel any desired degree of penetrative value is immediately obtained. The adjustable tube just shown was made in my laboratory, but here are two others on the same principle, made respectively by Messrs. W. Watson & Sons and Mr. Cossor, who have kindly lent them to me for exhibition.

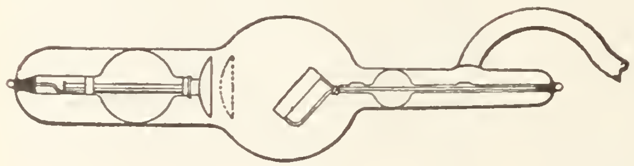


FIG. 9.

In conclusion, I should like to lay stress upon the great importance of good and accurate workmanship in the making of x-ray tubes if the best results are to be obtained. In no instrument is work of the cheap and nasty description more to be deprecated. Bulbs should be of uniform thickness, and as thin as will bear the atmospheric pressure. Cathode and anticathode should be placed axially so as to produce accurate focussing, and so that they are symmetrical with the glass. The platinum leading-in wires should not be too small, or by becoming overheated they may crack the glass. The cathode and anticathode should be substantially supported so that they can not become displaced. The cathode should not merely be roughly stamped out of sheet metal, but should be turned up and polished on a lathe to a true spherical surface. The terminals should be substantial and a long distance apart so as to preclude sparking between them.

As the application of considerable electric power is found in practice to give the best results, the anticathode should be of sufficient mass not to readily become overheated or deformed. The exhaustion should be most carefully carried out, till as far as possible a permanent degree of vacuum is obtained. Even if tubes made in this way cost more than others, they will give much superior results. They will also prove much more durable, and will in many cases stand being re-exhausted many times. Finally, if eventually the glass is cracked or broken, or becomes too much blackened, the cathode and anticathode will serve again to make another tube.

I trust that I have not wearied you with too much detail, but it is upon detail chiefly that success depends—at any rate, so far as x-ray tubes are concerned—and, after all, of all the apparatus that the practical user of Roentgen rays employs, the tube is the most important, and perhaps I may say also, the least generally understood.

I must mention, in conclusion, how much I am indebted to the untiring assistance of Mr. J. C. M. Stanton and Mr. H. Tyson Wolff, who have made and exhausted all my experimental tubes, and without whose willing aid I do not suppose I should ever have attacked these very difficult problems.

The cuts reproduced in this article were kindly furnished by the *Electrical Engineer*, N. Y. City, for use in THE AMERICAN X-RAY JOURNAL.

DEFLECTION OF THE MAGNETIC NEEDLE IN RUSSIA. *Electricity.*—The result of the investigations made by a French savant and Russian scientist into the extraordinary deflection of the magnetic needle over an immense area of Central Russia show that the greatest aberrations are found in the province of Kursk, the capital town of which is some 600 miles almost due south of Moscow. In the northern part of the province, near Tim, the needle deflects 20 degs.; further south, in the district of Staroi Oskol, up to 30 degs.; while in the southeast of the province, about 150 miles south of Tim, the deflection is over 96 degs., the needle standing almost perpendicular and pointing east and west, instead of north and south. A number of new railway lines are in process of building over this part of the country, and it will be most interesting to railway engineers, says a telegram, to follow the probable effects of this magnetic force on the durability of steel rails, which, in places not specially magnetic, are known to last much longer when laid north and south than when they run in any other direction, the line of most wear and tear from magnetization being, of course, due east and west.

[It has been suggested that since the cathode rays are deflected by the magnet the radiance of a Crookes tube is impaired or improved according to its axial position to the poles of the earth.]

THE PRODUCTION OF X-RAYS OF DIFFERENT PENETRATIVE VALUES.

BY A. A. C. SWINTON.

As is well known, if the x-rays coming from an ordinary Crookes tube of the Jackson focus type be observed with a fluorescent screen during the process of exhaustion, the penetrative value of the rays is found to change as the exhaustion proceeds.

First of all, at less than a certain degree of vacuum no x-rays are produced. Next, as the vacuum is increased, x-rays commence to show themselves, but of a quality that will do little more than penetrate the backing of the screen. As the vacuum is further increased the rays become more penetrative and show the shadow of the bones in the hands. As exhaustion proceeds further, a point is reached when the flesh of the hand seems to be almost completely transparent, while the bones are almost entirely opaque. At higher vacua than this, the bones becoming more and more transparent, the contrast between bone and flesh becomes less and less, till at length, at the very highest vacuum at which the discharge will pass, the bones scarcely show at all, owing to their having become nearly as transparent as the flesh, while the whole hand throws but a very faint shadow on the screen.

Similarly, it is found that at any given degree of vacuum the penetrative value of the x-rays is increased by increasing the power of the Ruhmkorff coil, and thereby increasing the difference of the electrical potential between the cathode and the anode portions of the tube, as measured by the length of the alternative spark in air.

Again, similar results are obtained without alteration to the vacuum or to the power of the Ruhmkorff coil by varying the resistance of the tube by means of a magnetic field.

In this case the gradual strengthening of the magnetic field produces a gradual decrease in the resistance of the tube, and of the difference of the electrical potential between the cathode and anode, and, at the same time, causes a gradual diminution of the penetrative value of the x-rays.

I have further found that it is possible to vary the penetrative value of the x-rays produced in a focus tube by simply altering the distance between the cathode and the anti-cathode.

Upon the anti-cathode being approached to the cathode, the x-rays immediately became of a more penetrative value, just as though the vacuum had been increased, while at the same time the potential difference, as measured by the alternative spark, was found to have risen. Again, when the anti-cathode was moved in the opposite direction, and placed at a greater distance from the cathode, the potential difference fell, and the x-rays became less penetrative, and similar to those produced at a lower vacuum. In this way, without varying the vacuum, the penetrative value of the x-rays could *be* increased or decreased as desired within the limits of the focus on the one hand and the travel of the anti-cathode on the other.

Again, I have found that the penetrative value of the x-rays can be altered by employing cathodes of different diameters.

Throughout the experiments it was further found that the potential difference, as measured by the alternative spark in air, was much greater when the small cathode was in use than with the larger cathode.

The penetrative value of the x-rays produced by any given tube appears, therefore, to be dependent upon several conditions.

1. The penetrative value is higher for a high vacuum than for a low vacuum.

2. It is higher when the electrical

power applied is great, than when it is small.

3. It is higher when the resistance of the tube is great than when this resistance is reduced by magnetic means.

4. It is higher when the distance between the cathode and anti-cathode is small than when the distance is great.

5. It is higher when the cathode itself is small than when it is large.

6. It is higher when, as a consequence of one or more of the above, the potential difference between the cathode and anode portion of the tube, and consequently the electrical excitation of the cathode is great, than when it is small.

On the assumption that the cathode rays consist of negatively charged molecules that are repelled from the similarly electrified cathode with an initial velocity that depends upon the degree of electrical excitation of the cathode, the above conditions are those that would conduce to a high average velocity of the molecules at the moment at which they strike upon the anti-cathode, and, at the same time, to a high average difference of potential between the traveling molecules and the anti-cathode at the moment of impact.

At high exhaustion, not only is the electrical excitation more, and the initial velocity of the molecules consequently greater, but, owing to the smaller number of collisions with the other molecules of residual gas in the tube, the average velocity of the molecules and the amount of their negative charge have suffered less diminution by the time they reach the anti-cathode than in the case of lower exhaustions.

Similarly, when more electrical power is employed, the electrical excitation and the initial velocity of the molecules is increased, while the employment of a magnetic field reduces the resistance and the electrical excitation, and consequently reduces the initial velocity and negative charge of the molecules.

Again, when the anti-cathode is near to the cathode, the moving molecules having a less distance to travel before they reach the anti-cathode, have by that time lost less of their initial velocity and charge by collisions than when the anti-cathode and cathode are further apart.

And, lastly, not only does a small cathode become charged to a higher electrical potential than a large one, and consequently impart a higher initial velocity and charge to the molecules, but with a small cathode the traveling molecules are more compactly arranged than with a large cathode, and consequently are not likely to make so many collisions and lose so much in velocity or electrical charge during their transit.

It would, therefore, appear that, whatever the precise cause, the penetrative value of the x-rays, produced under any given set of conditions, is dependent upon the average velocity of the molecules and the difference of potential between them and the anti-cathode at the moment of impact, being higher the higher the velocity and the greater the potential difference.

Further, since the excitation of the cathode is not uniform, but varying, so that different molecules have different initial velocities and charges imparted to them, and since some of the molecules will make fewer collisions than others, and some molecules will thus strike the anti-cathode at higher velocities and in a more highly charged state than others, the same hypothesis will account for x-rays being more or less heterogeneous under all conditions.

Finally, it appears that the penetrative value, as distinct from the quantity of x-rays, is independent of the material of which the anti-cathode surface is made. Experiments with a tube in which the anti-cathode was made partly of platinum and partly of aluminum, and so arranged that, by inclining the tube, the anti-cathode could be moved, and either the platinum or the aluminum part could be brought into use, show that, even with metals having such very dissimilar atomic weights, the penetrative value of the x-rays produced was the same, though the quantity of the rays, as measured by photographic action or by the brightness of a screen of barium platinocyanide, was distinctly greater with the platinum. Further experiments with other tubes fitted with anti-cathode of aluminum, iron, copper, silver, and platinum, confirm these results. The metals of high atomic weight form the most efficient anti cathodes, and give a larger quantity of x-rays, though the difference is not so great as might, perhaps, be expected. All, however, appear to give x-rays of the same penetrative value under similar conditions.—*Electricity.*

THE X-RAYS IN THE DISCOVERY OF GALL STONES.—Buxbaum (Carlsbad) recommends the use of photography in searching for gall stones. The patient is placed upon his face with the photographic plate under the abdomen and the tube just over him. In this way clear-cut pictures of the gall stones in the gall bladder may be obtained. The possibility of making these discoveries is of great value in medicine and opens up another field of usefulness for the x-rays.—*Revue med. de therapeut.*, No. 2, 1898. *Journal of Electro-Therapeutics*, May, 1898.

ANATOMICO-SURGICAL RESEARCHES BY MEANS OF RADIOGRAPHY. *Paul Reynier and Jules Glover.*—Most interesting experiments upon radiography of the osseous cavities of the face and cranium, the venous sinuses of the duramater and their relation to the external wall, etc. For a full comprehension of the subject the reader is referred to an illustrated article in the *Archives Internationales de Laryngologie*, November-December, 1897. *Journal of Eye, Ear and Throat Diseases*, April, 1898.

TESTING GOLD QUARTZ BY THE ROENTGEN RAYS.—An ingenious application of the Roentgen rays has recently been made, viz., to ascertain the presence of gold particles in quartz. The particles of gold in a paying gold quartz are often so finely divided as to be invisible to the naked eye. Since gold is more opaque to the Roentgen rays than quartz, it is natural to suppose that some indication of the presence of gold in quartz would be given on the screen or the photographic plate when the quartz is traversed by the Roentgen rays. A physician in Los Angeles, California, is reported on accidentally photographing a lump of gold quartz to have found on the shadow of the outline of the quartz a number of very dark points. These points were due to the presence of particles of gold in the quartz. It is possible, therefore, to detect the presence of gold in quartz by the presence of Roentgen rays, and it may sometimes be convenient in the laboratory, but it is not to be expected that the gold prospector will add a battery, an induction coil, and vacuum tubes to his kit.—*Electrical Review*, London, England, May 13, 1898.

A full account of this discovery can be found in THE AMERICAN X-RAY JOURNAL, Oct. issue, 1897. The discovery was made by Dr. Yoakum, of Los Angeles, Cal.

SEOKOLOFF, of St. Petersburg, reports four cases of acute articular rheumatism in children in whom marked improvement took place after the use of the Roentgen rays. The child was placed from fifty to sixty cm. from the tube, and the time of exposure was sixteen to twenty minutes. In one girl of nine years the pain and swelling of the joints, which were very great, disappeared after two treatments, while one girl of fourteen recovered after the first seance.—*La Rev. Med.*, Jan. 19, 1898.

ACNE TREATED BY ELECTROLYSIS AND THE X-RAYS.*

BY MADAME LE DR. POKITONOFF, OF PARIS.

I propose to submit to you some results obtained in the treatment of obstinate acne by means of the x-ray.

I hope that it may be of interest to women, and young girls, in particular, since it is these cases that I most desire to reach with the aid of the latest scientific discoveries.

Nearly every practitioner recalls cases of acne impossible to cure, in spite of medicaments and rigid diet.

I have tried to treat and alleviate those cases which are beyond the reach of local applications. For years I myself was thus afflicted, and finally I concluded to try massage and electricity.

When my patient is a young girl who has no internal lesions, but whose functions have rather lost tone, and when the forehead above all is most affected, I touch each pimple with an electrode, and I follow this up with a twenty minutes' massage.

In such a case numerous treatments are required—but a series of from twenty to thirty affords much relief.

Notwithstanding the presence of spores and bacilli, which belong to this affection, one must observe that weak tissues about the sebaceous glands is a favorable condition for the development of bacilli, which must be considered as a secondary cause; the first one being the weakened condition of the tissue, which should first be attacked—and here is where massage has a beneficent action.

But I can not recommend this in the case of those enjoying good constitutions, and whose functions are normally active. I tried faradism instead, which acts most favorably on muscular contractions, and it possesses as well the merit of causing an amelioration in those conditions where there is much congestion.

For in many cases of acne the local congestion is the first thing to be combatted, I have tried electro-massage, *i. e.*, massage and electricity combined, which is an economy of time.

With certain women acne has a bad moral effect, as they are constantly worrying about it. For this reason, having failed in my other methods, I decided to try the x-ray.

The following is an account of one of three cases:

Miss M., twenty-three years old, good constitution, family history good—parents living—lived always in country; menstruated at fourteen, irregular, scant, but without pain; had measles and scarlatina; at seventeen had a gastric disturbance, with cramps and colic, but was not confined to her bed.

She had pimples before her menstruation, at the age of ten—did not treat them, believing in their disappearance at puberty. As, on the contrary, they increased, she consulted a physician.

At fifteen she followed a special diet, took various alteratives, used many local applications, but in vain; at twenty-three she came to me and announced that she wished to marry in a year, and begged me to remove the deformity.

Having touched each pimple separately with the electrolytic needle, we commenced the electro-massage.

The treatments lasted about thirty minutes, after which I covered each pimple that had been treated with a small piece of surgical plaster. The following five treatments were each of them from thirty to thirty-five minutes, on alternate days, making ten treatments in fifteen days; after which she felt so much better that she decided to return to the country.

Indeed, each pimple became smaller by this method, and the redness gradually disappeared. But, on the other

*Revue Internationale d'Electrotherapie et de Radiotherapie.

hand, the patches on the cheeks appared to grow.

Later we had three new series of treatments, and after seven months although better she was not cured. As the time of her marriage approached it was necessary to do *something*, as her mental distress was great, so I sent her to my excellent confrere, Dr. Gautier, for electric baths—she slept and ate better, but the patches and pimples remained. Finally we decided to submit her to the influence of the x-ray, which after twelve treatments bleached the red blotches without accident.

Dr. Gautier gives the details of the treatment as follows:

We know that the x-rays have caused erythema and deep burns—these accidents are due to lack of care; not only is the x-ray without danger if employed properly, but it may be of great service in dermatology. The treatment should be applied as follows: 1. Daily treatment. 2. Duration, five or six minutes. 3. Crookes tube, medium size, excited by a coil which takes four amperes at eighteen or twenty volts, tube enveloped in a black cloth. One must finally protect the eye-brows, eye-lashes, and hair by means of a plate of lead; the lead is flexible, and may be molded at will to the shape of the skull.

The tube should be thirty centimeters from the face, and first one side and then the other of the face should be treated. A result begins to show itself after six treatments; the skin peels, the pimples become less red, and the glands are less apparent. It is right to inquire how the x-ray acts. This is, by a decongesting atrophic action, and probably also by a microbicidal action. This atrophic action affects also the follicles, for the hairs fall out, to grow again finer. The nails become brittle. These accidents have not occurred with us, for we have kept the tube thirty centimeters away from the patient; and we know that at this distance the electric waves lose their force. And according to the last researches of Dr. Balthazard, these electric waves are responsible for the accident, and not the x-rays themselves. Besides, these waves lose their power when the tube is wrapped in black cloth.

Old Remedy—New Uses.

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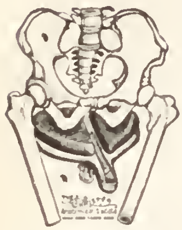

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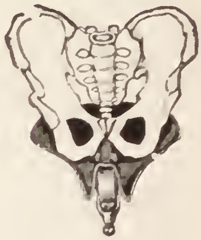

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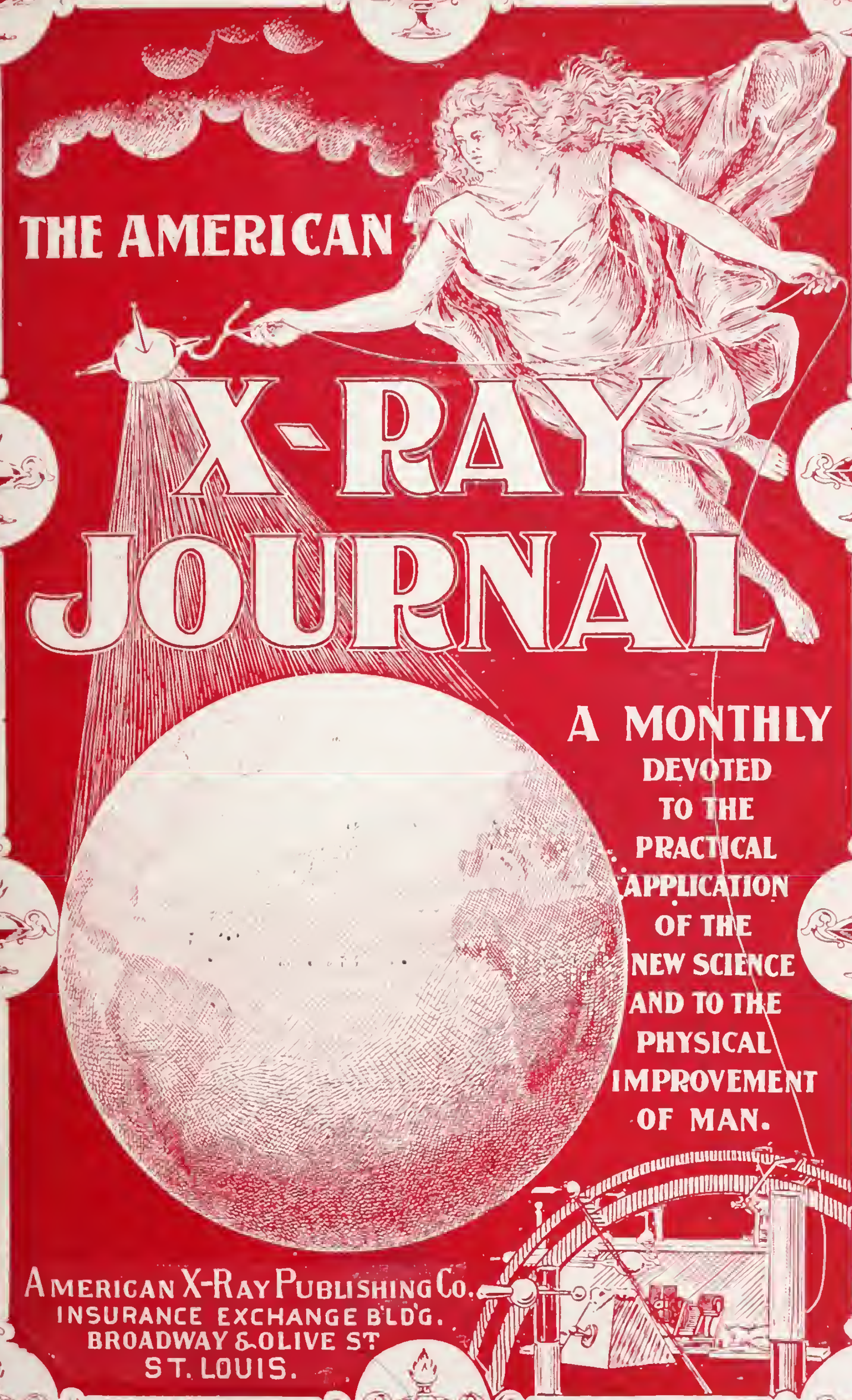

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RADIANCE APPROACHING THE MAXIMUM, ITS PRODUCTION AND USES.

WM. W. GRAVES, M. D., ST. LOUIS, MO.

In my Preliminary Report on "A Method of Overcoming High Resistance in Crooks' Tubes; A Possible Step toward Maximum Radiance," which appeared in THE AMERICAN X-RAY JOURNAL for April, 1898, the following observation was made:

"Whether for fluoroscopic or cathodographic work, approaching maximum radiance is always to be desired. A tube which gives only fair radiance has little practical value, other than from development by usage it may attain high efficiency.

High efficiency may be secured in any good tube by repeated use, thus assuring continued development in tube life, and may be more quickly attained by using tubes which have been exhausted to the highest possible point.

All authors, users and makers practically agree that continued usage engenders a vacuum resistance, which, in time, will become impassable, and if the various measures for the control of this resistance as engendered by usage fail, there is but one thing to do—have the tube re-exhausted.

Morgan's experiments with extreme exhausted tubes, and since Roentgen's discovery, experiments of Thomas A. Edison and others, tend to confirm the commonly accepted belief, that through an extremely exhausted tube no discharge will pass. My experiments during the last six months with heretofore believed to be "dead tubes" as described in my preliminary report, and some recent experiments with tubes exhausted to the highest possible point, confirm me in the belief that usage does not engender a resistance which may not be successfully overcome, and that it is not possible by true pump exhaustion to exhaust a tube to a point through which no discharge will pass; that the greater the resistance afforded by any given tube, however engendered, whether from usage or extreme pump exhaustion, the higher will be its efficiency when its resistance is overcome; that the true test for tube resistance is that resistance shown when the tube is connected, positive to cathode, and negative to anode; that is to say, reversed, and that it being possible to overcome in a satisfactory manner resistance in the tube reversed, it is also possible to do so in the tube properly connected.

Now, if it is a fact, and experience so teaches, that the greater the resistance as afforded by the vacuum tube, the higher will be its efficiency when the resistance is overcome, it must follow that approaching maximum radiance will not be attained until it is possible to overcome all resistance. Therefore, those tubes that are set aside for rest, and those tubes that are returned to the makers for re-exhaustion, are the very tubes which if their resistance, can be successfully overcome—are capable of affording nearest approach to maximum radiance.

If there were a way of overcoming resistance in such tubes, approaching maximum radiance would be the rule, and not, as now, rarely seen. I believe there is a way, but it is not found by using tubes which have regulating devices, for in such tubes no sooner does the radiance begin to approach the maximum than its penetration is lowered by the use of the "extinguisher."

It is evident that the expressions from various authors, the personal experienee of users, the advice of makers, a demand for and the sale of, the various adjustable vacuum tubes, all bear witness to the universally, accepted facts: That usage does increase resistance; that from continued use resistance does become so great that all heretofore known procedures for the control of vacuum as engendered by usage fail, and that when the various procedures do fail there is but one thing to do—have the tube re-exhausted.

The seemingly correct method of operating the tube and proper use of current interrupters, the proper degree of reversal, the application of tin foil, and the self evident value of efficient generating apparatus, have all been worked out and given what I am led to believe is the true position of each as an essential for success in readily reviving so-called dead tubes, solely by experimenting with the so-called dead tubes, as may be seen by carefully reading my "Preliminary report on a method of overcoming high resistance in Crookes' tubes; a possible step toward maximum radiance."

The probable reason why approaching maximum radiance is not universally had is on account of the heretofore believed unconquerable resistance as engendered by usage. In my preliminary report certain specific conclusions are established concerning the effect on tube resistance by interrupting the positive or negative discharge, reversal, application of tin foil, and the necessary technique required is indicated therein, and the following conclusions are drawn:

"That success in overcoming the heretofore believed high vacuum, as engendered by usage, will depend upon proper technique in current and tube manipulation; that the trouble is not in the tube per se: that a Crookes' tube which has once afforded radiance should continue to do so as long as its electrodes are not disintegrated or its vacuum destroyed; that the so-called high vacuum, as engendered by usage, is most likely a myth; that a tube which has once afforded radiance requires neither baking, boiling, rest nor re-exhaustion; that the longer a tube is used the greater it grows in efficiency; that usage is to the Crookes' tube what the crucible is to crude gold; that maximum radiance has never been seen, and that the way to maximum radiance may possibly be found in the overcoming of the heretofore believed impassable barrier of resistance, thus assuring continued development in tube life."

The universal attainment of a nearer approach to maximum radiance, is the only remaining requisite, and may be attained by better technique in current and tube manipulation, to the end that Roentgen's discovery may have the widest range of usefulness, be universally employed, and be made a necessary part of the armamentarium of every physician.

With more pertinacity than reason it is still claimed by some writers, specifically stated by certain tube and apparatus manufacturers, that tubes differing in efficiency are required for different work. For instance, if it is desired to make an exposure of the hand or forearm a tube of low resistance and efficiency is required, because when the vacuum is high the rays have much greater penetrating powers, but less photographic effect than they do when it is lower, because a radiograph of the hand can be made in much shorter time with sharp detail and strong contrast between bone and flesh if a low vacuum is used. On the other hand, for exposures of the denser portions of the extremities, trunk or head, a tube of higher vacuum and efficiency is required, though it is claimed that such a tube does not show as much contrast between bones and muscles as it penetrates both.

The truth of the matter is, that for all purposes for which Roentgen's light is now employed, whether fluoroscopic or cathodographic, whether we desire to examine the thicker or denser structures of the body, the nearer the light of any given tube approaches the maximum the better will be the result, and the more satisfactory will be the examination. No one has yet stated that too much could be seen with the fluoroscope; on the contrary, higher and still higher efficiency is universally sought for fluoroscopic work. Then why should any one believe, much less assert, that light can be made too penetrating for cathodographic work? The better the light, the greater the contrast, and the more the detail, irrespective of the portion of the body to be examined. The better the light, the shorter the exposure. The better the light, the greater the distance to be had between the tube wall and the subject. This latter fact alone is sufficient reason for desiring and requiring radiance approaching the maximum for all work. Long exposures with tube in close relation with the subject, inefficient generating apparatus and ordinary light, have been the causes of so-called x-ray burns. When the user of x-ray apparatus shall have ceased employing tubes of ordinary efficiency for any purpose whatever, and will use instead, tubes affording radiance approaching the maximum for all purposes, Roentgen's discovery will be universally employed, and the so-called x-ray burns will become ancient history, and those who shall still cling to the belief that x-rays do cause burns will have lost their last "prop," because there will be no burns.

It may be asked, what is considered radiance approaching the maximum? The maximum is not known, because the longer a tube is used the greater it grows in efficiency, but a minimum radiance for good x-ray work may be readily established. When a tube becomes available for good x-ray work its radiance should show the pulsations of the heart in a man weighing 150 pounds with clearness and distinctness five feet from the tube wall. The best light obtainable, the nearest approach to maximum, is the rule whenever fluoroscopic examinations are made, and it should also be the rule when we desire to show shadows in the completed print.

An x-ray print, if proper light and exposure is had, should show the different layers of clothing, the skin, the fat, the muscles, the bones, and bones through bones, the marrow and cancellated bone structure, and in certain poses the blood vessels, intermuscular spaces, the shading of the muscles, depending upon their densities, and tendons and their attachments. In sprains where rupture of ligaments has taken place the points of separation should be shown. The brain in its relations to the skull, the spinal cord and in one print in my collection may be seen what appears to be the gross structure of a portion of the cerebellum. Of the great and lasting benefit Roentgen's discovery has up to the present moment been to the medical profession, and, in turn, to mankind, it is not necessary at this time to speak. We have every reason to believe that fully one-half of the possibilities of this wonderful light are yet unknown.

In concluding I do so with the hope that radiance approaching the maximum shall be the rule, and the only radiance for all purposes wherein Roentgen's unparalleled discovery now is and may in future time be employed, and with all, that the man who pointed out the way, Dr. William Konrad Roentgen, may not be forgotten.

1943 North Eleventh Street

TRAUMATIC NEURASTHENIA.

BY THOMAS H. MANLEY, M. D., NEW YORK.
Professor of Surgery, New York School of Clinical Medicine.

Read before the seventh annual meeting of the New York State Association of Railway Surgeons, held at the Academy of Medicine, in New York City, November 16, 1897, and published in the International Journal of Surgery.

[This article in its entirety is reproduced in *The Atlantic Medical Weekly* for May. The subject is one of general interest. We reproduce only that portion of the article which refers to the x-rays.]

The surgeon in such a dilemma now turns to the latest and one of the most invaluable gifts of modern science, to the utilization of the Roentgen rays, that he may critically inspect the naked framework of the bones, and spare his patients the dangers of sanguinous surgery. But, unfortunately, here disappointment may await him, for the skiagraph is neither a positive nor definite resource in a considerable number of osseous disorganizations which are not readily detected by ordinary means. For example, quite a few cases have been reported where it has pointed to cleavage and rents in bones that did not exist, and vice versa, indicated osseous perfection where crepitus and mobility established beyond question the presence of fractures. Speaking from an abundant experience with the radiograph, Tracy, of Boston, says: "While much has been gained in accuracy of diagnosis by the aid of x-ray pictures, there is one branch of practical medicine where harm is threatened by their employment. I refer to medical jurisprudence. * * *

Their indiscriminate admission will hurt the cause of justice, because they can easily lead to fallacy and error." He goes on to show where the deformity of a Colles' fracture may be photographed in the normal limb.

Dr. P. M. Jones is more optimistic and says: "Here we have an agent which cannot err; if it gives an answer at all, it must be truthful and shows to the examiner the actual conditions." *Journal of the American Medical Association*, November 6, 1897. The former is a practical surgeon and the latter a teacher of electro therapeutics. Possibly sometimes error comes through want of skill in photographing; but when the sketching is done by experts, ignorance cannot be charged. And these are the very instances where the greatest fallacies have been demonstrated. Dowd has lately verbally reported a case of fracture of the leg, three days old. The patient, inspired by curious motives, had the limb skiagraphed; but the pictures were identical in both tibiae and he refused to pay the bill for professional attendance on the ground that he had no fracture.

The past summer at the University Hospital, London, it was my privilege to witness an operation by Mr. Barker, on a girl's hip. It was a case of old dislocation. A large, well developed x-ray photograph showed the head of the femur resting on the dorsum ilii, a deep, hollow cavity marking the site of the femoral head was in evidence, and the acetabulum was entirely obliterated by absorption, a smooth, hard surface only remaining. I saw a somewhat similar case at the Laraboisiere in Paris, where the ray exhibited a subcoracoid dislocation of the humerus. In vain varied and repeated efforts were made to reduce it. Section showed no luxation at all, but a fracture through the anatomical neck. The skiagraph is the most valuable diagnostic aid we possess, and in conjunction with other resources of great assistance, but alone unreliable.

After dislocation of a limb, one of four things may occur:

1. It may be overlooked; something which happens oftener than is commonly supposed.

2. It may be reduced; the ordinary event.

3. It may be irreducible; quite unusual.

4. It may be reducible, but can not be retained; rare in most articulations, but common in one.

5. Exclusive of scapulo-clavicular dislocations, which as a class can not be retained after reduction, there are others in which reduction can not be maintained because of a chipping off or fracture of the rim of the mortice.

That a person may go about unconscious of a luxation goes to show that dislodgement of a bone from its socket is not always incompatible with the retention of a fair degree of function remaining. This is notoriously the case in the humero-scapular and claviclo-scapular luxations. Dislocations of the acromial end of the clavicle, when complete, are rarely reducible and seldom or never can be retained.

Failure of reduction or retention invariably implies permanency of defect in a limb, though rarely to such a degree as to incapacitate one from his ordinary employment, if this does not entail heavy labor.

By the former we designate those traumatisms in which the disorganization of bones is the dominant factor, as in Pott's or Colles' fracture, or fractures of the humerus, with simultaneous dis-dislodgment of the scapular head; a condition readily detected when impaction is absent.

Dislocation fracture is one which is produced by the head of the bone impinging on the border or margin of the mortice or joint-hollow. The best description of this important lesion is given by Senn, who collected twenty-eight cases, and more recently by Dr. Edmund Andrews, of Chicago, who designates this "rim-fracture." (Fractures of the Rim of the Acetabulum and the Margins of other Joints Complicating Dislocations. *International Clinics*; Vol. VIII., 7th series, October, 1897.) In these cases reduction after the bone fails, because of loss of osseous support. Accuracy of diagnosis in this class is of the highest importance because of its bearing on prognosis; and here the Roentgen rays render possible the precise recognition of the lesion, without division of the soft parts, a boon of priceless value.

REGENERATING X-RAY TUBES. Graves. Lond. *Elec. Rev.*, June 10; abstracted briefly from THE AMERICAN X-RAY JOURNAL, April.—Dead tubes may be resuscitated by reversal, separate gaps and tin foil on the cathode end of the tube. In tubes of ordinary resistance the direct resistance is about three times the reversed and when the current refuses to pass in the proper direction it can probably be passed in the reverse direction; but if this is impossible then success will usually be attained by introducing a spark gap between the tube and the negative terminal of the generator; a spark gap at the negative pole reduces the resistance, while at the positive pole it increases it; tubes that have been thus resuscitated are far more efficient than new tubes which have not yet become dead.

PRACTICAL X-RADIANCE.

BY J. M. SCOTT, M. D., KANSAS CITY, MO.

The power of all x-ray machines are rated according to the lengths of spark they will give. According to experience this has less to do with their actual capabilities than the volume of spark. In an inducting coil the length of spark it will give is governed by the length of wire and number of turns in the secondary. The volume of spark is governed by the size of the wire in the secondary. It is much cheaper to make a coil which will give a twelve inch spark of small volume than with a large volume. A coil with the secondary wound with a size number thirty-six wire, which is a small size, will give a spark of small volume, while a coil wound with a number thirty-two wire in the secondary will give a very large volume.

FIG. 1.

It will take at least four times the weight of number thirty-two wire to give a twelve inch spark that it will of a number thirty-six. In using a Crookes tube the pressure or voltage is to overcome the resistance of the vacuum in the tube between the internal electrodes When you have sufficient voltage to force all the current your machine will give through the tube at the correct vacuum for the work you wish to do, that is all that is necessary; any more than this simply heats the platinum electrode to such a high heat that it will melt if you do not cut down your current by some means, or short circuit part of it.

The more volume of current you have the more voltage it will require to force it through the same tube—this is according to Ohms' law, that one volt will force one ampere through one ohm of resistance. Now to force more current, or say two amperes through one ohm of resistance, it will take two volts.

The power of x-ray depends on the volume of current you pass through your tube at the correct vacuum. By experiments I have found I can get as good, if not better, results with the fluoroscope and take as good a picture with the same length of exposure using the same tube in both experiments with an eight inch spark coil wound with a number thirty-two secondary which gives a large volume of current as I can with a twelve inch spark coil wound with a number thirty-six secondary which gives a small volume of current.

In order to get penetrations with a tube we must have a vacuum which will back up about a three inch spark. I do not find it practical to use a higher vacuum than this, since, if you do it will make the bones nearly as transparent as the flesh, both with the fluoroscope and radiograph, then in using it to photograph through the trunk you will get very little contrast in your negative and consequently a poor picture. If it is true the molecules of residual air in the tube become charged with electricity and pass at a high velocity from one part of the tube to another, the reason a high vacuum gives more penetration than a low one might be explained in this way: if the theory that the x-ray is produced by transverse vibrations or pulses in ether, somewhat like light, but the vibrations are shorter and much more frequent, and the x-ray vibrations are caused by the electrified molecules in the tube striking some obstruction which is generally the platinum disc, then the harder these atoms strike the platinum the greater force and penetration will be given the x-ray vibrations. The higher the vacuum in the tube the less will be the number of molecules, so those which are in motion can go a greater distance without colliding with others and therefore gaining a greater velocity than if the vacuum was lower and there were more molecules in the tube, consequently having a greater velocity they will strike the p'atinum harder and give off more penetrating x-rays.

FIG. 2.

To sum up, in order to produce a powerful x-ray with an induction coil and force it through a thick substance like the trunk of the body in a few minutes we must have a tube of high vacuum to get penetrations; to use this tube we must have a high voltage current such as will throw a spark across an air gap ten to fifteen inches long, then a current of large volume, such as given from an induction coil with the secondary wound with a number thirty-two wire.

It is easy to take a picture through the body in three minutes and through the hand in five seconds where a short time ago it would take one hour to take a picture through the body and five minutes to take a hand. This is a great improvement as it entirely eliminates the danger of electrolysis or so-called burning. The x-ray has absolutely no injurious effect on the body; all the injurious effects such as burning are caused by the current of electricity.

FIG. 3.

The current used to excite the Crookes tube being one of high voltage does not have to come in contact with the body to pass to it. If any part of the body is held within six inches or less of a Crookes tube some of the electrical current will pass to it which may not be felt by the person but if noticed will feel like a breeze blowing against the part unless the part is held within an inch or two when the current may jump in the form of a spark. Exposing a person close enough for the current to pass to him for five or ten minutes will do no damage, but if held six inches away for thirty minutes or more, or three inches for fifteen minutes or more, it is very liable to cause an electrolysis or so-called burning. To prevent burning, hold the part exposed eight inches or more away; if exposure is over five minutes there is absolutely no danger. In fifteen months' work with the x-ray taking pictures nearly every day I have never had a single bad result follow.

In making an exposure for a picture the further away you place the tube from the plate and the closer you place the object to be taken to the plate the better definition you will get. If the tube is held close to the part exposed or the part exposed is held away from the plate the resulting radiograph will be magnified and distorted.

I use approximately the following distances of tube from plate and time of exposure on a person weighing one hundred and fifty pounds:

Hand and wrist, 30 seconds at 6 inches.
Forearm, 45 seconds, at 6 inches.
Arm above elbow, 1 minute, at 10 inches
Shoulder, 4 minutes, at 18 inches.
Thorax, 3 1-2 minutes at 20 inches.
Hip joint, 5 minutes, at 22 inches.
Knee, 3 minutes, at 18 inches.
Foot 2 minutes, at 14 inches.

FIG. 4.

By using the above distances I get good definition and still am not so far away but what I can make a short exposure. I have been using about the above distances in all my work and have never even produced a dermatitis or had any bad results, although when I first commenced the work I had to make long exposures, some as long as one-half hour and several of these in a day.

DEVELOPING X-RAY.

It is a great advantage to an x-ray operator to develop his own pictures; he will naturally give them more care than a photographer. Very often a picture which is over or under exposed can be developed carefully and a splendid picture obtained. A photographer can tell you your picture is under or over exposed, but it is impossible for him to express to you just how much or to what degree, while if you are accustomed to developing yourself you can tell exactly how much it is under or over exposed in proportion to the length of exposure you have given it then you are sure of getting a correct exposure on the second trial; if your tube gives off the same amount of rays and is placed at the same distances as with the first exposure.

In the choice of plates I always use a plate especially prepared for x-ray work which has a double thick emulsion on it. I have never seen any rules laid down for developing these plates, but I spoiled many a good picture by not continuing the development long enough.

I use either of the following developers: Pyro-Eikocum Hydro. or J. C. Tabloids, but use them much stronger than the formula given for ordinary plates and add two drachms of 10 per cent solution bromide of potash as a restrainer instead of about ten drops as for ordinary plates; I often use the following formula with the J. C. Tabloids: take three J and three C tabloids and dissolve in five ounces of water, then add two drachms, 10 per cent solution bromide potash. I also have some stock solution of the tabloids made up on hand to add if the picture is very slow in turning dark and some extra bromide if it turns dark immediately, showing over exposure. If the picture is through the arm or hand you can see first the outlines of the hand or arm will appear, then later the bones. If the picture is through the body or thick part this will not occur, but the part of the plates which will have the picture on it will turn dark slowly and you will not see the outline of the bones or only slightly.

FIG. 5.

In the above I refer to the upper or film side of the plates; the back of the plate will remain white much longer than the front. If the picture is through a thin part like the hand, the outline of the hand will not disappear entirely, but if through the body, the outline of it will soon be lost and the film side of the plate will look as though you had no picture. I continue developing, if for a hand, until the back of the plate has turned dark or nearly black with the exception of the part which has the outline of the hand, but this should be somewhat dark. If the picture is through the body I continue developing until all of the back of the plate has turned dark, then wash in water and put in the hypo. and leave for twenty minutes. On an average I take about twelve to fifteen minutes to develop the plates.

The image taken with the x-ray does not show in developing like in a photographing plate and the developing should be carried much further. As to the printing of the picture, I leave that to the photographer; if he does not get a good picture the first time he can try it again, but if he does not develop a negative well he can not do it over.

The x-ray certainly proves the often made assertion that you can not tell where a bullet is located by the direction from which it enters the body. In one radiograph I made, a ball was found buried in the body of the fourth dorsal vertebra; the party who did the shooting was considerably above him and shot downward, the ball entered in the side at about the seventh rib; this was twenty-three years ago. Twenty years ago he was operated on, as it caused paralysis of the lower extremities. An incision was made thirteen inches long on the side of the vertebrae but the bullet could not be found. About six months ago I located the ball by a radiograph, in the body of the fourth dorsal vertebra, after taking a radiograph extending from the fifth dorsal vertebra to the eleventh and another below this. He was operated on by Dr. Geo. Halley and the ball removed successfully; his paralysis has improved in his opinion some. Could the ball have been removed at the first operation the paralysis probably could have been relieved. The paralysis was all motor. He has always been well nourished.

In another case I located a twenty-two caliber ball in the pelvis on a level with the articulation of the head of the femur which entered on a level with and struck the fifth rib.

A blood clot will often obscure a foreign body. In a case brought to me for a radiograph of the hand to locate a needle, I did not remove the bandage. The Doctor assured me there were no pins in the bandage, and said he had made several incisions where the needle was supposed to be.

I then made an exposure and developed the negative but found no needle; but found light, irregular lines, where after examining the hand proved to conform to the incisions which were filled with clotted blood. I made another exposure and on developing the negative found the broken needle but no outlines where the clot showed before. The needle was under the clot in one of the incisions.

In another case I was trying to locate a piece of steel in an eye. I made the exposures with the plate on the side of the head and the tube opposite but in the negative I could not get the outline of the cavity of the orbit as is usual in taking a picture in this position. From a former experience with the needle, I concluded there must be a clot of blood in the eye which was proven correct as the eye was removed and found filled with clot. The piece of steel was in the clot.

FIG. 6.

Fig. 1 is a radiograph of a shoulder of Mr. K—— Residence, Guthrie, I. T., taken for Dr. F. R. Smiley, Boonville, Mo., showing a bullet lying on the scapula. The party who fired the pistol, a thirty-eight caliber, was standing directly in front, the ball struck the clavicle and glanced to where it is shown in the radiograph.

Fig. 2. Fracture of base of neck of femur. Radiograph made for Dr. H. D. McQuade. Mr. L——, residence Kansas City, Mo. Age 38. Occupation, merchant. Fracture caused by fall. It is somewhat impacted but not sufficient that it could be diagnosed by measurements; there was considerable pain on movement of limb, he could move it himself but could not stand on it on account of pain, little swelling, one-half inch shortening; the exact condition is shown in the radiograph. It made the condition a certainty out of an uncertainty. The original radiograph shows the outline of the articulation of the head of the femur much more plain than the cut, proving there is no dislocation. It might not be out of place to mention here that any tubercular softening of the head of the femur can be accurately shown and also its relation to the head of the femur and its exact extent even if very small. I have two good pictures of tubercular softening, one in the head of the femur and one at the sacro-iliac articulation, both of special interest because they have been operated on and the correctness of the radiograph demonstrated. It is also interesting to note that in the reproduction of the radiograph of the fracture of the neck of the femur that although the bones at point of fracture are separated and the break does not extend entirely through the bone, still the lines of the fracture show very similar to what they would in a photograph of a bone with the flesh removed.

FIG. 7.

Fig. 3 shows the radiograph of a watch in the esophagus of a man just above the cardiac orifice of the stomach swallowed for the experiment of taking the radiograph of a watch in this position. Immediately after taking the radiogragh it was removed by pulling it back through the mouth by the chain attached to it. The subject of this operation is an ostrich man who gives exhibitions of his different abnormal powers; among them are the swallowing of the watch and letting persons hear it tick by placing their ear to his chest; taking a piece of plate glass an inch square, one-half inch thick, crushing it in his teeth and swallowing it; he also swallows loaded cartridges, money, tacks, screws, seven grains of strychnine at a dose, twenty grains morphine, three grains of arsenic and other poisons. He is able to take these large doses of poison by commencing years ago with ordinary doses and gradually increasing some until now it is a habit he can not quit. He says he passes the metallic articles in twenty-four hours.

Fig. 4. Radiograph taken for Dr. E. R. Lewis, showing deformity of bones of left foot, and also right one for comparison. On inspection both feet were apparently alike.

Fig. 5. Showing aneurism of arch of aorta. Case referred to me for a radiograph by Dr. C. F. Wainwright and Dr. Hal Foster. This case is especially interesting as the post mortem has been made. The radiograph was made about six weeks before death. The following history is given by Dr. Wainwright and Dr. Foster:—

"Mr. M. H. Stevens; age sixty-two; single; occupation, cigar dealer; born of healthy parents; temperate in habits; never had any severe sickness, commenced complaining about two years ago; slight cough which was paroxysmal and continued up to the time of death; he complained of slight aphonia and on examination of throat there was slight paresis of vocal cords and on physical examination of the chest the respiratory murmur on the left side was slightly enfeebled. Aside from this difference the examination of the lung was negative. There was a slight area of dullness above the heart and aside from this there was no physical signs of aneurism. The radial pulse in the two sides were similar. There was no inequality of pupil, no bruit or change in heart sounds, no abnormal pulsating area, nor pain. The heart was normal in size and there was no evidence of valvular lesion. The diagnosis of aneurism was made from the character of aphonia due to pressure upon the recurrent laryngeal nerve.

FIG. 8.

"The patient died from exhaustion after a history of two years duration and a very large fusiform aneurism was found involving the entire arch of the aorta extending to the body of the vertebrae against which it pressed, filling up almost entirely the upper part of mediastinum. The tumor was filled with coagulated fibrin through which an opening passed about the size of the aorta, abnormally. The x-ray in this case proved to be valuable from the fact that there was no physical signs of aneurism aside from the pressure upon the recurrent nerve. The dark area as shown in the picture was highly diagnostic and strengthened the opinion of the aneurism."

FIG. 9.

Fig. 6. Needle in hand. Mrs. K—— broke off a needle in the palm of her hand. Dr. Scott made an x-ray photograph of the hand which showed the fragment to be at the junction of the phalanx and metacarpal bone of the third finger. The needle was apparently pushed through the head of the phalanx, but when we operated could not find the needle where we supposed it was. Another x-ray showed the needle free in the tissues between the third and fourth fingers at the metacarpal articulation; the second operation proved successful; after an incision over the needle and down to it the knife struck the fragment. The knife serving as a guide, a forcep introduced along the blade easily grasped the needle which was withdrawn. Any one who has attempted to remove a needle from the fleshy parts of the body must certainly know the difficulties of such a procedure. An x-ray photograph acting as a guide makes this operation a comparatively simple affair.

Altogether the x-ray has proved itself an invaluable aid to us in locating foreign bodies we would no more think of operating without its aid than operating without the usual aseptic precautions.—Drs. Rosenwald, Adams and Anderson.

Fig. 7. Radiograph of the arm taken for Dr. G. O. Coffin, showing dislocation of radius and shattering of the ulna by a thirty-eight caliber ball.

Fig. 8. Radiograph of pelvis of girl six years old taken for Dr. Perkins, showing dislocation of femur with partial absorption of head of bone. Pelvis tilted some.

Fig. 9. Radiograph of head, taken for Dr. J. Block, showing a round bullet in back of same; another radiograph was taken of the above head from before, backward, showing the ball to be one-half inch to the right of the median line. The party was shot about thirty years ago. The ball entered in back of external canthus on the left side. A short time ago he had a paralysis of right arm; as the ball entered near the arm center of the brain, it was thought it might be the cause of the paralysis. Dr. Block therefore had a radiograph taken to locate the ball, and it being found in the back of the head, was known that the ball itself was not causing the paralysis.

Fig. 10. Radiograph of arm taken for Dr. G. W. Lilly, showing non-union of the ulna and union of the radius. The bones had been wired together, the wire is also shown.

FIG. 10.

Fig. 11. Radiograph of head taken for Dr. E. W. Hethrington and Dr. W. E. May, showing bullet in head, behind the eye. A picture of this case was taken also from before backward and showed the ball on a line a little to the nasal side of the pupil of the right eye.

Fig. 12. Radiograph of abdomen of

ostrich man, Mr. G. W. Whallen, taken for Dr. E. Von Quast. The dark mass on the left side of the picture contained one hundred and sixteen different pieces of metal and a handfull of glass. Patient operated on June 8, 1897, at Ger-

FIG 11.

FIG 12.

man Hospital. Occupation, showman; twenty-six years old. Median Gastrotomy. The following foreign bodies removed:—3 oz. glass, two pocket knives, one a barlow four and one-half inches long, the other one, a four blade, five knife blades, one barb wire staple, three screws, one horse-shoe nail, sixteen tacks, forty-one wire nails, forty-seven twelve penny nails. On account of the weight of the above articles, the stomach was lower than normal. The outline of the articles do not show, as they were all rolled up in a round mass. Patient emaciated from want of food, he could not eat anything for about one week before operation. Foreign bodies had been in stomach for two or three weeks. After operation stomach was closed by interrupted and lambert sutures. Death in forty-eight hours from enteritis and exhaustion. There had been hemorrhage from bowels. The post mortem showed absolute union of wound in stomach, no leakage, wound had healed in part.

The above radiograph and history of cases are reproduced by permission of the physicians for whom they were taken.

New Ridge Building.

ANODE RAYS. Sandrucci. *Nuovo Cimento*, March; abstracted in the Lond. *Elec.*, June 17.—He showed that both electrodes in a vacuum tube emit so-called cathode rays, the only difference being that they are of greater strength at the true cathode; at a certain exhaustion there proceed from both cathodes two cones of rays, one enclosed in the other or partly separated, which bear charges of opposite signs; both are deflected by a magnet; there is no radical difference between the two kinds of rays.

X-RAYS. Kalischer. *Elek. Zeit.*, June 16.—The beginning of a review of the subject of x-rays, with special reference to that which may be of permanent value.

CATHODE RAYS IN AN OSCILLATING ELECTRIC FIELD.

The theory of the cathode rays most in favor among physicists in this country is that which assumes that the rays consist of a stream of particles charged with electricity. This theory has not been generally accepted in Germany, though recently it has made a few converts.

One apparently fatal objection urged against the view that the cathode rays consist of charged particles, is that they are not deflected by an electrostatic force. If these rays consist of electrified particles, one would expect *prima facie* that they would be more susceptible to an electrostatic force than to a magnetic force. The reverse, however, is the case. They can be readily deflected by a comparatively weak magnet; but Hertz found that no deflection was produced when the rays passed between two plates connected to a battery.

Prof. J. J. Thomson makes an ingenious attempt to explain away this anomaly in the charged particle theory. He says: "We must remember, however, that the cathode rays, when they pass through a gas, make it a conductor, so that the gas, acting like a conductor, screens off the electric force from the charged particle, and when the plates are immersed in the gas, and a definite potential difference established between the plates, the conductivity of the gas close to the cathode rays is probably enormously greater than the average conductivity of the gas between the plates and the potential gradient on the cathode rays is probably very small compared with the average potential gradient." He also describes an experiment in which a deflection can be produced when the electrostatic field is caused to act on the dark space next the cathode, and this he explains by the hypothesis that the gas in the dark space is either not a conductor at all, or, if a conductor, a poor one, compared with the gas in the main body of the tube.

An interesting experiment is described by J. J. Thomson, which illustrates this curious resistance of the dark space to the passage of the cathode rays. Two spherical bulbs were connected together by a glass tube; one of these bulbs was small, the other large; they each contained a cathode, and the pressure of the gas was such that the dark space round the cathode in the small bulb completely filled the bulb, while that round the one in the larger bulb did not extend to the walls of the bulb. The two bulbs were wound with a wire which connected the outsides of two Leyden jars; the insides of these jars were connected with the terminals of a Wimshurst machine. When sparks passed between these terminals, currents passed through the wires and induced currents in the bulbs, which caused a ring discharge to pass through them. Things were so arranged that the ring was faint in the larger bulb and bright in the smaller one. On making, however, the wires in these bulbs cathodes, the discharge in the small bulb, which was filled by the dark space, was completely stopped, while that in the larger one became brighter. Prof. Ebert has also shown that a cathode stream is deflected out of its straight path by creating a dark space in its way.

The charged particle theory gives no satisfactory explanation of this curious property of the dark space; and though some ingenious experiments, similar to that of Perrin, have been devised by J. J. Thomson to show that the cathode rays discharge negative electricity on anticathode conductors, yet, while so many important phenomena remain inexplicable by the theory, it appears advisable, for the present, to suspend our judgment.

Jauman also obtained a deflection of the cathode rays by placing a conductor close to the side of the tube just in front of the cathode. But this has been shown by Schmidt and Wiedemann † to be due to a displacement of the starting point of the cathode rays owing to the change produced in the electric field by the presence of the charged conductor, and not to a deflecting influence exerted on the cathode rays by the electrostatic field. The deflection obtained by J. J. Thomson may be explicable in the same way, since the conditions of his experiment were very similar to those of Jauman.

Though it is still doubtful whether the stationary electric field produces any deflection of the cathode stream, it has been recently shown by Schmidt ‡ that unmistakable deflections are produced by an oscillating electric field. The conditions of the experiments made by Schmidt exclude the possibility of the deflections being due to a displacement of the starting place of the cathode rays.

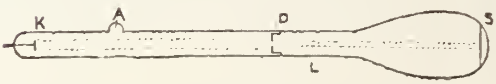

FIG. I.

Schmidt's experiments were made with a special vacuum tube designed by Braun.§ In this tube, illustrated in fig. 1. K is the cathode disc, and A is the anode. At D is an aluminum diaphragm with a central aperture about 2 mm. in diameter; S is a disc of mica coated with phosphorescent material, on which the phosphorescent spot can be seen through the glass when looking at the end of the tube.

If an insulated metal plate is brought near the tube in the neighborhood of L, the phosphorescent spot widens out a little. This phenomenon is intensified if the plate or, in its place, a brass ball

* Royal Institution Lecture, April 30, 1897, p. 10.

† E. Wiedemann & G. C. Schmidt, Wied. Ann., 60. p. 510, 1897.

‡ K. E. F. Schmidt. Abhandl der Naturforsch-Gesellschaft zu Halle, 21, p. 163 and 173, 1897.

§ Wied, Ann., Vol. 60, p. 552.

is connected to the cathode pole of the induction coil. Under these circumstances a comet-like tail is thrown out from the side of the spot opposite to the inducting body. The appearance of some of these comet tails is shown in fig. 2.

Since the publication of Schmidt's experiments, this subject has been taken up and thoroughly investigated by Prof. Ebert, of Kiel * Instead of the induction coil, Ebert used a small alternating dynamo driven at the highest possible speed by an electro-motor. This machine generated an alternating current with a frequency of 60,000 per minute. The E. M. F. of this current was raised

FIG 2

by a Siemens spark inductor with the condenser removed to 1,500 volts. The terminals of the secondary of this coil were connected to a pair of condenser plates placed at opposite sides of the Braun tube close behind the diaphragm. The cathode rays in the tube were produced by an influence machine. Ebert's arrangement, therefore, differs from Schmidt's in several features. (1) With Ebert's apparatus the oscillating electric field is persistent and regular, while in the Schmidt arrangement it is irregular and quickly damped, owing to the oscillations being derived from the ordinary induction coil. (2) The source of the oscillating field is independent of the source of the cathode rays in Ebert's arrangement, while in Schmidt's they are both derived from the same source, viz., the secondary of an induction coil.

Ebert satisfied himself, by experiment, that the time changes of the electric field between the condenser plates were almost perfectly sinusoidal, and followed one another without a break. With this apparatus were obtained not only comet-tailed extensions of the nucleus spot on the phosphorescent screen, but well defined deflected rays could be seen, which, in the rotating mirror, were drawn out into oscillation curves of the greatest regularity.

The two metal plates, P_1 P_2 fig. 3, having each a surface of 3·7 x 6·8 cm., were formed into a small condenser by fixing them at one end to a block of vulcanite, S_2 2·5 cm. thick. These plates projected far enough over the vulcanite to embrace the tube, B. When the machine was started, the spot on the phosphorescent screen was drawn out into a thick vertical band of about 3 cm. in length. This experiment, therefore, proves that in the oscillating electric field cathode rays are distinctly deflected, and always in the direction of the lines of force, the latter assertion being easily demonstrated by turning round the condenser. The deflection in this case can not be explained on the theory of the displacement of the starting point of the cathode rays, since that was 30 cm. distant from the condenser plates, and it was found that these plates lost their deflecting power if they were moved away from the tube even a few centimeters. The deflection is greater the greater the surface of the plates, and it also increases if the condenser is moved toward the end of the tube, as if the amplitude depended on the leverage at which the condenser acted. The deflection also increases with the potential difference between the plates.

Ebert suggests three different theories to explain this deflection effect of the os-

* Wied. Ann. 64, p. 240. 1898.

cillating electric field, and then proceeds to examine these theories by crucial experiments to determine which gives the correct explanation. He considers it possible that the deflection may be due to:—

I.—The magnetic effect of the displacement currents in the dielectric.

II.—The electrostatic charges on the walls of the vacuum tube.

III.—The deflection effects of secondary cathode phenomena.

I.—The Influence of the Displacement Currents.

The displacement currents of Maxwell's theory oscillate backwards and forwards along the electrostatic tubes of force, and would consequently give rise to circular magnetic lines of force surrounding each tube. These magnetic circles are equivalent, according to Stokes' theorem, to a shell of rectangular magnetic lines of force lying in the planes joining the edges as the condenser plates. The magnetic effect of these lines would tend to deflect the cathode rays in exactly the same direction as is shown by Schmidt and Ebert's experiments. But it remains to be seen whether in other respects this magnetic force is sufficient to account for the phenomena observed.

Ebert makes use of several arguments to show that, notwithstanding this partial agreement between the predicted and the observed results, the deflections are *not* due to the influence of the displacement currents. One of the strongest is the answer to the following question: Is the movement of the cathode rays in phase with the charging of the condenser, or with the displacement current? If G is the electrostatic potential gradient, the displacement current is determined by dG-dt, and therefore differs in phase from the charging of the condenser by a quarter period. If the deflection is due to the magnetic effect of the displacement current, it should have a phase displacement of about 90 deg. relatively to the curve of tension. In order to determine this point, the primary current of the transformer was made use of for comparison. By causing the two forces, whose phases are to be compared to act on the cathode beam at right angles, the shape of the resulting curve will give the required information, in accordance with the well known rules for combining simple harmonic motions. In the primary circuit of the transformer was interpolated a small solenoid, M, fig. 3. This solenoid or bobbin was mounted on guides, R_1, at right angles to the axis of the Braun tube, B. The condenser, consisting of the two metal plates, P_1 P_2 and an intervening

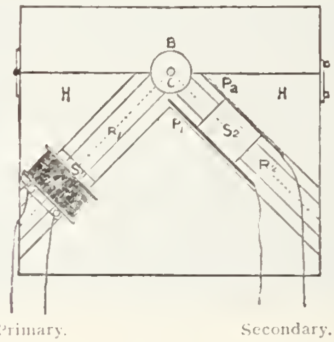

FIG 3.

vulcanite block, S_2, was mounted on guides, R_2. at right angles to the axis of the tubes and also to the guides, R_1. The bobbin, M, produces a magnetic deflection of the cathode rays at right angles to the magnetic lines of force, and the condenser, P_1 P_2, produces a deflection in the direction of the electrostatic lines of force. These two deflecting forces, therefore, produce deflections at right angles to each other, and the bobbin and the condenser can be adjusted at such distances from the tube that the deflections are equal.

As the result of numerous experiments, Ebert found that the figures produced by the combination of these two perpendicular oscillations were invariably approximately circular ellipses. This showed that the phases of the oscillations differed by as nearly as possible a quarter period. Now we know that the phase difference between the primary and secondary of the transformer must in this case be quarter period, and it follows, therefore, that the oscillations of the cathode rays are in phase with the charging of the condenser and not with the magnetic field produced by the displacement currents.

Ebert has also shown, by calculation, that the deflection which would be produced by the magnetic field produced by the displacement currents would be only 1-300000th of that actually observed.

It may be taken, therefore, as proved, that the oscillations of the cathode rays between the plates of a rapidly charged and discharged condenser are *not* due to the magnetic effect of the displacement currents.

II.—The Electrostatic Charges on the Walls of the Vacuum Tube.

It is well known that a vacuum tube in which cathode rays are being produced shows strong electric charges on its walls. In the Braun tube, which is somewhat different in shape from the ordinary Crookes tube, the distribution of the surface charges can be easily ascertained by a proof ball and an electroscope. The proof ball (of brass) is fixed on the end of a glass rod; different parts of the surface of the active tube are touched by the ball, and the charge on the ball is then tested by the electroscope. By exploring the surface of the Braun tube in this way, Ebert found a very strong negative charge on the cathode end of the tube, which covered the whole surface of the tube to about half way between K and A (fig. 1). The charge was so strong that sparks could be drawn from the surface of the tube, and the surface charge lasted for a considerable time after the discharge in the tube had stopped. The negative charge was gradually neutralized towards A, and before A was reached was replaced by a positive surface charge, which, however, was not quite so strong. This positive charge continued in varying amount up to the diaphragm, D, reaching a minimum shortly before D was reached. In the cylindrical part of the tube behind the diaphragm, D, there was found very strong positive charge, which increased steadily towards the end, S, and reached such an intensity on the surface of the pear-shaped end, that small sparks could be drawn off after the discharge in the tube had ceased. The positive charge outside the tube implies a corresponding negative charge on the inner surface of the tube. In the active Braun tube, therefore, all parts of the inner surface of the section D S, even where the cathode rays do not strike, are coated with a layer of positive electricity which binds a corresponding negative charge outside

By these surface charges the course of the cathode rays is essentially influenced. It is well known that the cathode stream always moves along the axis of the tube, even with considerable variations in the shape of the cathode; but if the surface distribution on the tube is disturbed by putting one part to earth, or by drawing off sparks, the beam of cathode rays jumps at first suddenly to one side, and then returns slowly to its original position. The return of the rays to the axis of the tube is evidently due to the restoration of the surface charges by the action of the tube.

The oscillating electric field will evidently have the effect of periodically changing this surface distribution, with the result of producing oscillations of the cathode stream, in the same way in which a single disturbance produces a temporary deflection. Some idea of the mechanism by which this deflection is produced may be obtained from what follows.

III.—The Influence of the Cathode Phenomena Called Into Existence by the Oscillating Electric Field.

Ebert and Wiedemann have shown* that when alternating electric tensions are applied to electrodes on the outer surface of a sufficiently evacuated tube, cathode rays, with all their attributes of dark space, &c., are produced opposite the electrodes inside the tube. It was found sometimes, however, that these phenomena could not be obtained, though all the essential conditions of the experiment appeared to have been fulfilled. Then it was discovered that the cathode phenomena could always be started again by sending a direct discharge through the tube from internal electrodes. From this it would appear that the cathode discharges produced by alternating potentials applied to external electrodes are only possible when there are considerable surface charges on the walls of the vacuum tube.

From what has been said above, it will be seen that these conditions exist in the Braun tube, as used in Schmidt's and Ebert's experiments. When the tube was examined in a dark room, sparks could be seen passing between the condenser plates and the sides of the tube, but no corresponding cathode discharges were observed inside the tube till after the main cathode discharge had taken place.

Ebert and Wiedemann have shown† that the dark space from one cathode offers a great resistance to the passage of rays from another cathode. They described one experiment, in which, by means of a movable cathode, the rays were brought gradually closer to the dark space of another cathode. As they were brought closer they failed completely to penetrate through, but became deflected and bent round the outline of the dark space.

These experimental results can now be applied to explain the oscillation of the cathode rays in the oscillating electric field. The electric oscillations proceeding from the condenser plates, will project a dark space into the interior of the tube, first from one side and then from the other. These alternately projected dark spaces bring about the observed oscillations in the main cathode beam. According to the experiments of Kaufmannand Aschkinass, ‡ the deflection *ceteris paribus* is proportional to the potential gradient of the deflecting cathode. There must, therefore, with a regular periodic electric force, be an oscillation of the cathode rays obeying the sine law. And this is exactly what has been observed.

These interesting experiments of Ebert's appear to show that the deflection of the cathode rays in the oscillating field are not primarily due to the potential gradient of the electrostatic field but to a cathode discharge which is created by this gradient. Why the dark space should have this curious resistance to the passage of cathode rays remains unexplained, though it appears to be a well established experimental fact. Ebert, indeed, with true scientific caution does not consider that his experiments exclude the possibility of direct electrostatic influence, but only that such influence if it exists is too weak to be shown by the Braun's tube. These experiments, however, appear to be fatal to the view that the whole of the electric current is carried by the particles of the gas in the form of electric charges. They point rather to the view that the current inside a Crookes tube differs only in degree from what takes place when a current passes through a gas outside the tube.

Ebert points out that his apparatus,

* Wied. Ann. 50, p. 42, 1893.

† Sitzungsber Physikal Societat Erlangen, 24, p. 114, 1891.

‡ Wied Ann 62, p. 588, 1897

illustrated in fig. 3, forms a very convenient and sensitive arrangement for measuring the difference of phase between the primary and secondary currents in transformers, and recommends its use to electrical engineers.—*Electrical Review*, London, June 3, 1898.

X-RAYS IN THE ARMY.

The question has been asked, how can the x-rays be used to advantage on the battlefield? Wherever the surgeon can pitch his tent, there also a tent suitable for a complete x-ray apparatus can be pitched, being constructed the same as any other tent, only lined with black cotton flannel, and it is ready for the Rhumkorf coil, storage battery, Crookes' tubes fluoroscope and the necessary adjunct, the Dennis fluorometer.

By the fluorometric measurements and markings, the location of a bullet or piece of shell can be accurately located in a few minutes and the patient turned over to the surgeon; with an exact diagram marked with an indelible pencil on the limb or body, showing to the surgeon at what point he can find the missile.

Sometimes a few hours delay in the treatment of wounds makes it necessary to save life, that the soldier suffer the amputation of a limb. The use of the fluorometer does away with the delay consequent upon taking a radiograph and the necessity of taking a photographic outfit onto the battlefield.

It should be considered a greater achievement for the surgeon in the army to save a soldier's limb by extracting a bullet or piece of shell than to successfully amputate it, when gangrene or blood-poison has developed from delay in removing the foreign body, consequent upon his being carried in an ambulance to an army hospital located miles away from the scene of battle. To save an arm or leg may mean the saving of hundreds or even thousands of dollars in pensions in after years.

RECENT ADVANCES IN THE TREATMENT OF FRACTURES OF THE EXTREMITIES.*

BY JOHN B. ROBERTS, M. D., OF PHILADELPHIA

Surgeons have recently made notable advance in the investigation of fractures by the employment of Roentgen rays, which, by means of the fluoroscope or photographic plates, show the exact condition in obscure cases of fracture. In other instances fractures which were supposed to have been properly reduced have been shown by the use of the Roentgen rays to be still the seat of deformity.

Another improvement is the freedom with which obscure fractures may be investigated by aseptic incision of the soft parts, which discloses the exact nature of the bony lesion.

The treatment of fractures has been much improved in recent years by the more extensive adoption of plastic splints made of gauze and plaster-of-Paris. These should substitute, to a great extent, the manufactured splints of metal and wood which instrument makers sell at a high price for use upon fractured limbs which they seldom fit. It is possible to properly pad a wooden splint or successfully adjust a metal or felt one to the injured limb. It is, however, far better to make a splint out of plastic material, like gauze filled with gypsum, which will absolutely correspond with all the inequalities of the surface of the patient's limb.

Ambulant splints, which permit patients with fractures of the leg to get out of bed and walk upon the injured member at a comparatively early period, are also the result of the advance in fracture treatment that has come by study of the imperfections of older methods. The employment of massage during the entire period treatment of a fracture will be

*Abstract of an address before the Altoona Academy of Medicine and Surgery. "Pennsylvania Medical Journal," May, 1898.

found to lessen the rigidity of the muscles, stiffness of joints, and inflammatory infiltration around the seat of fracture, which so often retard the patient's full recovery of function. Massage should be used with discretion, but may be employed with much satisfaction to the patient every time the splint is removed for the inspection of the seat of fracture. The desirability of this method of establishing a healthy condition of the soft parts makes it desirable to remove the splints much more often than used to be thought necessary.

Tenotomy of the tendon of Achilles, to prevent displacement due to muscular spasm, in fractures of the leg near the ankle is another accessory of treatment often neglected. Tenotomy will also probably be found of avail in some cases of fracture of the olecranon, and perhaps in other regions where muscular contraction leads to difficulty in maintaining reduction of fragments.

The surgeon should not forget that where accurate coaptation of the broken bone can not be readily accomplished, an aseptic incision will add practically nothing to the patient's risk. Such an incision not only gives a better understanding of the condition of the parts, which may be essential to proper treatment, but permits disentanglement of fragments of bone from lacerated muscles, thereby averting non-union of the fracture. It also permits the use of wire or cat-gut sutures in cases demanding such direct methods for maintaining apposition.

It is probable that few surgeons, and perhaps almost no general practitioners, realize how easy it is to keep a fractured bone in position when the surgeon sees the exact line of break. Much of the deformity of many fractures would be overcome and the anxieties of the period of treatment lessened if the medical attendant, after finding the line of fracture, simply drove a nail through the soft tissues into the broken bone in such a manner as to hold the pieces together. It is not improbable that the time is near at hand when many fractures will be treated by some such direct method. Ordinary wire nails or long tacks made aseptic can be driven through aseptic tissues into the bone without disadvantage. This can be done in closed fractures as well as in the open ones. An ordinary straight surgical needle does very well for this purpose. If necessary, an ordinary brad awl may be used to drill a bone.

Refracture or osteotomy of deformed union after fracture should be used much more frequently than it is. It is probable that much of the difficulty in fractures about joints comes from imperfectly apposed fragments. Investigation of such cases by free incision and the use of nails or sutures in the bone to hold the fragments in proper position would probably lead to more perfect restoration of function than is usual in fractures involving the joints. Many surgeons who fearlessly investigate fractures associated with wounds experience unreasonable hesitation in making aseptic incisions down to the seat of fracture in obscure and troublesome cases.

The recent advances here outlined in the treatment of fractures of the extremities have brought about the following results: The restoration of the patient to a condition of health permitting him to transact business in much less time than formerly; the establishment of this desirable end with little or no pain during the period of treatment; and the much less frequent occurrence of troublesome anchylosis after fractures involving joints.

V SIBILITY OF ROENTGEN RAYS. Dorn. *Wied. Ann.*, 64, p. 650; abstracted in *L'Eclairage Elec.*, June 4.—A reply to the criticism of his recent publications on this subject.

ROENTGEN SOCIETY, LONDON.

Committee of Inquiry into the Alleged Injurious Effects of X-rays

It having been alleged that injurious effects on the human body have been caused by exposure to x-rays, it was decided at a meeting of the Council of the Roentgen Society on April 5th to nominate a Committee to collect information on the subject.

The following members were selected, with power to add to their number :—

Professor Sylvanus P. Thompson, President, Dr. David Walsh, Secretary, ex-officio members; Mr. Thomas Moore, Dr. Barry Blacker, Mr. Ernest Payne, Secretary to the Committee, Hatchlands, Cuckfield, Sussex.

This Committee will be glad to receive information from all workers with x-rays of any case of injury that may have come under their notice after exposure of a patient to the rays.

In order to obtain accurate information the Committee have prepared a set of questions to which they would be glad to receive answers as complete as possible. The questions are framed with a view to elicit opinion and collect information which will show whether the injury was the result of any of the following causes :—

1 The x-rays themselves directly.
2 Some electrolytic or electrothermal action of a leakage discharge current from the leads or from the terminals of the tube.
3 Some actiou due to the varying electrostatic charges on the surface of the tubes.
4 Some combination of these causes.
5 Some other, hitherto unrecognized, kind of radiation emitted simultaneously with the x-rays.
6 Some other cause hitherto unobserved

A list of the questions is given below. The Secretary of the Committee will be glad to send forms for answer to any medical man or other worker who may have information of any case about which he is willing to give particulars.

No names will be published, connected with the information supplied, except by the distinct consent or request of those concerned.

The Committee will also be glad to receive accounts and results of any experiments that may have been tried which throw light upon the subject. They hope to be able to collect sufficient details of the cases that have occurred (which are happily not numerous) to enable them to place the results before general meeting of the Society before the end of the year.

QUESTIONS.

MEDICAL.

1. Nature of injurious effect.
2. Description of case radiographed.
3. Part exposed to the rays.
4. Condition of subject.
    a. Well nourished or emaciated.
    b. Temperament—nervous or phlegmatic.
    c. Diathesis of patient.
    d. Local condition of part exposed.
5. Did the patient complain of any feeling of warmth, tingling, or other sensation during or after the exposure ?
6. Duration of effects, temporary or permanent.
    Remarks.

ELECTRICAL.

7. Apparatus employed—Induction coil, spark-length, voltage and amperage used in exciting the same, or influence machine.
8. Exact form of tube, length from terminal to terminal.
9. Distance of tube from patient's body.
10. Number of exposures. Interval, if any, between the exposures. Duration of each exposure.
11. Situation of tube with regard to body or limb of patient ; *i. e.*, position of anode and cathode.
12. What covering, if any was used.
    a. Material of which it was composed.
    b. Rough or smooth, thick or thin.
    c. Color, if dyed
    Remarks.

David Walsh, M. D , is Hon. Sec'y of the Roentgen Society and J. W. Barbour, M. D., is Librarian.

The mathematical accuracy of the Dennis Fluorometer in correcting divergence of the x-rays was recently demonstrated in the St. Louis Hospital.

THE ROENTGEN SOCIETY, LONDON.

A meeting of the Roentgen Society was held at 11, Chandos Street, on Tuesday, March 1st, 1898. The President, Prof. Silvanus Thompson, F.R.S., in the chair. Minutes of previous meeting were read and confirmed.

The following were balloted for and declared duly elected: Prosper H. Marsden, M. D.; W. J. Paley Marling, M.A.: W. A. Coldwell; J. Morrison Barbour, M.D., F.R.C.S.; G. Paxton.

The following candidates were nominated, on the recommendation of the Council, to be balloted for at the next meeting: H. W. Cox, H. J. Loe, John H. Dudgeon, Miss Roma Austen, Miss Moberley, A. P. Sinnett, Dr. Heber Robarts.

Mr. Isenthal introduced M. Rochefort, of Paris, who demonstrated a new coil invented by him jointly with M. Wydts.

The Secretary showed a skiagram of double congenital dislocation of the hip by Mr. Noble Smith.

The President mentioned a case of writing submitted to him for Roentgen ray examination, and the matter was discussed.

Mr. Ernest Payne suggested that in view of the importance of the so-called Roentgen ray dermatitis, a committee of investigation be appointed by the Society.

After some discussion, the further consideration of the matter was left to the Council.

The date of the next meeting was announced to be April 5th.

A paper was read by J. H. Gardiner, F.C.S., on "The Relation between the Photographic Activity and Penetration of Roentgen Rays generated at different vacua."

A general meeting of the Roentgen Society was held at 11, Chandos Street, on Tuesday, April 5th, 1898, at 8 p. m. Prof. Silvanus P. Thompson, F.R.S., in the chair.

The President announced with great regret that the Hon. Secretary, Dr. Walsh, was absent through ill health, and that Mr. J. J. Vezey, a member of Council, had kindly undertaken his duties for the evening.

The minutes of last general meeting were read and confirmed.

The following were balloted for and declared duly elected: H. W. Cox, H. J. Loe, J. H. Dudgeon, Miss Roma Austen, Miss Moberley, A. P. Sinnett, Dr. Heber Robarts.

The following candidates were nominated on the recommendation of the Council, for ballot at next meeting: Leon Gaster; Arthur Talbot; Walter D. Jamieson; John Lynn Thomas; T. Maltby Clague; W. Reginald Cookson; Frank S. Pepperdene, M.A., Ph. D.; Margaret Mary Sharpe, L.R.C.P., L.R.C.S. Edin.; Leslie Miller, A.I.E.E.; Harold H. Simmons, A.I.E.E.; Ernest Greville, M.B., C.M. Edin; F. H. Buhl; Sydney F. Walker; Lewis Jones, M. D.; Alfred Apps, M.I.E.E.

Exhibits:

1. A drawing by Mr. Webster, and a note supplementary to his paper read in January last.

2. Two photographs from Mr. W. A. Coldwell, one a case of hip disease, the other a case of prostatic calculi.

The President announced that, in accordance with the suggestion made at the last general meeting by Mr. E. Payne, the Council had just appointed a committee for the investigation of dermatitis (x-ray).

The next meeting was announced for May 10th.

A paper was then read by Mr. James Wimshurst on "The Advantages of the Influence Machine for Lighting X-ray Tubes," with a demonstration.

Re-enforced Radiographs. Lond. *Rev. Gen des Sc.* June 15.—A short article in which he describes experiments made with the use of fluorescent screens behind the photographic plate, for the purpose of re-enforcing the radiograph or producing a darker impression in a shorter time; others who tried it came to the conclusion that such images were not as clear and that it was due to the granular nature of the re-enforcing plate. He made a systematic study of this, using strips of five different re-enforcing screens on the back of the same impression and also a band in which the image was not re-enforced; the resulting print is reproduced. It shows that the actions of the various screens are quite different; the greatest re-enforcing was obtained with the sulphide screens of Becquerel, and especially with those of Kahlbaum, both of which fluoresce with a violet tint; with a phosphorescent screen, or those made of the platinum salts, the impression was less pronounced than when no screen was used. The sharpest definition was where there was no screen, the others showing a sort of halo around the edges, but this he found was not due to the granular nature of the material, but to a true halo caused by the diffusion of the light, and which, therefore, increases with the time of exposure, and is due to the fluorescent radiations.

"The use of the x-ray will prove of the greatest value in all future attempts to locate bullets. In order to locate the bullet with sufficient accuracy to enable the surgeon to determine the propriety of an operation for its removal, and to guide him safely in his work, photographs from at least two directions will have to be taken. Every field and general hospital should be supplied with an x-ray apparatus, and in all difficult cases this, one of the most recent diagnostic inventions, should be made use of before undertaking an operation, and in preference to repeated recourse to the probe."—Extract from an article by Nicolis Senn, M. D., entitled, "The Modern Treatment of Gunshot Wounds in Military Practice," which appears in *The Journal of the American Medical Association*, for July 9. Dr. Senn is Lieutenant-Colonel U. S. Volunteers, Chief Operating Surgeon with the army in the field.

At the transactions of the New York Surgical Society recently, Dr. L. A. Stimson exhibited a large number of radiographs, showing fractures of the elbow, forearm, wrist, and ankle, taken at the Hudson Street Hospital. Those of the elbow, taken in connection with photographs and specimens presented, show that the "gunstock" deformity is caused by angular displacement inward of the lower fragment after supracondylar fracture, the displacement being probably due to pressure of the sling under the elbow.

The radiographs of Colles' fracture showed comminution of the lower fragment to be frequent at all ages, and the prominence of the ulna to be due to the ascent of the lower fragment of the radius and the carpus; also that dorsal displacement of the lower fragment of the radius is much less marked than the common "silver fork" deformity indicates; also that fracture by extreme dorsal flexion of the wrist must be very rare. Fracture of the styloid process of the ulna was found only in cases with marked displacement.

The radiographs of fracture at the ankle showed very plainly the differences between fractures by inversion and those by eversion or abduction of the foot, the latter giving the well-known lines of fracture of Pott's fracture, while in the former the external malleolus is broken low down and the internal malleolus so high up that it brings away a considerable adjoining piece of the tabia.

A PHOTOMETER FOR SKIAGRAPHY. DR. BICSALSKI. *Deutsche med. Wochensch.*, 1898.—The author describes the following apparatus: A black pasteboard box, narrowed down at one end and cut to fit the face of the observer, the other end having a round hole, which is placed against the x-ray tube. In the box, and nearer the observer's end, is the usual fluoscopic screen, 12x12 c.m. In front of this (nearer the opening for the x-ray tube) is a pasteboard screen divided into thirty-six squares. One of these squares is covered with one layer of tin foil, the next with two layers, and each following square has an additional layer. Each square also has on it a wire figure, denoting the number of layers of tin foil.

Looking through this apparatus at the glowing tube, the figure on that square which can still just be made out denotes the number of layers of tin foil the particular x-ray can penetrate, and consequently the intensity. The knowledge of such intensity is of much value in estimating the desired exposure for a dry plate.—*The Post Graduate*, N. Y.

SOME interesting particulars are at hand from Vienna of a new application of the Roentgen rays for curative purposes. These were communicated by Dr. Edward Schiff, lecturer at the Vienna University at the last sitting of the Imperial and Royal Medical Society. A series of experiments conducted by Dr. Schiff and his assistant proved that these rays could be used for the cure of disease in a manner capable of perfect control by means of a more or less intense application for a longer or shorter period, producing reaction in the exact degree required. In this way it has been possible for the lecturer, on the one hand, to remove hair from parts of the body where it constituted a disfigurement without causing the slightest inflammation, while, on the other hand, he has been able to treat lupus with uniform success by means of an artificial inflammation, the intensity of which he was in a position to increase or reduce at will. The results secured by the new method both in the removal of superfluous hair and the treatment of lupus were demonstrated in the persons of some of Dr. Schiff's patients.—*Health*.

PATIENT WITH A BROKEN NECK LIVES A YEAR.—John K., a lad 9 years of age, living in Camden, N. J., fell from a tree June 9, 1897, sustaining a fracture of the cervical vertebra. The x-ray was applied and confirmed the diagnosis, locating the spicula of bone pressing against the spinal cord. Laminectomy was performed and the fragments of bone removed. The boy subsequently regained consciousness and by means of appliances was able to be carried in an invalid chair about the grounds of Cooper Hospital. Death occurred June 1, 1898.

DISCHARGE BY X-RAYS. Child. *Phys. Rev.*, May-June.—A long article describing experiments with the fall of potential at the surface of a metal when exposed to the discharging action of x-rays. The results are given in curves and tables, and show the following: That there is a large fall of potential at the surface of the metal when the discharge is caused by x-rays; that this fall is diminished by allowing the rays to strike the plate; that it is diminished to the greatest extent in the case of metals which absorb rays most.

THE G. CRAMER DRY PLATE CO. succeeds to the business of the G. Cramer Dry Plate Works, having just been incorporated with a capital stock of $200,000, fully paid up, divided into 200 shares of $1,000 each. These shares are held by G. Cramer, F. Ernest Cramer, Jason C. Somerville and Emile Cramer respectively. The officers of the new corporation are as follows: G. Cramer, President; F. Ernest Cramer, Vice President and Treasurer; Jason C. Somerville, Secretary.

BOOK REVIEW.

Cataphoresis Or Electric Medicamental Diffusion.

BY WM JAMES MORTON, M D.,

Professor of Diseases of the Mind and Nervous System and Electro-Therapeutics in the New York Post Graduate Medical School and Hospital; Member of the Medical Society of the County of New York; Permanent Member of the Society of the State of New York, Member and Post President of the American Electro-Therapeutic Association; Member of the New York Academy of Medicine, American Neurological Association, Howard Medical Society of New York City, American Medical Association, Societe Francaise d'Electro-Therapie, New York Electrical Society, etc., etc. Author of The X-Ray or Photography of the Invisible and its Value in Surgery. American Technical Book Co., N. Y. 266 pages, $5.00 net.

First authentic account of cataphoresis is that of Fabre Palaprat experimenting in 1833. He claimed to have placed on each arm a platinum disc—the negative saturated with a solution of potassium iodide and the positive with starch water. Upon application of a current, Palaprat claimed that the starch water turned blue (showing presence of iodine). Dr. W. J. Morton has tried this experiment, but unsuccessfully.

In the Ward Richardson experiments in 1859, with "Voltaire Narcotism", aconite and chloroform were introduced by means of an electric current into the leg of a dog and the leg painlessly amputated after eleven minutes of application.

In 1890 Thos. Edison read before the International Congress at Berlin, a paper on the treatment of gout by lithium salts cataphoretically applied. The patient's right hand was immersed in a jar of sodium chloride, (positive) and the left hand in a jar of lithium chloride, (negative). After applying a current, lithium was found in the urine.

In 1892, an acconnt was published of the experiments of Girtner and Ehrmann, of Vienna. These men introduced corrosive sublimate into the system as a treatment of syphilis, by electric baths. Mercury was found in the urine.

Dr. Morton has demonstrated that the effect of cataphoretic medication does not go more than half the distance from the positive to the negative pole. Cocaine combined with guaiacol is safer to use and the toxic effect of cocaine is minimized.

In making a successful cataphoretic application, the electrical resistance of the fluid plays an important role. If such resistance be very high (chloroform, sulphuric ether, alcohol, glycerine) little or no current is transmitted; but if resistance be too low (strong saline and acid solutions) much current passes but no action takes place. In order to transmit high resisting substances, it is necessary to incorporate them with foreign substances, such as Na2 So4 or Na cl.

The continuous current from a dry battery (40 cells) is that best fitted for cataphoretic medication. With the battery current we have no unpleasant consequences, such as the "grounding" of the electric light current would produce. A good rheostat is a very necessary adjunct for the outfit.

In using cocaine for local anaesthesia, it is well to fit a piece of blotting paper to a perforated electrode, then drop the cocaine solution upon the blotter until it is saturated. This pole (positive) should be applied to the area to be deadened, and the current applied gradually. The negative pole may be applied anywhere. Bear in mind that the area affected will correspond in size with the electrode. Dentists frequently err in applying a small electrode to a large cavity, whilst an electrode almost as large as the cavity will admit will give better results and larger field of anaesthesia.

Dr. Morton has found the electric current efficacious in removing tumors, treating trachoma and like diseases of eye, nose and throat. It has proven valuable in staining microscopical specimens, &c. For the aching teeth, hydrogen dioxide, cataphoretically applied, has accomplished all that could be desired.

One reason why we fail to employ

electricity, is conservatism, due to lack of knowledge of effects. The average physician or dental surgeon would in a very short time master the technique of handling an electric outfit properly and the benefit derived therefrom would be more than compensation for the time expended.

This book of Dr. Morton's is new and original. It is full of useful information which can not be found elsewhere. This character of work is growing in favor, actually becoming a necessity, in the hands of the surgeon and the dentist.

O'HARA.

VALUE OF THE RAYS IN MEDICINE.—In a recent case of torticollis following injury there seemed to be no reason for the condition. An x-ray examination revealed a dislocation of the fourth cervical vertebra. As a rule, any lesion of the vertebra can be immediately recognized by means of the ray.

Gouty lesions of the bones and periosteum can also be readily recognized.

In certain cases it is the only method of diagnosing with certainty aneurism of the aorta. It is also possible to tell if the heart contracts sufficiently and thoroughly empties the ventricles. In pleurisy it is possible to fix the limits of the effusion, and the movements of the diaphragm can also be observed. Cavities in the lungs can be recognized as a clear area, and exudations by a dark shadow.

A novice in the use of the rays may mistake the cartilages of the trachea and bronchi for foci of disease.

The kidneys can be made out, and if they contain calculi these can be found. By filling the stomach with a solution of bismuth its outline can be clearly made out.

Classification of the arteries can be seen with great distinctness.—*M. Rumpf, Independence med.*, October, 1897.

Overcoming High Resistance in Crookes' Tubes.

In THE AMERICAN X-RAY JOURNAL, April, 1898, Dr. Graves makes some very interesting remarks on methods of restoring x-ray tubes which have become "dead" by increase of resistance in use. He considers that by proper treatment any "dead" tube may be made to work again, without exhaustion, or without the use of restoratives, such as vapor emitters in side pockets. Dr. Graves' treatment consists in a rational combination of certain artifices already known and applied separately. The principal artifices employed by Dr. Graves to resuscitate "dead" tubes are reversal, spark gaps, and tin foil on the cathode end of the tube. He finds that in tubes of an ordinary resistance, the direct resistance is about three times the reversed resistance. When, therefore, the current refuses to pass in the proper direction, the chances are that it will be able to pass when it is sent in the reverse direction through the tube. If it is found impossible to send the current through the tube in the reverse direction (when the leads are connected directly to the tube), then success will usually be attained by introducing a spark-gap between the tube and the positive terminal of the generator. Dr. Graves has repeatedly observed that a spark-gap at the negative pole reduces the resistance of a tube, while a spark-gap at the positive pole increases it. The reversed current is sent through the tube till the phenomena observed are the same as when an ordinary tube is reversed. Dr. Graves maintains that tubes that have been resuscitated in this way are far more efficient than new tubes which have not become "dead" by continued use. Dr. Graves' paper is well worth the study of those engaged in practical x-ray work.—*Electrical Review*, London, June 10, 1898.

LOCALIZATION OF FOREIGN BODIES IN THE EYE.

At a meeting of the Section on Ophthalmology, College of Physicians of Philadelphia, held March 15, 1898, a number of interesting explanations and exhibits were made for localization of small bodies.

Dr. Charles L. Leonard exhibited his *apparatus for localization of foreign bodies within the cranium and orbit.* It consists of a yoke that can be firmly fastened to the patient's shoulders, and adjustable upon it an upright frame supporting the plates, and to which the patient's head is firmly fastened by bands. Rigidly connected with this, but adjustable at any angle, in a plane perpendicular to the photographic plates, is an arm which carries the x-ray tube. The relational angle can be read from a divided arc situated at the articulation.

The apices of these angles are marked upon the skin, and shown upon the photographic plates by two lead ferrules, which are placed upon the margins of the plates, and do not, therefore, cast their shadows in the field of observation. They slide upon an aluminum wire permanently placed upon the upright frame. The tube, foreign body, and plates are, therefore, held in known rigid relation to each other and the known point while observations are made, which give data from which their mutual relation may be mathematically determined, or accurately measured by the graphic method.

The sources of error common to other methods avoided by this rigid apparatus are: changes in relation of the tube, foreign body, known point, and plates, by unconscious motion of the patient or during interchange of plates. An additional advantage is absence of all foreign bodies from the field of observation.

The x-ray "burn" is not due to the x-ray, but to the static electric charge induced in the tissues by the high potential induction field surrounding the tube. It is never serious, and may be prevented by introducing a "grounded" aluminum conductor as a shield between the tube and patient.

Dr. Howard F. Hansell reported a case of *diagnosis of the presence of a piece of steel in the left eye* by the x-rays, and its localization by the method of Dr. Wm. M. Sweet. It was extracted from under the lower periphery of the lens after iridectomy by the medium-sized curved tip of the Hirschberg magnet. It weighed 9.5 mg. and measured 4 *x* 2 *x* 9-10 mm. The eye recovered perfectly, although vision is reduced to perception of large objects on account of blood in the vitrious chamber. The x-ray plates unexpectedly revealed the presence of another fragment of steel in the orbit near the external outer angle, of which no history could be obtained. It may have entered contemporaneonsly with the other injury. Against this supposition is the absence of any external wound, hemorrhage, bruise or contusion, and the second fragment was found after removal to consist of steel of a different character and quality from those of the other. Its localization was demonstrated by response to the magnet, which, when passed over the skin in its neighborhood, was invariably puckered and elevated. With the aid of the magnet it was easily excised and its dimensions were found to be 6 *x* 1 *x* 1-4 mm. and its weight 23.5 mg.

Dr. Wm. M. Sweet reported the results of his experience in the *localization of foreign bodies in the eyeball* by his apparatus. The various methods employed resolve themselves into determination of the angle of the x-ray tube with the foreign body and with dense objects situated near the eyeball. Approximate results have been obtained from a study of the shadow of the foreign body in relation to the shadows of the orbital bones, but owing to variations in the position of the eyeball, shown by Cohen to amount in healthy individuals to as much as ten mm. behind the edge of the orbit and twelve mm. in front of it, this method does not equal the accuracy possible by other means. Whatever form of indicating object is used in working out the position of the foreign body, certain factors are essential: 1. A tube should be used which may be run at high vacuum, in order that the rays readily penetrate the bones of the head. 2. The patient should be in recumbent posture to ensure steadiness of head and body. 3. The visual axis should be parallel with the plane of the plate at the side of the head, or, if it deviates, the angle should be measured and allowed for in the determinations. 4. The situation of the indicating objects with respect to the center of the cornea in each individual case should be known; otherwise determination of the location of the foreign body will vary with the varying situation of the eyeball in the orbit of different persons. 5. The angle of the tube with the indicating objects must be accurately measured. The two indicators being parallel with each other and with the plate, the distance the shadow of one of the balls is posterior to that of the other is the measure of the distance that graphic plate and the indicating objects, and also the varying position of the eyeball in different individuals with respect to the external orbital angle.

[The Dennis Fluorometer is the only invention that will accurately locate foreign bodies at any distance from the tube and at any distance from the sensitized screen. The instrument is simple and easy to manipulate and is mathematically correct.—Ed.]

Roentgen Society.—At the meeting of this society held at 11, Chandos Street, Cavendish Square, W., on Tuesday, 7th inst, papers were read by Mr. T. C. Porter on "Work on the X-Rays," and Mr. A. A. Campbell Swinton, on "A Pin-hole Roentgen Ray Camera and Its Applications." David Walsh, M. D., is Hon. Sec'y. of the society.

Roentgen Rays in Warfare.—Before the Royal United Service Institution on Friday last, Surgeon-Major Beevor, M. B., Army Medical Staff, lectured on the "Working of the Roentgen Ray in Warfare." The lecturer said, according to the *Times* report, that his object was to give his experience in the working of the x-ray in military surgery, and through the kindness of many official friends he would be able to give the audience the results of its employment on the recent frontier expedition in India, and then to lay before them some modifications in the construction of the appliances for generating the x-ray which had suggested themselves to him after working among the wounded on the field of battle and its adjacent hospitals. He then exhibited, by means of the magic lantern, photographs of cases from the Frontier War, which showed with the utmost clearness the importance of the use of the x-ray in the treatment of wounded men. The positions of bullets in various parts of the body were made perfectly evident in cases where it was quite impossible to localize the bullets by ordinary surgical methods. The lecturer said that it was not only possible, but quite easy to have an x-ray apparatus working at the front. The cases exhibited contained indisputable proof that even in savage warfare, where the Geneva Convention was unknown, the x-ray could be brought under control, and an immensity of human suffering obviated; it was not necessary that every field hospital or bearer company should be supplied with an apparatus, as it could be readily transported from one part to another of the field of operations. He felt sure they would see what an advantage it was to be able to localize bullets, and other foreign bodies, without the painful process of searching with probes, and that a threefold advantage was gained in the treatment of patients by this means —first, the absence of any pain or physical injury, from which arose the second advantage, that in cases where there had been much loss of blood or injury to bone, they were enabled to ascertain the exact condition of affairs, without the risk of increasing the depression of the patient by operation, and they thus gave him the best chance of reaction, upon which depended his recovery. He maintained that it was now the duty of every civilized nation to supply its wounded in war with an x-ray apparatus, among other surgical aids, not only at base hospitals, but close at hand, wherever they might be fighting and exposing themselves to injury in the performance of hazardous duty. The rest of the lecture was devoted to consideration of technical questions in connection with the appliances required for generating the x-ray.—*Electrical Review*, London.

An X-Ray Cinematograph.—Dr. John Macintyre, of Glasgow, presented before the Glasgow Philosophical Society an x-ray cinematograph. The experiment was made on the hind limbs of a frog, and the photographs were recorded on a film 40 feet long.

When this film was passed through a cinematoscope, illuminated in the ordinary manner, the movements of the frog —that is, of the skeleton of the frog— were plainly shown.—*Arch. of Skiagraphy*, April, 1897.—F.

Fluorescent Screen. *L'Ind. Elec.*, Feb. 25.—A note stating that according to Ducretet opaque celluloid, such as used for collars and cuffs and called in France, "American Linen," becomes very fluorescent in the presence of x-rays.—*The Electrical World*, March 19.

True Americanism.

Physicians and pharmacists, like the masses of the people, have tired of the arrogation of superiority implied by the announcements of foreign manufacture, and are revolting against them. This spirit is especially commendable at the present time when a vast wave of patriotism is rolling over the land, making the North and the South, the East and the West as one band of brothers by its magic influence. The Antikamnia Chemical Company, of St. Louis, in all of its advertising matter, whether through the journals or by circular, takes particular pains to impress upon physicians and pharmacists that its goods are made in America, by Americans, and for American use. This enterprising Company realizes that the words "made in Germany, "or made in France" no longer possess the influence and meaning they once had. The people of this country no longer scorn or underrate the products of their own native laboratories and work shops.—*The National Druggist.*

A Useful Chart.

Write to the Imperial Granum Food Company, New Haven, Conn., for sample copies of their new "Nursing World Fever Chart" for recording the vital signs and other information relating to the Baths given in the treatment of fever cases. It is very complete and will be found especially useful in typhoid fever.

Polk's Medical and Surgical Register of the United States and Canada is now undergoing its fifth revision. Physicians who have not given their names to the canvassers are urged to report to headquarters at once, giving full information. Address, R. L. Polk & Co., Detroit, Mich.

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X-RAYS AND ELECTRO-THERAPEUTICS IN LONDON.

Editor AMERICAN X-RAY JOURNAL

In common with perhaps the majority of American physicians I have held the idea that Berlin and London were really far ahead of New York in scientific work in these fields and that we in the United States had much to learn here. I was very desirous of coming to London at least to compare results and technique with our own and to better fit myself for next season's work. No one can sum up London in a few words, for in this huge city a great deal of the best private achievement never reaches public print or knowledge and hence what I write must be taken to represent only what I have actually seen or heard from reliable sources. Regard for many courtesies shown me by members of my profession here will lead me to make all my remarks impersonal, for a stranger may be easily misled by report and do injustice without intent.

Certain straws in press notices led me to expect a great deal from London. Before reaching England I had read in the *London Graphic* how King Menelik, of Abyssinia, had stated to the mission visiting him recently, that "amongst the many new inventions which he wished to see, the Roentgen ray apparatus had the greatest interest for him."

This seemed to indicate strong British backing for x-ray work, and floating paragraphs like the following pointed to an official recognition somewhat beyond our slow American progress :

THE BATTLE OF ATBARA.

"General Russel, M.P., will put further questions to-morrow in the House of Commons relative to the medical arrangements at the recent battle of Atbara.

"He will ask the Under Secretary whether complaints have reached him that the medical arrangements for the reception of the wounded British officers at Cairo were insufficient and unsatisfactory ; that seven wounded officers were put into one small ward and that the nursing staff was entirely inadequate ; whether no apparatus for the application of the Roentgen rays was carried with the field army; and whether there is reason to believe that some lives of wounded officers and men might have been saved had these appliances been available."

But yesterday the Prince of Wales slipped and broke his patella and the press at once announces that x-rays were used to examine the fracture. The fact is, however, that the work is done here very largely outside of the medical profession and so many minor differences exist in details of apparatus and methods that until each has seen the apparatus of the other, an American and an English surgeon can not talk intelligently in the same language about the same things.

My first forcible encounter with this curious fact was occasioned by the fluoroscope,—in our hands a convenient, practical instrument which is easily used and which we could not do without. Dr.—— was showing me his apparatus about dusk but apologized for not working a tube as "it was yet too light to use the screen,' and he had no means of darkening his office. I saw no reason for not using the fluoroscope and so remarked, whereupon he showed me his "screen" and I at once perceived that it could only be used in the dark. In reply to my question as to why he used such a screen and if it was superior to the fluoroscope, he raised objection to the latter that I could not understand at all. He spoke of its great weight, large and clumsy size, difficulty of holding it up, using both hands, &c., so that I felt utterly ignorant on the subject of fluoroscopes and was eager to become acquainted with better and "more convenient" screens. In due time I shall explain about screens but will now begin at the beginning of my letter and try to write the chief points of interest both for American physicians and makers of apparatus.

In the first place the London Roentgen Society is growing in membership and has now nearly 100 associates. As no meetings are held during the summer no papers or reports of progress will be presented until the winter session. There is said to be little prospect of much practical development in x-ray advances through the agency of the society. But the influence of the members will be felt. In at least one direction the society has work before it of great importance. Unfortunately x-ray work is mostly done here by the clerks in the shops which sell coils and tubes. Several of these dealers have a dark room in their shop, and portable apparatus at call. They have a routine of work. Patients are sent them by surgeons, or they are ordered to go to the patient's house and make a picture which is handed over to the surgeon for interpretation. The charge varies with size of plate, &c., but all pictures are paid for. Only a few hospitals are equipped with apparatus and when a hospital case is sent to the dealer for a picture the usual fee is from \$2.50 to \$5.00 paid out of the funds of the institution. Private cases pay about \$15.00 for a picture taken in the shop, and when the coil is moved to the house or another town the cartage and time is added. The dealer is always paid for his services, but by retaining in his own hands so much of x-ray work he tends to cut off the market for his apparatus. His excuse is that medical men will not go to the trouble to do the work themselves.

On the other hand, physicians who are doing the laborious work of the x-ray departments already established in some of the leading hospitals, receive no pay and seldom get a case in private practice, for the dealer gets them. There is a growing feeling that an effort must be made to reform this unfair arrangement and if the Roentgen Society acts in the matter to secure both the work and the proper fees to the medical profession, it will help the cause.

The Prince of Wales is attended by several surgeons and the daily paper report of the consultation had in it the remark: "One of the first requirements was to ascertain the precise character of the injury and it was decided to employ the x-rays for this purpose. A specialist was called in early in the afternoon and photographs of the injured knee were taken." The "specialist" called in was probably a shop keeper's assistant. The whole plan is a bad one and should be reformed.

I shall now take up in turn the subject of apparatus, results, &c. Practically, the whole work here is done with plain Rumkhorf coils. I have seen many of them in operation and, as usual, the effectiveness of the coil varies with the skill of the operator. No such variety of coil and break-piece devices is known here as our dealers in the United States advertise. The coil in general use is usually 6 or 10 inch spark, has a spring contact breaker and is operated by 4 or 6 storage cells. A few use a rheostat, a very few use a mercury contact breaker, and one dealer showed me a rotary break wheel but said he had never sold one. Some rivalry exists here between English made goods and goods "made in Germany." London made coils are considered the best. A standard dealer retails them for the following prices:

3 inch spark coil about	$	63 00	U. S. money.
4 " " "	"	80 00	"
6 " " "	"	112.00	"
8 " " "	"	138.00	"
10 " " "	"	183 00	"
18 " " "	"	375.00	"

Only a few "investigators" use an 18 inch coil. This maker told me that all his coils were tested with a small current—3 storage cells of about 8 volts—and with a full current would far exceed the schedule. He said that he had made one of his 3 inch coils give a 6 inch spark, a 4 inch give 7, and his 10 inch coils would average 20 per cent over length of bobbin. Certainly the 10 inch coil he kindly demonstrated to me gave as good a current as any coil I ever saw work. He used a 6 cell portable battery and no rheostat, but controlled the action of the coil from a half inch mild discharge to a superb thick spark of 12 inches by the cell switch and screw of the vibrator.

I may mention here that the only alternative coil I have seen anywhere in London is the Tesla. Nearly all the hospitals and surgeons I have visited have one standing aside. Physicians call my attention to it and remark that they bought it some time ago in hope of getting a greater bombardment but could not make it work satisfactorily and abandoned it. I state the fact here and if our American makers can see what the trouble is and correct it I think the Tesla coil would sell better here than any other. The fault is probably a lack of care or skill.

Portability is considered a prime requisite in nearly all the apparatus used here and no stationary equipment is seen.

What about the static machine in x-ray work in London? If the editor of this journal should search through the United Kingdom he could not discover *one*. The useful and practical machine with which I have worked and of which I have written is *absolutely unknown here*. What I say about its simplicity, effectiveness and satisfactory action can not be comprehended by Englishmen who have not seen it.

When I speak of electro-therapeutics I will explain more fully about static apparatus in this country. The few who possess a Wimshurst machine of large size have a good generator of current but lack practical means of using it. They are blind to this shortcoming. If my apparatus was here I could surprise the London profession to a considerable extent.

The fluoroscope is almost unknown here and is practically ignored. Britains build in massive style. American lightness of structure is wanting here in many ways, and the fluoroscope is one of them. The convenient and indispensable instrument made by Messrs. Aylsworth & Jackson is unknown in London. I think no medical man from even rural America could look at a London fluoroscope without laughing. I have seen about twenty—no two exactly alike and none of them fit for use. If I could dictate this letter to a typewriter I could describe many details about apparatus, but the pen is so irksome to a hurried sightseer who is searching for rest that a full description of the "barbaric London fluoroscope" must be omitted. Nor can men here grasp my meaning when I tell them that our fluoroscope is very light, can be used in daylight, is held easily in one hand, fits the eyes perfectly and excludes all radiance save that from the tube. Operators here use only the screen mounted in a small wooden frame. They can not work as we do but require a dark room for the simple examination with the eye. For this reason it is a routine to go ahead at once and "take a picture." During the exposure the action of the tube is not observed with the screen nor is its efficiency tested beforehand. I have been surprised to note that almost all x-ray examinations here are made in a routine and chance manner, there being very little appreciation of refinement of detail or the value of our accessory devices. Not having them they do not miss them. The open screen does, however, possess two advantages. Eyes with different focus can accommodate the distance at will, and tracings are more easily made than with our fluoroscope. Still, actual work for patients is almost limited to taking a picture in a routine way. The sum total of work done in this manner is very large. At one hospital about 1000 x-ray negatives have been made during a year and a half. An intensifying screen is rarely used. One dealer told me they were a novelty here and had only been introduced in May. Others say they were used six months ago, but were then of a poor quality. Mr. W—— states that although they were employed a long time ago, yet it has been only of late that a fine photographic screen could be obtained. Whatever the facts are, I observe that no general use is made of them in London. Exposure times are about the same here as with us. Our plate makers are perhaps more enterprising in wrapping and preparing plates for convenient use. The troubles of London operators center about tubes. Tube manipulation here, as my students are taught it, is unknown. I have seen work done by nearly all the varieties of English and German tubes sold here. No point of superiority appears in any of them. An Owen & Co. adjustable tube is also made here and the dealer admitted to me *sub rosa* that it was "an American idea". Some operators complain that the light tubes sold break in a few days and one surgeon destroyed four in a half hour. In hospital and other practical work, therefore, a preference is shown for a German tube of very heavy construction which lasts a long time. The life varies, however, with the skill of the operator and with the current used. One surgeon in a large hospital has found them very durable, lasting him for an indefinite number of months (one being bought as long ago as October, 1897) while in another hospital the operator stated that a new tube (of the same kind) would reach its maximum in about three days, remain good about a week and then last for small work for a month.

For the last half year a special effort has been made to get away from platinum as an anode. The chief metal exploited so far has been osmium, a rare and high priced substance which will soon pass. Its alleged advantage is said to be a melting point of about 750 degrees higher F. than platinum. A small nugget is fused into the center of an anode disc of cheap metal, and the electrodes are set near together in the hope of catching the cathode stream at its finest point, and hence, improving definition. Some are enthusiastic over osmium tubes even at the price of about $15.00, but conservative men best qualified to judge are in doubt and reserve judgment. My own belief is that their supposed superiority arises from the inferiority of the average tube used here, and I do not recognize the alleged need of finding another substitute for platinum. This noble metal is abused here by tube makers and deserves better treatment at their hands. A thin scale of platinum is laid on a disc of aluminum and expected to stand the heat of a 10 inch coil current. It does the best it can and endures wonderfully, but if makers would be more liberal in the quantity they use they would greatly oblige operators and prove that no other metal is required. In variety and working qualities the U. S. appears to far surpass England in tubes and I have never seen here a single specimen of the large, substantial, thick platinum anode now furnished in leading American tubes.

Mechanical comprehension seems to be defective among makers here. They have had marvelous encouragement. A few wealthy amateurs have devoted themselves to the scientific development of x-ray work in a manner which is astonishing. For instance, I hear of one who had a fluorescent screen 6 ft. by 2 ft. made to assist his investigation. I hear of a Wimshurst static machine of 120 plates 36 inches in diameter. One distinguished surgeon told me that he had personally spent nearly $5,000 on x-ray apparatus. Yet a chain is no stronger than its weakest link, and in every case the tube is one of the vital points. The great hindrance to the cause of x-ray diagnosis in England (as with us in the United States) is not, primarily, the lack of good tools or skill to use them, but it is to be found in the fact that all-round knowledge and skill is not combined and widely *distributed*. Dr. A. takes up the work and develops certain uses of x-rays with the genius of his ripe experience and training in his branch of professional practice. Dr. B. does the same in some other line of work. Dr. C. adds his quota to the splendid whole and if one operator could do all that A. B. and C. collectively do, he would be a master of technique. But no one operator becomes able to demonstrate this all-round skill ; scientific advances remain fragmentary, and while theoretically rapid and even magnificent we find in practice only the average operator and his ordinary routine. This is the case here. I have been delighted a number of times by interesting demonstration shown me by men who are esteemed as leaders in England, only to find that in ordinary work their striking developments are ignored. Remarking only that among instruments the Dennis fluorometer seems to be unknown here, for I can find no one who has ever heard of it.

I must close this portion of my letter and leave "results" and electro-therapeutics to another time.

S. H. MONELL.

856 Union Street, New York City.

London, Eng., July 22, 1898.

VISIBILITY OF X-RAYS. Courmelles. *L'Eclairage Elec.*, April 30.—An abstract of an Academy paper in which he describes experiments made with young blind subjects. Out of 204 there were nine who could see the rays. It is not possible to draw definite conclusions from the observations.

BULLETS IN THE BRAIN AND THE ROENTGEN RAYS.

Von Bergmann (*Berl. Klin. Woch.*, May 2, 1898) *Gaillard's Medical Journal*, July, refers to 32 cases of bullet wounds of the brain which he had observed, and in which the bullet has been left undisturbed. Of these, 8 were severe cases, and the patients rapidly died. Of the remaining 24, 19 recovered, and these had remained well. Of the other 5, 2 developed an abscess of the frontal lobe, and both subsequently died, although the abscess was opened; 2 others died apparently from a suppurative meningitis and the fifth had not been heard of. The patients who recovered either showed no symptoms or were unconscious for a short time, or had a local paralysis or spasm. It is possible that in the first named group of cases the bullet did not penetrate the brain substance. Thus it becomes important, as Eulenberg has shown, to determine the situation of these bullets by the Roentgen rays. The author gives details of two cases examined in this way. Case 1 occurred in a woman, aged 28, who shot herself in the head when cleaning a loaded revolver. There was severe pain in the head and vomiting, but no loss of consciousness. The site of entry of the bullet was on the nasal side of the left upper eyelid. There was no paralysis. The wound was healed in the second week, and the patient subsequently recovered from an exophthalmos and choked discs. The situation of the bullet was found by the Roentgen radiography to be in the white matter of the occipital lobe.

Case 2 was that of a man aged 25 who was wounded by a revolver shot in the right temporal region three years ago. He was unconscious for three days, and had a left hemiplegia and partial anasthesia. His sight was also impaired and the hearing in the left ear. Very considerable recovery followed. Within the last six months, however, there had been severe attacks of pain in the head, chiefly limited to the right side. Here the situation of the bullet was at the junction of the anterior two-thirds and posterior one-third of the hinder limb of the internal capsule, and this was confirmed by the Roentgen rays. The patient wished to have the bullet removed. During a stay of three weeks in the hospital there was no return of the pain, and the patient was eventually dissuaded from an almost certainly fatal operation.

Von Bergmann says that both cases supply evidence in favor of leaving these bullets alone. The treatment should consist in not searching for them, and in a most rigid protection of the wound against infection. When the bullet lies in or near the bone without penetrating the brain, the treatment described may not be suitable, and the Roentgen radiography should determine the situation, and hence the treatment. The author refers to a case in which the bullet had not even penetrated the skull, but lay outside it.

PROPERTIES OF BECQUEREL RAYS. Stewart. *Phys. Rev.*, April.—A summary of the present state of our knowledge on the subject, and its bearings on the subject of x-rays. He concludes that there can be no doubt that they are transverse ether rays; transmission by metals indicates that the wave lengths must be shorter than that of any ultra violet rays which have been obtained from any light source. Like x-rays, they are not homogeneous; the similarity between the two rays is very striking, the principal difference being the absence of any reflection or refraction of x-rays; this leads to the conclusion that x-rays are also transverse waves shorter than Becquerel rays; the similarity of both presents a strong argument in favor of the theory that x-rays are short, transverse ether waves.


Gun shot fracture

THE X-RAY DIAGNOSIS IN CHILDREN.

A. V. L. BROKAW, M. D.

The science of radiography and fluoroscopy in its application to children is of extraordinary value; the scope, utility and application being as wide as in the adult. By reason of the alleged harmful effects, and believing the more delicate organism of the child to be susceptible to a greater degree to the untoward influence of the new form of radiation, many surgeons have been deterred from the frequent use of x-rays in children. That such is the opinion of many is a matter of regret. I feel quite confident that this reasoning will not be sustained after a further consideration of the subject. After large experience, I can but come to the conclusion that the adaptation of this discovery merits a wider application and more general use than is at present in evidence. The danger of burns and deep-seated tissue degeneration has been reduced to a factor so slight that it does not merit the dignity of very serious consideration. In the early experimental stage of the development of this new diagnostic aid, burns of varying intensity occurred with a frequency sufficient to arouse general attention, especially as the daily press found these accidents news items worthy of publication. Happily, such accidents are rare in comparison with the thousands of exposures being made the world over. The destructive effects, the accidents, it will be noted, have followed where the operator used a coil apparatus. As far as I am aware no serious effects have presented themselves when the source of generation of the rays has been effected by static machines. This source for generation of the rays, I believe, to be the best, and undoubtedly the safest in the examination of children, and it is therefore recommended. By the exercise of tact children manifest little fear of the apparatus, as it is almost noiseless.

Even very young subjects are often more tractable than nervous adults. Fluoroscopic examination should be as short in duration as possible. A good radiogram, to my mind, is of greater value than the momentary appearance of a shadow cast upon the screen. To secure a radiogram, or even more than one, requires but little more time than a careful fluoroscopic examination. Especially is the above true in children. It has been my custom to secure the part to be radiographed to the sensitive plate by a few turns of a roller, or a strip or two of adhesive plaster, thus reducing blurring and double images to the minimum by an easy restraint. The time necessary for exposure in children, to secure good results, is fortunately much less than in adults, the tissues being singularly easy of penetration, and the detail all that could be desired. The certainty of location of foreign bodies in any part of the economy in children is a matter of satisfaction. The assurance that such foreign body will appear upon the plate is looked forward to with a degree of positiveness, which does not obtain in the adult at all times.

The advantages of a routine use of the x-ray, as a necessary part of an office equipment, should appeal to every surgeon. So numerous are the occasions for the use of the apparatus that to-day we would feel at a loss without it. No surgeon can dispense with this diagnostic aid, and the same necessity in the near future will appeal to the physician. In the diagnosis of intrathoracic diseases it is a fact that, as an adjunct to the methods of physical diagnosis, most positive information is given to those capable of interpreting fluoroscopic appearances. A grand field is to be opened up in this direction by those interested particularly in internal medicine. To those whose instincts and work run in the line of general surgery, a brief enumeration of a few instances of the routine utility of the new agency may not be without interest. It has been my pleasure to locate bullets in the head, thorax and thigh; indeed, in all parts of the economy. The location of the same in the extremities is never difficult to radiograph, clear, distinct pictures being uniformly obtained. The location of foreign bodies in the head, lumbar vertebra and upper sacral region requires in adults, at times, more than one exposure. In children the purely mechanical difficulty of penetration does not apply by reason of diminished distance through the parts and the ease with which the rays pass through histological structures possessing less density. The study of unusual joint lesions, dislocations, fractures and the differential diagnos s of obscurities in the osseous system demand, for intelligent management, x-ray examination. The text-books of surgery and anatomy will necessarily, in part, require to be rewritten, owing to the revelations at variance with past teaching and ideas. The excuse that the conditions in a fracture-dislocation about the elbow can not be determined, by reason of great swelling of the soft parts, will not, in the future, prevail. An examination with the fluoroscope, or the positive evidence of a radiogram, will establish with certainty the conditions present and enable the attendant to make a prognosis as to the future of the joint, thereby protecting in a measure the attendant from the all too frequent damage suits. The detection of gall-stones is a matter of uncertainty and no assurance may be given in any case that their presence will be demonstrated. Urinary calculi lodged in any part of the tract present fewer difficulties. Stone in the bladder in children is usually to be demonstrated. From a large collection of radiograms a few illustrative of x-ray diagnosis in children are exhibited. The half-tones, while of most excellent workmanship can not do justice to the original negatives.

No. 1 shows a marble impacted in the lower end of the esophagus. The boy, aged 5, was brought into the office from the street by a passing pedestrian, who found the child gasping for breath, in fact, in a critical condition. A playmate gave the information that his unfortunate companion had had several marbles in his mouth and had been suddenly seized with a choking spell. The marble could be felt through the cervical soft parts. We could not grasp the foreign body with forceps, and in manipulation by external pressure the smooth, round "flint-glass" marble passed downwards the child was immediately relieved, as far as urgent respiration symptoms were concerned, but the pain was intense until it reached the stomach. The fluoroscope revealed the marble *in situ*, and I could not resist securing a radiogram. A five-minute exposure was at once made. A few moments later the marble must have passed into the stomach, as all pain suddenly ceased. The subsequent history of the case is without interest, as two days later the object passed *per viam naturalem*.

Fig. 2 shows distinctly the absence of the head of the femur through tubercular disintegration, and the empty acetabulum.

The radiogram, Fig. 3, shows a five-day-old subject, injected with liquid mercury. To the anatomist the study of injected vessels is particularly interesting, the relationship to the osseous system showing far better than some dissections.

The early differentiation between primary acetubular disease and tubercular disease of the head of the femur is only

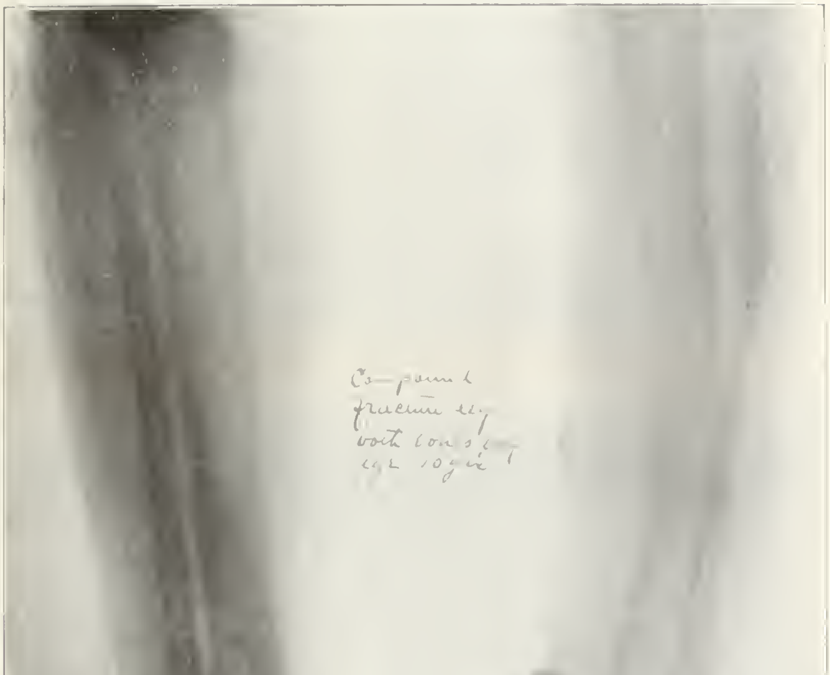
Compound
fracture leg

FIG. 1.

FIG. 2.

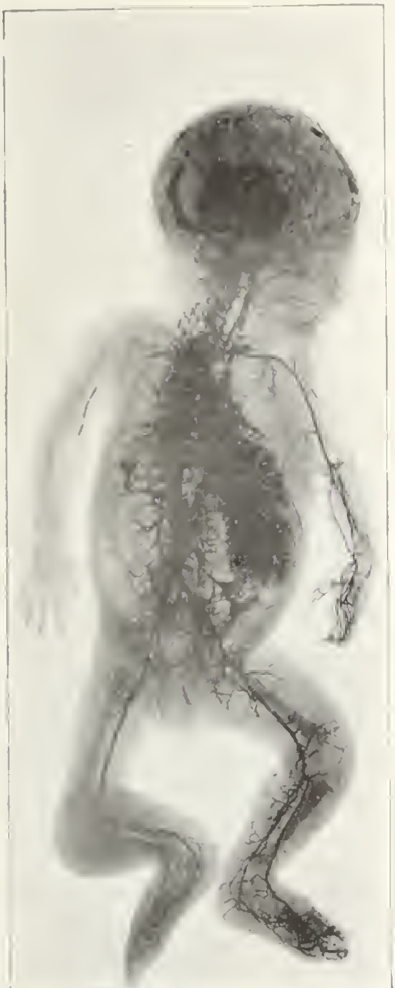

FIG. 3.

FIG. 4

FIG. 5.

possible, with certainty, by means of the Roentgen rays.

Fig. 4 the appearance after resection and removal of the diseased bone.

Fig. 5 illustrates a typical tubercular knee in a little girl.

The radiogram of the elbow, Fig. 6, one of many, illustrates the thickening in fractures through the condyles. After an experience in making over five hundred radiograms, it might be formulated, that the younger the subject, the shorter

FIG. 6.

the exposure. The results we have obtained can be equaled by any one, probably surpassed by many, so no claim is made for superior knowledge of the subject. Our object will be obtained if these hurried jottings lead others into the field.

3147 Washington Avenue, St. Louis, Mo.

[From June Number (Vol. XI.) Annals of Gynecology and Pediatry, Boston.]

Rotation of Cathode Rays. Braun. *Wied. Ann.*, No. 6; abstracted briefly in Lond. *Elec.*, July 8.—A thin bundle of cathode rays strikes a fluorescent screen at the end of a vaccum tube: a bar magnet penetrates through the vacuum through this screen and is protected by a glass tube, the rays then form a ring around the bar magnet. He investigated "whether this ring represents the influence of cathode rays, which are in a state of rapid rotation around the pole;" several tests showed that there was no evidence of rotation.

Examination of Coal by X-rays. Couriot. *Eng. and Min. Jour.*, July 2. —A brief abstract of a French Academy paper. He states that x rays afford an

instantaneous and certain means for determining the purity of mineral fuel; coal, diamond and wood are permeable to these rays, while silica and silicates are opaque; thus the silicious ash, forming constituents of coal, obstructs the passage of the rays; owing to the great transparency of coal, it is not necessary to trim the sample, large fragments sufficing for the test; impurities are clearly shown as dark spots. A 10-inch spark coil will answer, with an exposure of about five minutes, the samples measuring 1.25 to 2 inches. A brief account is also given in *L'Eclairage Elec.*, June 18.

ON THE SOURCE OF THE ROENTGEN RAYS IN FOCUS TUBES.*

BY ALAN A. CAMPBELL SWINTON

Communicated by Lord Kelvin, F.R.S. Received June 7th, read June 16th, 1898.

The writer has already described ("Some new Studies in Cathode and Roentgen Radiations," a discourse given at the Royal Institution on February 4th, 1898) how he has found it possible to study by means of pin-hole photography the active area on the anti-cathode of a focus tube from which the Roentgen rays proceed.

By means of a special camera he has now been able to make further investigations. The camera is illustrated in Fig. 1, where A is the pin-hole in the removable lead disc secured by a brass cap to the brass cone B, which is lined with thick lead so as to be opaque to the Roentgen rays. D is a framework into which slides either the fluorescent screen E, or a carrier containing a sensitive plate should photographs be required. F is an observation tube for use with the fluorescent screen. It is made of insulating material to avoid danger of shocks.

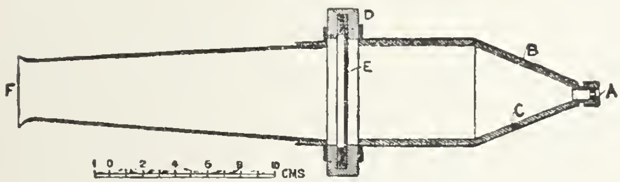

FIG. 1.

With this apparatus directed at the anti-cathode of a focus tube, it is easy with the fluorescent screen in place to take accurate note of the image of the active anti-cathode area which appears on the screen, and to observe the variations in form, dimensions, and brilliancy that take place under varying conditions. Similarly by replacing the fluorescent screen by a photographic plate in a black paper envelope, the Roentgen ray image can be photographed. Exposures, varying from 1 to 30 minutes, according to conditions, are found sufficient to impress upon the plate any effect that can be seen directly with the screen. It has not, however, been found possible, even with very prolonged exposures, to photograph anything not directly visible with the screen, and having regard to the difficulties of maintaining the vacuum and other conditions constant for any considerable length of time, the method of direct observation seems generally to be the best and most convenient. For direct observation, rather a large pin-hole, say, about 2 mm. in diameter, gives the best results ; for photography about half this diameter is preferable, as it gives sharper images.

The writer has made numerous observations and photographs with this apparatus, both with focus tubes of the ordinary pattern, and also with a special tube in which both the cathode and also the anti-cathode (which in addition acted as anode) were independently adjustable along the axis of the tube, so that the distance between them could be varied from a minimum of 4 to a maximum of 14 cm. This special tube is illustrated in Fig. 2, and during the observations it was connected to a mercury pump so that the degree of exhaustion could be varied as desired.

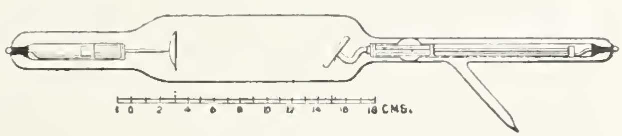

FIG. 2.

The following are the main effects observed :—

1. When the anti-cathode intersects the cathode stream at the focus, the dimensions of the active area are independent of the degree of exhaustion. For all other positions beyond the focus it is larger the lower the exhaustion

*Paper read before the Royal Society.

and *vice versa.* These observations are, of course, only possible between the limits of exhaustion with which Roentgen rays are produced.

2. When the anti-cathode intersects the cathode stream beyond the focus, the active area is larger the greater the distance between cathode and anti-cathode. For instance, with the tube illustrated in Fig. 2, exhausted to a good Roentgen ray vacuum, it was found that the active area gradually increased from about 0·15 cm. diameter with 4 cm. distance between cathode and anti-cathode up to about 2·3 cm. diameter as the distance was gradually increased to 14 cm. The increase is less the higher the vacua, but is always very considerable.

3. When the anti-cathode intersects the cathode stream considerably beyond the focus, the active area is found to consist of a well defined and very intense central nucleus, surrounded by a much fainter, but quite appreciable halo. Both of these increase in size as the distance between cathode and anti-cathode is increased.

In some cases the halo consists of a well marked hollow ring with a dark space between it and the central nucleus. In other cases two distinct concentric rings are visible surrounding the nucleus. Moreover, the nucleus itself, when very large, shows distinct signs of being made up of one or more concentric rings, sometimes with a still smaller nucleus within them. These observations correspond with and amplify what the writer has already noticed by direct observation of the visible luminescence of a carbon screen arranged to intersect the cathode stream.†

4. With an anti-cathode inclined at an angle of 45 deg. to the axis of the conical cathode stream it is found that those portions of the stream which impinge most normally upon the anti-cathode surface are considerably the most efficient in producing Roentgen rays. Similarly those portions of the stream that impinge on the anti-cathode surface very much on the slant are correspondingly ineffective in producing Roentgen rays.

5. At the degrees of exhaustion most suitable for producing Roentgen rays, and with concave cathodes of the usual dimensions, the cathode stream proceeds almost entirely from a small central portion of the cathode surface, the remaining portion of the surface being apparently practically inoperative. That this is so was very conclusively established by photographs taken with the tube shown in Fig. 2. In the manufacture or subsequent exhaustion of this tube three very minute fragments of glass by some means attached themselves on to the concave surface of the aluminum cathode, and remained fixed there during the experiments. The cathode itself was 29 mm. diameter, and the radial distances of the three glass fragments from the centre were respectively about 9 mm., 4 mm., and 2·5 mm. In all the pin-hole photographs of the anti-cathode of this tube with which the enlargement of the active area was sufficient, the shadows of the two glass fragments nearest to the centre of the cathode are clearly visible, while in none of them is there any appearance of the third and outer fragment. It, therefore, is evident that the whole of the cathode stream that was effective in producing Roengen rays came from an area of the cathode surface less than 18 mm. diameter, or less than two-thirds of the full diameter of the cathode. Further, in each case the shadow of the two inner glass fragments appeared outside of the central nucleus, showing that the whole of the more intense portion of the cathode stream proceeded from a portion of the cathode surface less than 5 mm. in diameter. These results confirm the writer's observations made with carbon cathodes.‡

†See Proc. Roy. Soc. Vol. 61. pp. 81—84

‡Ibid, pp. 92—93.

6. The different portions of the cathode stream proceeding from the different portions of the cathode, cross at the focus and diverge in a cone that retains any special characteristics of the convergent cone. The relative positions of the two inner glass fragments on the cathode, and the positions and enlargement of their shadows on the anti-cathode for different distances between the latter and the cathode, were found to show this very clearly.

7. Though by far the greater portion of the Roentgen rays given by a focus tube proceed from the active anti-cathode area, still, a very appreciable quantity is also given off by all those portions of the glass of the tube that shows the green fluorescence.

Using a somewhat large pin-hole, this is easily observed by turning the tube so that the more powerful rays from the anti-cathode can not reach the pin-hole, when a Roentgen ray image of the whole of the fluorescent portions of the glass of the tube can be distinctly seen. Further, it is noticeable that that portion of the glass that shows the brightest fluorescence, *i.e.*, that part which lies in the path in which cathode rays would be reflected from the anti-cathode surface were they reflected according to the law of equal angles of incidence and reflection—gives off the most Roentgen rays, while those portions of the glass that show no fluorescence do not give off any Roentgen rays. The conclusion appears obvious that whatever produces the one also produces the other, but as has been pointed out by Prof. S. P. Thompson § and others, the fluorescence is not due to the direct stream of rays from the cathode which cannot reach portions of the glass that show fluorescence, but to some description of radiation that proceeds from the surface of the anti-cathode that faces the cathode. In the paper above referred to Prof. Thompson calls these radiations "paracathodic rays," stating that they differ from the Roentgen rays in respect of their power of penetration, and in their capacity of being electrostatically and magnetically deflectable. In these respects the writer's experiments confirm those of Prof. Thompson, but when the latter goes on to differentiate these rays from ordinary cathode rays, on account of their not exciting Roentgen rays where they impinge on a solid surface, the writer is unable to agree, for as above stated, these rays do excite Roentgen rays where they impinge upon the glass walls of the tube; as mentioned, however, they do this only to an extent that is relatively very feeble, and so far as the author knows only discernable by the pin-hole method of observation, which no doubt explains Prof. Thompson's failure to observe the effect. The "para-cathodic" radiations in question do not, however, appear to be ordinary cathode rays. In the first place they do not proceed directly from the cathode, but only from the surface of the anti-cathode that faces the latter. Secondly they do not appear to be negatively but positively charged, as can be ascertained by means of an exploring pole connected with an electroscope. The writer suggests that, assuming the correctness of the Crookes theory of the nature of the cathode rays, these "paracathodic" rays may very probably consist of cathode ray particles which, having struck the anti-cathode and having thus given up their negative charges and acquired positive charges, rebound, both by reason of their elasticity and also by repulsion from the anti-cathode. Perhaps owing to the comparative roughness of the anti-cathode surface, they fly off to some extent in all available directions, but they do so especially in that direction which the law of equal angles of incidence and reflection requires. It also appears very possible that these "paracathodic rays are identical with the pos-

§See Phil. Trans., A. Vol. 190, pp. 471—490.

itively electrified streams proceeding from the anode, which the writer has investigated by means of radiometer mill wheels, recently described in a paper to the Physical Society.

In any case, it seems clear that in the tubes observed and photographed with the pin-hole camera, the Roentgen rays given off by certain portions of the fluorescent glass are not originated by the impact of an ordinary cathode stream, but apparently by the impact of positively charged streams proceeding from the anti-cathode.

The writer is greatly indebted to Mr. J. C. M. Stanton and Mr. H. Tyson Wolff, for the construction of the apparatus described, as also for valuable assistance in the carrying out of the experiments.

The twenty-fourth annual meeting of the Mississipi Valley Medical Association will be held at Nashville, Tenn., Oct. 11—14, under the Presidency of Dr. John Young Brown, of St. Louis, Mo.

This Association is second in size only to the American Medical Association and has done most excellent scientific work in the past. The annual addresses will be made by Dr. Jas. T Whittaker, of Cincinnati, on Medicine, and by Dr. George Ben Johnson, of Richmond, Va., on Surgery. The mere mention of the names of these gentlemen establishes the fact that the Association will hear two scholarly and scientific addresses.

Nashville is a most excellent convention city and is well equipped with hotels, and with the record of the meeting in Louisville in 1897, as an example, the local profession under the leadership of Dr. Duncan Eve as Chairman of the Committee of Arrangements has prepared to have a better meeting.

Already titles of papers are being received. These should be sent to the Secretary, Dr. Henry E. Tuley, No. 111 West Kentucky Street, Louisville, Ky., as early as possible to insure a good place upon the programme. Reduced rates on all railroads will be granted on the certificate plan.

HENRY E. TULEY, Sec.

The Roentgen Rays In War Surgery.

The English papers of May 21 give considerable space to a lecture delivered on the previous day before the Royal United Service Institution by Surgeon Major Beevor of the army medical staff. The object of the lecturer was to give his experience in the working of the x-ray in military surgery, and to show by the results in the recent frontier expedition in India that the apparatus can be carried on a campaign and be of the greatest possible benefit to the wounded. He maintained, in view of his success, that it was the duty of every civilized nation to supply its wounded in war with an x-ray apparatus, among other surgical aids, not only at base hospitals but close at hand wherever there might be fighting. There is no doubt of the desirability of having this aid in field hospitals nor of the possibility of furnishing it for the field hospital of a particular expeditionary force, but we doubt the ability of an army medical department with our present experience of the x-ray to have it available in the field hospitals of a large army during the hours of activity that follow incoming of the wounded from a great battle. Surgeon-General Sternberg has provided the apparatus for the Philippine expedition, for the hospital ship Relief and for the general hospitals to which the wounded from the field hospitals will be sent for treatment ; and the experience thus gained in its applicability to war surgery may lead hereafter to a further extension of its use on behalf of the wounded in war.—*Journal of the American Medical Association.*

ACTION OF ROENTGEN RAYS UPON THE GROWTH AND ACTIVITY OF BACTERIA AND MICRO-ORGANISMS.

R. NORRIS WOLFENDEN, M. D. CANTAB.,
AND
E. W. FORBES-ROSS, M. D. EDIN.

Some work has been done upon this subject, but it has not led to any definite conclusions, and in view of the somewhat conflicting statements published we have thought that further investigations would be desirable.

With this end in view we have selected the bacillus prodigiosus as the first subject for experiment. Six culture tubes of the normal growth on potato were obtained from University college laboratory, and on May 25th these were set to incubate in a Hearson incubator at a temperature of 35 deg. C. in the dark. After five days' growth a tube was taken and from it two fresh cultures were made; one was a simple control culture and the other was rayed along with the mother culture for an hour. After twenty-four hours' growth that in the tubes that had been rayed (i. e., the mother and one of the daughter cultures) had increased markedly in comparison with the original tubes, which had now been growing for six days. The control culture appeared to be only just showing a margin of increase. The difference in growth between the two tubes which had been rayed and the non-rayed control tube was very great, showing that undoubtedly the action of the x-ray tube had been exceedingly stimulative.

In order to determine whether the exposure of the potato to prolonged x-ray action would produce such changes in the medium of growth as to account for any marked increase in bacillary growth, two sterile tubes were rayed for an hour. A culture was then made of one of them from one of the previous tubes which had been rayed and which showed active growth, and another culture was made in the second tube from a culture which had never been rayed at all. These were incubated under precisely the same conditions as the previous tubes. When examimed two days afterward the growth in the rayed potato culture from rayed bacilli, had entirely outgrown the culture on rayed potato from non-rayed bacilli; therefore the only cause of this exceptional growth must have been a property of the bacilli themselves and not of the medium of growth.

Cultures up to the fifth generation were made and the following facts were arrived at: A single exposure to the x-rays increased growth markedly, and along with it there was an increase of chromogenetic property, even though grown in the warmth. As is well known, the bacillus prodigiosus does not form pigment when grown in a warm atmosphere. Further exposure to the rays so stimulates the growth as to again deprive the bacilli of power to form this peculiar pigment in the warmth, though on return to cold this property is afterward recovered to such an extent that this amount of pigmentation, though slightly different in color, is in excess of the original culture. Up to the fifth generation the result of exposure for an hour to x-rays of the culture is to produce an exuberant growth—apparently the pigment power is somewhat altered.

The method of application of the x-rays was as follows: With a large 18 in. spark coil of Newton's make a power was used of 16 volts, and from 8 to 10 amperes. The focus tube was placed about 6 in. above the test tube containing the potato growth. In every instance the exposure was of from fifty to sixty minutes' duration, with occasional resting of the tubes, which were run with the anodes as nearly red hot as practicable.

We do not here attempt to enter into

the explanation of these phenomena of growth. We are content to record the facts that exposure of the bacillus prodigiosus to the radiations of a focus tube induces very marked increase of growth and peculiar changes in the pigment-forming powers of this particular micro-organism. We will merely add that in some of the lower forms of vegetable life the same changes are observed, notably in the protococcus. An exposure of this organism to x-rays for from five to ten minutes appears to much stimulate its activity, and if the exposure is a little prolonged the cells become much paler, the chlorophyll disappears, and the protoplasmic contents are more granular. The cells recover their green color when exposed to sunlight, but on renewed exposure to x-rays the chlorophyll seems to disappear more or less completely.

The following microscopic changes are to be noticed as the result of exposure of these bacilli prodigiosi to x-radiations. There is apparently little to call for notice as regards the relative size of the rayed and non-rayed bacilli. As regards grouping, an unusual property of the bacillus prodigiosus was apparent—that is, growth in chains or strepto-bacteria; and further, what is at present giving rise to a controversy, spore formation, which seems to be clearly established by the presence of a chain preparation. For the rest, the bacilli appear in both cases equally granular and stain equally at the ends and as irregularly.

We are continuing these experiments, especially upon the pathogenic bacilli, among which it is possible that changes in growth may be accompanied with some alterations in the character of the bacilli.

THE Creighton Medical College, of Omaha, has recently added to its already very complete equipment an x-ray outfit of the latest and best make.

How Best to Secure Exact X-Ray Indications.

Having read with considerable interest the description of the Fessenden x-ray apparatus in your last issue, I can not but feel surprised at the fact that in this and many other recent articles in various electrical journals reference is made to the fact that photographs or radiographs are still being taken in connection with x-ray work, while it is a well-known fact that by the use of the fluorometer a great saving in time and tubes is effected, and much more accurate work done.

To properly locate a bullet in almost any portion of the body by photography requires the making of two radiographs; the work on which, including the taking, developing, fixing and printing, takes fully two hours' time, and the surgeon has even then to probe for the bullet to a large extent by guess work, guided, of course, by the two radiographs before him. Now not only does this process take up some two hours of valuable time, but the long exposure deteriorates to a great extent the tube which is used, so that the expense is great compared with the work accomplished. In using the fluorometer the patient is laid upon the table, the instruments are adjusted, the tube is turned on for a total of not more than five to ten minutes, and the patient's body is marked at four different points, which represent the terminals of two lines crossing each other at right angles at the intersection of which the bullet is absolutely sure to be found. In this case, as you will note, the marking is direct upon the body and no error can possibly be made by the surgeon.

In view of these facts, it is almost impossible for me to conceive that any one could resort to the taking of a radiograph in the present advanced state of the art.—*The Electrical Engineer*, July 21.

W. J. CLARKE.

New York, July 13, 1898.

A THEORY IN REFERENCE TO THE ORIGIN AND CHARACTER OF X-RAYS.

BY GEORGE ADAM, M. D
Lecturer on Electro-Therapeutics, College of Physicians and Surgeons, San Francisco.

Jean Perrin enunciated the following theory in reference to cathode rays: That, there being an intense electric field in the vicinity of the cathode, some of the molecules of risidual gas are torn into ions. The negative ions start toward the positive pole, but, gaining sufficient velocity, they go outward in straight lines independent of the anode. The positive ions move toward the cathode. Accepting this hypothesis, the writer would extend the theory in explanation of x-ray phenomena. Supposing we have a residual gas such as carbonic acid (CO_2). Disintegration takes place at the cathode, the carbon seeking the cathode, the oxygen starting for the positive, but acquiring an enormous velocity which is capable of overcoming the attraction of the anode, if that pole is not directly in its path.

The oxygen ions are electrified by the current.

The forces, therefore, that are active in this stream of oxygen which form the cathode rays are as follows:

A large kinetic potential, an electric charge, an atomic attraction or adhesive force, and an atomic separative force, owing to the high exhaustiou of the tube and increase of intermolecular space. To what extent do these forces act together, and to what extent do they oppose each other? I would reason that the electric charge would strengthen the atomic adhesion, and thus keep the atoms in a molecular state, whereas the velocity and the rarity of the gas would act in the opposite direction to separate the atoms and break up the molecule.

The characterics of the cathode rays prove that the molecular condition is maintained. The chemical action, therefore, that would take place at the cathode is represented thus:

$$(CO_2)_2 = C_2 + (O_2)_2,$$

and the cathode rays would be represented by the formula

$$O_2 + O_2.$$

It will be well here to consider the relationship of an electric charge to atomic adhesion. An electric current passing through a solution of a substance whose atomic constituents have different polarity will produce molecular disintegration; but there is no evidence, however strong the current, that atoms of the same polarity would be separated. On the contrary, atomic adhesion is a form of magnetism, which latter obeys the same laws as electrification and may be identical. Or it may be stated thus: That it requires positive and negative electricity to produce molecular disintegration in the electrolyte. In this instance the oxygen molecules are acted on by the negative electricity of the current.

The cathode rays bombard the fluorescent spot as molecules.

What do the cathode rays lose at the bombarded spot? They lose their electric charge. This is proved by the difference of the action of x and cathode rays in charging and discharging bodies. Do they lose any of the velocity? No; because there must be a reverse stream from the bombarded spot to establish an equilibrium in the exhaustion of the tube. This reverse force acts only at the commencement with the x-ray stream.

Then, what forces are active in this stream of radiant energy as it leaves the bombarded spot? The kinetic force, the separative force, owing to the increased intermoleculur spaces, and the atomic adhesive force (assuming that this last is a magnetic force, some of it may also have been lost in the bombardment).

We have, then, two disintegrating influences capable of overcoming the one adhesive force, and as a result the molecule is torn to pieces. Issuing then from the bombarded spot is a stream of atoms, in this case of oxygen, with an immense kinetic potential and intense chemical potential. The formula would be

$$O+O+O+O.$$

The stream is sent out in straight lines from the bombarded spot, the same as the cathode rays issue from the cathode.

Let us consider some of the characteristics of the x-rays, and see if they can be accounted for by our atomic theory. The penetrating power of atoms must necessarily be greater than that of molecules, and in this respect comparison with other radiant energies supports our theory. The penetrating power would be different in different media owing to the chemical actlon, and as the stream would decrease in velocity the chemical action would assert itself.

Would not the bad effects produced by long exposure to x-rays be accounted for by the chemical action of the atoms on the tissues ?

Having lost its electric charge and perhaps some of its magnetic adhesive force, such a stream of atoms would not be expected to be influenced by a magnet, but being infra-normal in this respect, when passing through a body would draw magnetism from the body, even if the latter was in a state of zero. This would account for the rays being influenced by the magnet after passing through a silver leaf.

A similar explanation will apply to the x-rays being incapable of charging a body electrically, and of its power to discharge a body already charged.

The x-rays are not generated in Geisler tubes because the intermolecular spaces are not large enough to assist in the work of disintegration of the molecule, and we have in that case a molecular stream.

In reference to Righi's experiment, showing that bodies in the neutral state were positively electrified by x-rays, I would offer this explanation :

The x-rays take away negative electricity from such a body and leave the latter positively electrified by the body's own electricity.

Thompson's experiment, showing that the penetrating powers of x-rays varies with the vacuum, that is, the higher the vacuum within certain limits, the greater the penetrating power, may be explained in this way: The enlargement of the intermolecular spaces is followed by a greater inter-atomic space in the stream. As the rays meet resistance the space between the atoms becomes smaller, and when the space is entirely obliterated the atoms unite and form molecules. It follows that the larger the space, the longer time it will take to obliterate it, and therefore the greater the distance traveled. This explanation would also account for there seeming to be two or more kinds of rays differing in penetrating power.

Such a ray as described, which we might call the atomic ray, would not be expected to be found in sunlight, nor any artificial light known, and the x-ray is not so found.

Radiant energy, consisting of a stream of atoms, would be a real ray, and would not be characterized by refraction, diffraction or interference phenomena, such as wave motion is, and no such characteristics have been found in x-rays.

A stream of molecules, or particles, would not be expected to produce all the phenomena characteristic of a stream of atoms, and accordingly we find no real ray obeying the same laws as the Roentgen ray.

CALORIFIC ACTION OF ROENTGEN RAYS. Dorn. *Wied. Ann.*, 63, p. 160; abstracted in *L'Eclairage Elec.*, June 17.—He measured the calorific effect by means of the differential pressure indicator of Toepler.

ON THE VISIBILITY OF ROENTGEN RAYS.

BY PROFESSOR E. DORN.

(Translated from the German.

Doubt has been thrown* by certain physiologists upon the researches on the the visibility of Roentgen rays carried out† by Herr Brandes and myself; while at the same time the opinion has been expressed that we had allowed ourselves to be deceived by subjective light-phenomena (especially by those termed "accommodation phosphenes," arising from the muscular effort of focussing, or "accommodation") and by electrical influences.

So far as any unprejudiced readers of our detailed article in the *Annalen* are concerned, those objections disappear of themselves. Therefore, I will not again refer to my refutation given in another place, but will only submit some experiments which, independently of their special bearing, may perhaps be of some interest.

The question whether the stimulation of the eye by Roentgen rays can be ascribed to the conjoint effect of a (muscular) accommodation of a subjective sensation of light evoked thereby can be immediately decided by experiments upon an eye with paralyzed accommodation. Herr Scholdtmann, M. D., has had the extreme kindness to treat one of his eyes with homatropin, and to place himself at my disposal for observation.

On May 25th, 1897, in the evening, by bringing his head, carefully wrapped up so as to exclude light, near to the Roentgen tube, the appearance of light was observed to be only a little weaker in the paralyzed eye than in the normal eye. At midday on May 30th the difference seemed more evident, but it disappeared after a sojourn—half an hour long—in darkness. It was, therefore, obvious that the paralyzed eye had been blinded by the reason of the widening of the pupil in passing across the street in the bright noonday light. The stimulation of the sensation of light by the Roentgen rays resulted independently of the effort of accommodation.

With the co-operation of Dr. Rittenberger, I have made a series of researches upon the possibility of a stimulation of the nerves by electrical actions taking place in the neighborhood of the head. A cardboard cylinder was placed over the head, and rendered light-tight by means of velvet. Under these circumstances it was definitely ascertained that the observer saw the Roentgen rays distinctly. An aluminum sheet, 1·03 millimetres thick, 60 centimetres long, and 45 centimetres broad, somewhat weakened the appearance when interposed, but did not produce extinction of the phenomenon. Then I allowed the sparks (10 centimetres long) of the induction coil, which had supplied the tube, to jump across the space previously occupied by the tube at a distance of about 10 centimetres from the eye; *there was not, however, the faintest sensations of light.* Equally little was this the case when using a Himsted's apparatus for Tesla currents, although I experimented with spark-lengths of 4, 6, 10, and 16 centimetres, and with horizontal and vertical positions for the spark-path.

Corresponding observations were made with another arrangement of head-covering—namely, black paper over the eyes, and velvet over the head—with similar negative results, in spite of the fact that in this case the length of the Tesla sparks was increased to 21 centimetres, and the observer was situated with the region of his eyes in the glow of the discharge.

The most striking refutation of the suggestion that the sensation of light excited by Roentgen tubes is an illusion

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*See Proceedings of the Physiologi cher Gesellschaft of Berlin, May 7, 1897.

†See G. Brandes, Sitzungsberichte d. k. Akad. d. Wissenschaften zu Berlin, May 7, 1896; also G. Brandes and E. Dorn in Wiedemann's Annalen, vol. lx., p. 478, 1897.

due to electrical influences is, however, afforded by the following experiment:

The Roentgen tube was turned backwards, that is to say, with the back of the anti-cathode presented towards the eye. The eye, accustomed to darkness, could not detect the smallest action, although the appearance of light was distinctly seen, both before and afterwards, with the tube in the right position. The tube thus reversed in position produced only a very faint fluorescence upon a barium-platinocyanide screen.

Meantime, Herr Roentgen has himself confirmed the visibility of the rays discovered by him, and has given‡ an elegant modification of the fundamental experiment. If an absorbing metal plate with a narrow slit in it is held before the eye, there is perceived a bright line, which is either straight or curved according to the relative positions of the anti-cathode, slit, and eye.

Before I had received information of this, I made a similar observation, in which I saw the "Roentgen shadow" of a straight brass rod 5 millimetres thick appearing under certain conditions as a curved shadow upon the retina.

The result of both experiments is easily explained. To me my experiment was important, because I perceived the curvature by observation without any previous deliberation, and the unexpected result offered, therefore, a welcome confirmation for the view that I was not dealing with an illusion due to subjective phenomena of light.—*Wiedemann's Annalen. Archives of the Roentgen Rays.*

Cathode Rays. Battelli and Garbasso. *Nuovo Cimento,* Vol. 4, page 129, and Vol. 6, page 5; abstracted in *L'Eclairage Elec.,* May 7.—A paper discussing the action of cathode rays on insulated conductors. The results agreed with the hypothesis that the difference between the action of cathode and Roentgen rays depends essentially on the conditions of the medium which surrounds the electrified conductor.

‡ Roentgen: Sitzungsberichte d. k. Akad d. Wissensch. zu Berlin, May 13, 1897.

The following is a list of books published on x-rays:

Manual of Static Electricity in X-Ray and Therapeutic Uses, by S. H. Monell, New York.

The New Photography, by A. B. Chatwood, London.

Prof. Roentgen's X-Rays and Their Application in the New Photography, by August Dittmar, London.

The X-Ray, or Photography of the Invisible, by W. J. Morton and E. W. Hammer, N. Y.

The X-Rays, by Kolle, N. Y.

Practical Radiography, by A. W. Isenthal and H. Snowden Ward, F.R.P.S., London.

The Roentgen Rays in Medical Work, by David Walsh, M. D., (Edinburg).

La Technique Des Rayons X, by A. Hebert, France.

La Radiographie Appliquee, a L'Etude des Arthrapathics Deformatics, by Dr. F. Bayou.

Roentgen Rays and Phenomena of the Anode and Cathode, by Edward P. Thompson, M.E.E.E., N. Y.

Les Rayons X, by M. Ch. Guillaume, Paris.

The A. B. C. of the X-Rays, by W. H. Meadowcroft, N. Y.

The Induction Coil in Practical Work, by Lewis Wright, London.

Immersed Luminous Electrodes. Braun. *Wied. Ann.,* No. 6; abstracted briefly in Lond. *Elec*, July 8.—Aluminum electrodes can be used for the chemical rectification of current; in this connection he discovered that the aluminum electrode in the electrolytic cell emits over its whole surface a white or yellowish red light. The phenomenon is best studied by means of a thin strip or wire of aluminum, which is viewed in a revolving mirror. The luminosity gradually disappears with a constant current.

COLLES' FRACTURE AND THE ROENTGEN RAYS.

BY CARL BECK, M. D., NEW YORK

Colles' fracture is the commonest of all fractures, yet in regard to no other is there more difference of opinion as to treatment. Since the advent of Roentgen rays, our knowledge of fractures and dislocations has been greatly enlarged, and our methods of treatment revolutionized. Treatises on this subject which were written before the Roentgen era have ceased to be regarded as authoritative. Following the new discovery great interest was at once concentrated on the much disputed classic fracture of the lower end of the radius, and it soon became evident that a much greater variety of the different types of this fracture (which represents ten per cent. of all fractures) exists than was ever anticipated before. As far as my own experience is concerned, I must admit that I never saw a case in which the diagnosis made before a skiagram was taken was not more or less modified thereafter, especially when considerable effusion and swelling were present.

Since March, 1896, I have observed forty-four cases of Colles' fracture, all of which were skiagraphed. Most of the skiagrams revealed conditions not thoroughly anticipated when examined by the usual methods. One most surprising feature was that in nineteen of these cases *a distinct transverse fissure above the capitulum ulna* existed, without causing any apparent symptoms. In seven cases the styloid process of the ulna was entirely broken off. In some instances besides the typical transverse fracture there was also a vertical fracture of the radius, which reached into the radiocarpal joint. In fourteen cases there was no displacement in spite of the great extent of the lesion, the periosteum of the dorsal surface apparently having kept the fragments together.

There is a different plan of treatment to be pursued if there be a total separation of the lower end of the radius or only a fissure with little or no diastasis. It is of great importance to know the direction of the line of fracture, whether it extends into the joint, and whether or not there is any impaction. Sometimes there is a decided turning of the fractured end, its upper margin being forced toward the ulna while the lateral margin protrudes and the joint-surface is directed upward to the dorsum. It is apparent that in all such cases unless thorough reduction is at once made the function of the wrist will never be restored; and, *vice versa*, if the fracture-line extends upward from the volar side and downward to the dorsum, the displacement must occur in the opposite manner, the principle of reduction, however, remaining the same. If the direction of the fracture-line is oblique it generally extends into the joint—a point which has to be especially considered in the after-treatment. The method of reduction as well as of applying the dressing will also be modified when there is a fracture of the ulna or of its styloid process, or when a bone particle has been chipped off. These lesions are diagnosed with difficulty by ordinary methods, even when the manipulations are skilled, and are seldom recognized by any other means than by the Roentgen rays.

In the treatment of all fractures there are two very simple rules to be observed: (1) Replace a displaced fragment to its normal position, and (2) keep it there. If the skiagram does not show displacement, there is, of course, no need of reduction. This explains why the results in certain cases of Colles' fracture are always good, no matter what sort of treatment is employed. In fact, if treated by a quack, whose ignorance leads him to treat the injury as a sprain with an ointment, poultice, or with "faith," often a better result is obtained in such ordinary cases than by the learned medical neophyte, who, after having made a most erudite diagnosis, immobilizes the joint for too long a period in his zeal to keep the fragments together; there will be no deformity, but adhesions will be formed and the wrist will remain stiff or immobile. In such a case a patient, the motion of whose hand was not prevented by immobilization, would escape serious consequences. In all cases in which displacement is present of course a great amount of care and deliberation is necessary.

The first requirement, accurate reduction, may be carried out with little difficulty. If forced extension and downward pressure by the surgeon's thumb, while counter-extension is used on the forearm, flexed rectangularly, should fail, anasthesia must be employed. But the more difficult thing is to keep the fragments well adjusted in a proper position. This I have always been able to secure by applying a long adaptable wire splint reaching at the flexor side of the arm from the tip of the fingers to the elbow, the splint being applied while forced traction is made. If the direction of the displacement is upward—*displacement a la fourchette*, a pad of adhesive plaster is attached to the dorsal integument above the fragment. Then a short narrow splint of wood is placed on the dorsal aspect of the arm, reaching from the metacarpo-phalangeal joint to four inches above the wrist, and is kept pressing down by the application of a gauze bandage. If the tendency of the displacement is downward the same procedure is carried out in the opposite manner, the wire splint being applied on the dorsal and the wooden splint and pad on the palmar side of the arm.

If the displacement be sideways, which is generally the case when there is a simultaneous injury of the ulna, the immobilization must be carried out on entirely different lines. The adhesive-plaster pad must then be applied laterally to the fragment, two long, narrow, wooden splints being used at the same time. One of these splints, being a little broader than the diameter of the bone, begins at the metacarpo-phalangeal joint of the thumb, and the other at the same joint of the little finger. Both extend up to the elbow, the same as the long wire splint. If there should be any displacement to the opposite direction, the pad must be applied on the ulnar side. No dorsal splint is used in this variety. After the dressing is finished, the skiagram verifies the proper positions of the fragments. If there be much swelling, wet applications may be advantageously used by pouring a solution of acetate of lead, for instance, upon the gauze bandage, the wire splint permitting penetration of the fluid.

It is of the greatest importance in such cases, that the fragments after being properly reduced, be kept *in situ*. The extremely strong ligamentum carpi volare never breaks, as Nelaton well demonstrated, and, therefore, it is in the first instance the *bone* which has to be taken care of.

If after the lapse of a week agglutination of the fragments is obtained and no deformity is evident, then the soft tissues must receive consideration. It is only then that short splints are in order. They consist of well-padded pieces of wood, extending from the metacarpo-phalangeal joint up to the middle of the forearm. After another week they extend only to the wrist, thus permitting free motion of the hand. The patient is told to move his fingers, as in playing the piano. After the third week massage treatment is indicated, active as well as passive motion of the joint being employed at the same time.

If all these points are observed, and if their proper execution is certified by the skiagram, surgical clinics will no longer furnish so much testimony of deformities and functional impairment following Colles' fracture.

The writer then cites three illustrative cases, and ends by stating that nothing may inculpate or exculpate a surgeon more than a good skiagram.—*Medical News.*

St. Louis, Mo., May 13, 1898.

MR. C. C. ZIEGLER.

My Dear Sir:—I had the pleasure of reading a verse in one of the city publications the other day which attracted my attention and admiration. The beautiful sentimental reference to the x-rays therein contained endears the verses to me and makes the ode appropriate for publication in THE AMERICAN X-RAY JOURNAL. Will you give me consent for its publication? What incentive caused you to compose these lines?

Thanking you in advance.

Yours Truly,

HEBER ROBARTS.

In Mr. Ziegler's reply he said: "The beautiful x-ray views of the pulsating heart seen in Dr. Graves' office was the sole incentive for writing these lines."

The following is the sonnet as it appeared in *The St. Louis Public Library Magazine* for April, 1898:

SONNET.

Where is old Jove, the ruler of the sky,
Who in his hand the forked lightnings bore?
Where is Prometheus? Where the thunderer Thor
Whose glittering hammer made the mountains fly?
Dreams of the man-child! His believing eye
Saw in the forces he could not explore
Gigantic beings whom he must adore,
Appease, and e'en with blood their favor buy.
We have unroofed the heaven the ancients knew;
The lightning is our slave; through Roentgen's rays
The throbbings of the human heart are seen.
How have the gods of old faded from view
Before our modern searchers' vision keen!—
All faded, leaving but a little haze.

CHARLES CALVIN ZIEGLER.

The X-Rays and Their Safe Application. Destruction of X-Ray and Other Infections by Electro-Sterilization.*

BY J. MOUNT BLEYER, M. D., F. R. A. M. S., LL. D., NEW YORK CITY

Discoveries of the properties of the x-rays go on apace and the scientific world is watching with the closest interest the experiments that are being made from their different aspects, to determine the effect of these rays upon the human body. Since their discovery and their application in medico-surgical work, reports soon started and spread throughout the profession and lay public of a grave danger accompanying the use of these x-rays, owing to the fact that they produced so-called virulent burns by exposure to them.

Records now hold amongst their files many cases—differing in degree, and some have proven fatal from a lingering exposure to them. Even records tell us of a recent murder trial in this state in which the chief question arose—whether the physician who made this x-ray exposure upon a patient, was guilty of an act of negligence from which death followed.

Let me say at the outset of my remarks, from what I gathered from my experimental work, that all your timidity in their future application can be allayed. I concluded that if the x-rays are applied under certain precautions, and the proper apparatus used, no such conditions can be possible. I speak now from the actual employment of these rays daily to the chest wall, for the aid in gaining early diagnostic signs of tubercular and other allied diseases, if present.

This investigation gives me the right of an opinion, and I freely make it before you, showing how we all have fall-

*Read before the Psychological Section Medico-Legal Society, May 26, 1898.

en into that fallacious position by calling this phenomena as produced by these x-rays, burns, when they are nothing less nor more, than an inoculation. Now that we know how to remedy the dangers connected with their use, and how best to avoid repetitions from recurring, and if they occur, whether the physician, or who so applies them, is to take the blame if the proper precautions, as in any surgical operation, are not observed. Of all these facts I shall refer to in a few moments.

Let me dissipate those minds that an x-ray application or the use of its photography is a dangerous procedure, either on a long or short exposure. If this force is applied and handled by skilled hands and suitable mechanism, there is absolutely no atom of fear in producing this phenomena of inoculation, known fallaciously as x-ray burns.

This inoculation is due, according to my observation from a series of experiments, to several physical effects produced by the generation of these rays and the general conditions present. It is a known fact, that the use of the Rhumkoff coil, in connection with the generation of these rays, is an apparatus which gives an exceedingly high electromotive force and amperage, and therefore such high discharges when exhibited produce certain physical conditions surrounding the atmosphere of the patient or person who is exposed to these x-rays. To sum up these physical facts, we find that this high discharge is leveled against the subject, carrying with it from the surrounding septic atmosphere, certain particles floating therein, also surcharged with bacteria and foreign material upon the clothing and skin which are at all times present, setting up sometimes an infection and at other times an inflammatory condition from these forced driven materials under the skin exposed to this phenomena.

This inflammatory or inoculated condition is the result of all these facts which I came upon from my crucial experiments, and can be avoided without any difficulty now on the part of the operator, by the adoption of a few rules gleaned from my experience which I shall give in the summing up of my remarks.

I bring before your notice a few most important facts, which are also corroborative directly within my own investigation. Those facts can not help being appreciated, as they come also from several late observers who studied the question of burns, due to fire and hot water, &c., and the causes of death therefrom.

We already know that many deaths are due to burns produced from other causes than by the x-rays. This fact has puzzled scientists to account for deaths which occurred among persons suffering from burns, even where the injuries received seemed wholly inadequate to produce fatal results. The havoc caused by skin diseases might be much greater, and a far larger surface of the skin attacked, but generally a cure could be effected, whereas, in the majority of cases of severe burns the end would be fatal.

Persons who have escaped with their lives from a fire whether very severely burned or otherwise, suffer intense pain, which is followed by a peculiar torpor and drowsiness, and not infrequently by delirium and convulsions. The pulse becomes weak, the breathing irregular, the temperature lower and there almost always follows vomiting and other symptoms of poisoning, terminating within twenty-four to twenty-eight hours in death.

Although these symptoms have received the attention of a number of scientists, their views of the actual cause of death were widely diverse. The first guesses, though ingenious, were very far from the truth. A German, F. Falk. arrived at the conclusion that persons suffering from burns died of cold, caused by the abnormal amount of heat given off through the burned portions. Prof. Ponfite, on the other hand, believed the cause to be the destruction, by the heat, of a great number of blood corpuscles, inducing a disturbance of the circulation. Addakoff, a Russian physician, stated as his view, gained from clinical observations, that the results of burns upon the system bore a resemblance to the effects produced by certain poisons, particularly those generated in the body by the failure to throw off secretions. Lustgarten and Kijanitsin come still nearer to the truth. The former comparing the results to burning with that of ptomain poisoning, and the latter declaring that under some influence or other, probably that of a ferment or of bacteria, a poisonous matter developed in the blood of burnt persons. He actually found in the blood of such persons a poison (ptomain) that is not present in normal bodies. It is a formless, yellowish or brownish yellow matter, with a sharp, disagreeable odor and injected into dogs or rabbits produces all the symptoms caused by burning. The belief of Lustgarten that bacteria causing impurities, which settled in the wounds, were the generators of the poison, was shown by the experiments of Ajello and Parascandolo to be unfounded. Both these were able to take from any part of the body of a burnt animal, a poison, the injection of 10 grammes of which into a dog, weighing twenty pounds, produced instant death. The strongest poison was obtained from the burned flesh, a lesser was in burned entrails and the weakest of all came from the blood. From this may be deducted, with certainty, that the ptomain is not solely in the blood but in the whole of the burned portions and is thence carried into the system. Burned persons poison themselves, so to speak.

The poison may be regarded as the product under the influence of high temperature of the albumen, and the direct importation of bacterial poisons from without, &c. It has been found possible, however, to prevent the poison from spreading by removing the burned portions before the ptomain had entered the circulation. It is also known from Ajello's and Parascandolo's experiments with animals that all recovered without having suffered from the symptoms incidental to burns, when the amputation of the burned parts occurred immediately after the burns were received; where the amputation was delayed for twenty-four hours they all succumbed, except in instances where large quantities of blood were removed by bleeding; the blood drawn off being replaced, however, by a transfusion of pure blood. By the bleeding a large quantity of the poison was removed, the blood artificially supplied so strengthened the animals that there was facilitated a further separation of the poison from the blood by means of the kidneys.

I lay much stress upon this important point due to these x-ray phenomena. That the x burn always appears many days after the application of this force or light to a part of the body, and does not show absolutely any early manifestation,—as minutes or hours thereafter, but days elapse, even as late as 18 days thereafter. The x-ray burn begins with a painful dermatitis slowly, and symptoms resembling burns from heat or scales. It is therefore that from the very outset and conditions that the difference is apparent.

How should we avoid this dangerous condition in the application of the x-ray?

To sum up in a few clauses the whole matter, let me say in a few words the following, viz.:—

Above all supplant the static machine for the Rhumkoff coil. This form of electricity has not the physical properties of carrying foreign material into the depths of the tissue so readily as the other current. Static electricity gives only the high voltage with low amperage, while the other is productive of both high forces, making it an unnecessary dangerous appliance.

All parts to be either photographed or examined by means of these x-rays should have all clothing removed therefrom, and washed with an antiseptic solution, or so prepared as if a surgical operation is to be performed. Also, a room which is free from infectious materials as possible, should always be made ready, or especially appointed for the purpose. Those are the cardinal rules and must not be deviated therefrom in order to avoid a dangerous inoculation or poisoning. A screen of aluminum is a good adjunct also, and should be employed whenever convenient.

SPECIFIC TREATMENT FOR SUCH. CONDITIONS.

Should such a condition arise, from unforeseen causes or otherwise, sterilization of the affected part by means of electrolysis is the safest and quickest specific known to me—with the amputation of loose tissue surrounding the parts. I found in my early work, as far back as May, 1896, when I had been as unfortunate as others to inflict several patients with these burns, that something more was present to deal with than an ordinary electro dermatitis. Experimental study of this question soon elicited facts that brought me to the discovery of the following remedial agent, which I recommend to your notice. Electrolysis or sterilization of the parts is a specific.

What do we understand by Electrolysis?

Electrolysis is the act of breaking up of chemical compounds, organic as well as inorganic, into their constituent elements by the agency of electricity, the process being accompanied by the loss of heat, and, usually, by change in the volume of the substance submitted to experiment. The conditions requisite for the performance of electrolysis are: (1) A fluid or semi-fluid conductor; (2) Conveniently placed electrodes; (3) A continuous or galvanic current of sufficient electro motive force or strength of electricity to overcome the resistance interposed between the electrodes. As the result of the passage of a continuous current, through a suitable conductor, decomposition is the result. The current decomposes all the infected material and changes them into some other non-poisonous compound, thereby relieving the system of poisonous products. This is accomplished by placing such parts of the body into a salty solution of distilled water, and connecting the electrode with the negative pole of a galvanic battery with a mil-ampere meter. The positive pole may be placed on any convenient part of the subject—vessels of porcelain, wood or glass are best. The strength of this current should average 5 mil-ampere to a square inch of surface to be sterilized, lasting at least ½ hour, after that time the polarity should be reversed for 5 minutes, in order to set free the chlorine which will again react on all the external and internal exposed surface. Accurate measuring by means of a mil-ampere meter with the use of such current must be strictly adhered to, as serious conditions will arise unless one knows the exact amount of current passing, and so as to judge the exact quantity of chemical action, thereby controlling its destructive effects; which if are not known will do serious injury to healthy surrounding tissues.

I know of no more satisfactory and scientific methods in the treatment of these x-rays wounds, and, in fact, all deep and superficial wounds, than the sterilization by electricity as advocated in my method as stated. All wounds with pus should first be drained by incision before the above procedure is undertaken. I must state in my recommending sterilization by electrolysis to those that will hereafter apply it that they should at least be acquainted with the fundamental principles involving electro chemistry. Good judgment is necessary, as much damage can be done if improper precautions are not observed. The time of application must be always left to the discretion of the operator, especially in deep seated conditions. Reapplications can be always resorted to. There are no contra indications for this treatment by electrical sterilization to any class of infected wounds and skin diseases presented to surgery. After such treatment, protective dressing of simple kind are necessary to keep the parts from further external infections.

I bring my new and novel investigation before your notice for the first time in the history of antisepsis, and hope that it will find its way into general surgery with as much, and better satisfaction than the heretofore methods employed, and give as good account of itself as it has in my hands.

This work has been the outcome of my early results obtained in the treatment of tuberculosis and other inflammatory diseases of the lungs, &c., which still occupies my time, already with most fruitful results.

My investigations brought me to a most important point, and that is, that all microscopic crevices are cleaned of bacilli and pus cells, where, with the use of antiseptic solutions, &c., a mere coating is effected thereby, and always liable to a reinfection. This form of sterilization does not absolutely admit of such a condition as destruction takes place instantaneously by chemical decomposition, also by reversing of the polarity of this current, these microscopical crevices are again closed completely by its electro dynamic action.

Electro-sterilization must be highly recommended as a prime antidote to all kinds of stings, dog bites, or in fact by venomous wounds produced by serpents. The current should be applied a much longer time than for ordinary cases. When a person has either been bitten by a poisonous snake, or by a dog, or received a dangerous dissecting wound, our first efforts to influence the result may take three directions: (1) To prevent the absorption of the poison; (2) To counteract or lessen its effect on the organism; (3) To hasten its elimination. (Martin.). With the first object a ligature should be tightly applied to the seat above the situation of bite or wound. Then electro-sterilization prevents absorption of any poison by electro-decomposition. Ligaturing delays the absorption of a poison, as venom from a snake, etc., until electrolysis is accomplished. Electrolysis should be performed at the earliest possible moment.

The Prompt Solution of Tablets.

We are glad to know that the Antikamnia people take the precaution to state that when a prompt effect is desired the Antikamnia Tablets should be crushed. It so frequently happens that certain unfavorable influences in the stomach may prevent the prompt solution of tablets that this suggestion is well worth heeding. Antikamnia itself is tasteless, and the crushed tablet can be placed on the tongue and washed down with a swallow of water. Proprietors of other tablets would have better success if they had given more thought to this question of prompt solubility. Antikamnia and its combination in tablet form are great favorites of ours, not because of their convenience alone, but also because of their therapeutic effects.—*The Journal of Practical Medicine.*

The Best and the Cheapest.

In prescribing either medicine or nutriment, a physician must often consider the question of what is the most economical as well as what is the best for his patient. And it is only occasionally that he is made happy by the knowledge that *The Cheapest is The Best.* He always knows that "the best is the cheapest," but this helps him very little if economy must be thought of.

John Carle & Sons point with pride to the fact that their prepared food, Imperial Granum, is the most economical as well as the best food on the market, and in proof of this, they ask physicians to carefully note the weight of their handsome "Small" and "Large" size air-tight tins, and also to kindly notice the length of time either one will last, bearing in mind that their sterilized tins form the lightest, as well as the safest retainer that can be used.

Send $1 and subscribe for THE AMERICAN X-RAY JOURNAL.

THE TREATMENT OF DISEASE BY ELECTRIC CURRENTS.

A handbook of plain instructions for the general practitioner. By S. H. Monell, M. D., Brooklyn, N. Y. Published by William Beverly Harison, 3 and 5 West 18th Street, New York. 1088 pages.

Another extremely valuable work on electro-therapeutics has been launched by the same author as the recent publication, "Manual of Static Electricity in X-Ray and Therapeutic Uses," which has attracted world-wide reputation thus early for its clearness of description, and usefulness to the general practitioner.

It would be impossible for us to specialize the headings of the 70 chapters in this volume in the space allotted for this review, therefore it must suffice to state that every known modern employment for faradic, galvanic and static electricity and their therapeutic indications are detailed in this volume with conciseness of language and minute directness of application, so that the general practitioner may read and understand.

Probably no book on electro-therapeutics, and we say it conservatively, has ever equaled this volume for value to those of the profession who would use electricity as a therapeutic agent, and he who does not use it at this age is certainly not up to the times in his profession.

We therefore heartily recommend this volume to our readers, believing that they will not be disappointed in adding it to their libraries.—*Medical Times and Register*, Phila., Pa., January, 1898.

Manual of Static Electricity in X-Ray and Therapeutic Uses,	$6.00
Treatment of Disease by Electric Currents.	7.50

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X-RAYS AND ELECTRO-THERAPEUTICS IN LONDON.

Editor AMERICAN X-RAY JOURNAL

In the first section of this letter I wrote chiefly of apparatus and am obliged to say that if a delegation of ten of our leading U. S. makers should come here to inspect goods in their line they would want to hurry home to export a stock and drum up English trade. Many here are utterly oblivious of the fact that superior apparatus exists. A salesman in an immense house yesterday showed me some x-ray screens advertised in the *Lancet* (reading notice) to "give far better definition than any others." I would not buy until I examined one with a tube and when I remarked that it was only a very ordinary screen, &c., he seemed astonished to know that we had screens in America at all, and asked where we got them. He was much surprised to learn that they were neither English nor German, but were made in the United States. In some quarters I have found the same wonder about tubes. On the whole, however, it is probably correct to say that the *best* English coil, screen and result is nearly equal to the best American. The expert Londoner, however, can not appreciate the minor differences in our working method and would at first find our ways as awkward as we may think his.

In x-ray results the two countries are not far apart at the top. Good definition is obtained with short exposures by the best men I have seen here.

There has been for some time a desire to catch on the sensitive film the outline of stone in the kidney, and much quiet effort has been made to overcome the difficulties. Some cases are reported in print but they are very few. Three operators here have each been able to show me prints of *one* successful negative. Dr. —— made his 18 months ago and has never duplicated it. Dr. —— has also tried "dozens of cases of supposed renal calculi", and has one print to his credit, out of the lot. The histories of two published cases show the great value of x-rays in this direction if they can be made positively to show that stone does or does not exist. The detection and localization of pieces of steel, &c., in the eye is now reduced to an accurate process by a London ophthalmic surgeon, Mr. Mackensie Davidson, to whom I am indebted for much courtesy. Probably no one in England is his superior in fine and scientific work. In due time he will publish his own researches and it would be out of place for me to anticipate him.

Deep parts and the pelvis still perplex operators here. Definition of soft parts is obtained to some extent but can not be assured in advance. In general it may be said that we are working along parallel lines and I see little here that I had not heard of in America. But a few things that were written up in our home journals as long ago as 1896, and which I had neglected in my own experiments, have been here actually seen by me for the first time. The best large prints I have seen were three made by a private gentleman of means for his own amusement.

Some surgeons are beginning to demand an exact localization of such foreign bodies as bullets, needles, &c., before they operate, and for this purpose a "cross-string localizer" is available, but as yet too little used. It was introduced here in the winter, by Mr. Mackensie Davidson, yet is only just made for the market. Without a copy of the X-Ray Journal, of last summer (1897) at hand I can not recall how it differs from the device then described by Dr. Scott. The apparatus, as devised and used by Dr. Mackenzie Davidson, costs about $45. A cheaper substitute of a somewhat different kind is made for from $14 to $20. These prices are so much less than the cost of the fluorometer that I fear there will be no adoption of the latter here. The string localizer is best used with a negative but can be used with a screen. Striking effects are also shown by x-ray stereoscopy, and one view of such superb pictures as Mr. Davidson kindly showed me is quite apt to spoil the eye for the usual flat print. The view is also an instantaneous localizer. The full detail of an x-ray picture can not be even guessed until it is seen in lifelike relief in the stereoscope. I recall the note of Elihu Thompson on this point as early, I think, as April, 1896, but have had no time to attempt the work myself. One sight of a good steoroscopic effect is, however, enough to make the observer enthusiastic.

I have carefully inquired in the best informed quarters as to x-ray work in Berlin. No one here has any knowledge of any recent advance in that city, and some assert that London is ahead of Berlin in that field. From what I see of apparatus which is probably employed in Berlin I am disposed to credit the statement that Berlin is not in advance. One gentleman who saw Prof. Roentgen himself not very long ago told me that Roentgen was not likely to add to his original discovery. Of one thing I can vouch from tedious personal experience during the last two months in London, to-wit: Reports of x-ray miracles are not always crystalized fact. I have heard of various wonderful things here and have traced them up at the cost of much time and effort only to discover that they were not correctly reported.

Those who have read my book on "Static Electricity in X-Ray and Therapeutic Uses," will easily understand my desire to see Guy's Hospital and its historical electric room. Guy's has a new electrical department and a very good x-ray outfit but the little room where Golding Bird, Addison, and Gull did their remarkable work is in an old ward now used for obstetric cases. It was empty when I saw it. The attendant did not know much about it but thought the old static machine was in the *cellar*. In the modern room I found an old nurse who was better informed. She showed me a curious static machine made 7 years ago, a copy of the one that figures in the Guy reports. If Golding Bird had the patience to use such a device he deserves to be framed in history beside Job. At the foot of the machine stood an old platform—perhaps the original one. It was about 24 by 36 inches, placed on small porcelain knobs about an inch clear of the floor and had a top of sheet zinc, let in a frame of black painted wood with sharp corners. Across the street frcm Guy's is a large store dealing in surgical and electrical goods. I talked with two salesmen and neither of them had ever heard of a static machine and could not inform me of any dealer in London keeping such an article.

Americans who have heard so much of the Wimshurst machine will hardly be prepared for the facts I have since ascertained. *No dealer in England makes for stock and keeps for sale any static machines.* Mr. Wimshurst is not a shopkeeper. He is an electrical engineer in the consulting department of the Board of Trade and inspects certain parts of boilers and engines in ships. He is a courtly gentleman of about 65 years of age, lives several miles out of the city and only amuses himself by occasionally making a machine which bears his name. During a pleasant evening spent with himself and son I learned much that was new to me of the status of static electricity in Europe. As we know it, the thing don't exist here. From time to time a machine, usually small, occasionally very large, is made to order for some one. It has an excellent foundation of plates, but has no means of therapeutic use and in general no one knows that it can be used therapeutically. There are a few exceptions to these rules but diligent effort failed to find a single machine in London equipped in a manner to permit me to give a clinical demonstration to one of my new found friends who was interested. However, it is within the bounds of possibility that my visit here may bring about a revival of static electricity in England. I bring home with me a miniature plate as a souvenir, cut for me by the hands of Mr Wimshurst in his own laboratory.

In other departments of medical electricity an American visitor looks in vain for the complete and extensive outfits required for all-round work. The alternating sheet current fills in some deficiencies in an excellent manner and is much used in local and general baths by the best operators here. A good galvanic battery is easily found in many quarters but I have seen no faradic battery that an educated American physician would use. Fine faradic work, therefore, is unknown here. I see no slow vibrators in use. Meters are quite different in appearance and electrodes are few. In fact, the electro-therapeutic outfit seems to lack much in completeness and the routine work done seems very narrow. Only one dealer keeps a stock and he is a branch of a large German house. He tells me that 2000 physicians make some small use of electricity in the British Isles, chiefly in a very small way. He has sold six cabinets in eleven years. No electro-therapeutic journal is published here and electricity has little professional support with the pen. Hence, his sales are mostly cheap portable galvanic batteries and small faradic coils. There are but three books on the subject published in England—the total aggregating about 800 pages. Such a variety of clinical work as many of our home physicians do could not be done here even by the best expert in London—for the narrow limitation of his apparatus would not permit it. Yet, there is some advance and hope for more. This is Farady's land and although renowned for conservatism, yet, it seems as if the actual demonstrated merits of electric currents must some day lead to the employment of fine apparatus and must finally establish the repute of so practical and useful an agent as electricity. S. H. MONELL.

856 Union Street, New York City.
London, Eng., July 22, 1898.

INJURIOUS EFFECTS OF THE ROENTGEN RAYS.

BY JOHN T. PITKIN, M D

It is safe to say that no scientific discovery was ever received with greater rejoicing by suffering humanity than the enunciation by Professor Roentgen of the possibilities he had discovered that the x-ray possessed which could be utilized to photograph the living dense structures of the human body and thereby determine their physiological and pathological condition.

An army of scientific men including many of the medical profession hastened to become his disciples.

Static machines and induction coils or step up transformers of every conceivable size and description were suddenly very much in requisition.

An era of experimentation and investigation with x-rays galore was inaugurated, all of which was productive of many glowing accounts of what was seen and done through their instrumentality.

But this new variety or degree of light, too rapid in its rate of etherial vibrations to be perceived by the visual organs also failed to impress the nerves of tactile sensibility and thereby warn us of its dangerous and destructive qualities, consequently many untoward results have been experienced through which the serservices of the Roentgenian have been brought into disrepute and his great field of usefulness thereby unduly limited.

Many who have been exposed to the Roentgen rays have suffered as sequelae all conceivable varieties and degrees of burns. The loss of an eye, the detachment of an external ear, the sloughing of a lower extremity, alopecia of a large portion of the head are among the alleged injuries sustained and one exposure of the brain to the rays for a period of thirty-minutes at a distance of one and one-half inches from the tube was in all probability contributory to death.

Although not any one operator of the rays may even hope to determine all of their mysterious properties, still each by careful observation may be able to add a little knowledge toward the enhancement of their usefulness on the one hand and the limitation of their destructiveness on the other. It is in this spirit that the writer who has had an experience from almost daily employment since their inception, nearly three years ago, concluded to communicate the tabulated results of his investigations.

DESCRIPTION OF THE X-RAY BURN.

Not any disagreeable feeling is experienced in the parts during the exposure, only a gentle breeze caused by bombardment of parts by the particles of electrified air repelled from the outer surface of the Crookes' tube. A period of incubation lasting from one to twenty-one or more days in which the parts functionate as usual and are devoid of discoloration or discomfort. Small erythematous spots with itching and dull pain deep seated become manifest, the redness extends, the pain increases in severity, is worse at night, and at times almost unbearable. The epidermis becomes separated from the derma by a transfusion of watery serum forming large blebs which coalesce, break down and discharge profusely. The epidermis desquamates layer after layer much as we can remove the outer coatings from an onion, the parts are much swollen, stiff, hot, angry looking, bleed easily and are very painful. If the fingers or toes are attacked the nails lose their brightness, as they grow out the line of demarkation between the new and old texture becomes apparent. The stage of ulceration supervenes characterized by its indolence, severe pain and being usually devoid of suppuration, its depth depends upon the severity of the exposure and the vulnerability of the tissues, it may involve all of the subjacent structures even the bone participating in the inflammation. After several weeks or even months of chronicity, the parts very slowly repair, the destroyed parts are often regenerated and functional activity may be entirely restored but the new integument will be devoid of hair and hair follicles.

TREATMENT OF X-RAY INJURIES.

Treatment is of little avail—showering the parts with cold water reduces the temperature and for the time mitigates the pain. A rubber bandage loosely applied will hasten repair and afford a little relief, a solution of cocaine muriate will benumb the nerves, slightly raising the parts afford relief, but if raised too high, the suffering is intensified. Hot applications augment the discomfort of the patient.

THE CAUSE AND HOW TO AVOID THE DANGER.

If in accordance with the general consensus of opinion we concede that the rays in and of themselves are devoid of dangerous properties, that all of the bad results are attributable to the electricity unconsumed in their generation, it becomes obvious that as the x-ray can not be obtained without the electrical currents every precaution must be taken to keep the patient's body out of their field of operation.

In the atmosphere in the immediate neighborhood of every excited Crookes' tube two separate fields of force, the electrical and x-radial can be investigated, a portion of the former travels the dialectric air along the conductors to and from the tube. another portion which concerns us most is repelled from its exterior traveling a varying distance into space but incessantly tends to return to the generating apparatus by the path or paths of least resistance, this field of force constitutes the danger zone and can be explored by a floating feather or silken fabric which will travel through the areal electrical pathway. The x-radiance can be traced through this electrical field into the apartment by the aid of the fluoroscope, it will be observed to diverge from the deflecting target in the Crookes' tubes spreading out in a conoidal manner, rectilenear in propagation.

X-ray injuries may follow the employment of any variety of exciting apparatus but are by far more common from the unidirectioned than the oscillatory discharges, because the latter neutralizes its own potential with each pulsation in the immediate vicinity of the Crookes' tube, *i. e.*, has a smaller danger zone whereas, with the unidirectioned current the tendency is to select the patient's body as a path for a portion of the return flow.

Employment of the metallic grounded screen as recommended by Nikola Tesla as a protective measure is of extreme importance.* With the modern static machines capable of developing a pressure of several millions of volts, the employment of additional spark gaps increases the electrical dissemination, raises the resistance, developes amperage, increases the electrification of the patient and thereby adds to the danger.

Although it may seem paradoxical, the same strength of current from a large static machine delivering an electro-motor force of three million volts capable of causing severe x-ray injuries with the Crookes' tube attached, can be employed to bombard a patient's body placed directly in the circuit, after the tube has been removed, as a therapeutic proceed-

*See Electrical Review. May 5th. 1897.

ure, with only beneficial results, the skin may be reddened for a few hours immediately following the exposure, but no delayed impairment need be anticipated.

Insulating the body of the patient exposed to the x-rays, lessens his electrical transmissibility, and hence, decreases the danger.

Untoward results are in inverse ratio to the distance from the excited tube, the time of exposure and the efficiency of the apparatus—in other words the Crookes' tube, like the red hot stove, will not burn us unless we are brought into too close relationship therewith, but unlike the stove the excited tube will not warn us of its destructiveness and such manifestations are not immediate but delayed.

X-RAYS AND LUPUS.—It is reported from Vienna that Dr. Schiff has successfully treated cases of lupus vulgaris by means of the x-rays. His process is to set up an independent inflammation in the lupoid area by exposing the part to a very intense radiation. So far, investigations into the germicidal effects of the x-rays have gone to show that their activity in this respect is not greater than that of ordinary light. But Dr. Schiff's result is not a germicidal one, and we know that inflammation, and even necrosis may result from exposure in certain cases, although we do not know the determining factor which leads to iujury in some cases but not in others under apparently similar conditions. It is not, however, altogether improbable that Dr. Schiff's results may be due to a direct germicidal action of the x-rays on the tubercle-bacillus. Light, we know, is deleterious to this organism, and Dr. Finsen, of Copenhagan has reported cases of cure in lupus by protracted exposure to concentrated light, so arranged that the ultra-violet rays predominated.—*British Medical Journal.*

THE CAUSE OF THE EFFECTS PRODUCED BY EXPOSURE TO THE ROENTGEN RAYS.

BY ALFRED C. PRENTICE, A. M., NEW YORK.

When Dr. Wm. Konrad Roentgen discovered the x-rays he gave them this name because he did not know what they were, and the algebraic sign for an unknown quantity aptly signified his limited knowledge of their nature. It is significant that the name is still applicable. Dr. Roentgen's first reports were published in January, 1895, since which time scientists have eagerly crowded into this field of discovery. Much has been learned of the phenomena exhibited by the x-rays, but many difficult questions remain unanswered as yet by scientific facts. Very like the phenomena of electricity itself, the exact nature of which is still an enigma, the results produced by that form of electrical discharge in the vacuum tube, viz., the cathode rays and the x-rays, have found many new and varied applications in practical science, while many conflicting theories attempt to explain their action. Nor is the evidence brought forward as yet conclusive as to their exact nature.

The most important use of the x-rays is in medical and surgical diagnosis, but this has been involved with troublesome results in some cases. From their early use, and even now occasionally, there has followed a severe lesion at first apparently of the skin, but later involving the deep tissues as well. The constitutional disturbances have been most severe, and the process of healing is always protracted and exceedingly painful. Although cases of the "x-ray burns" so-called have become less frequent, and of the patients exposed to the rays, probably only a small fraction of one per cent experience any such results, nevertheless the uniform severity of the lesion and its obstinacy in healing can not but qualify as more or less dangerous any exposure to their action. Notwithstanding these objections, the use of the x-rays in surgical diagnosis is destined to become general. Cases are on record (1) in which even the courts are required to accept the skiagraph as corroborative evidence of expert testimony.

The theories adduced to account for the injuries resulting from the application of the x-rays, inducing the "x-ray burn," have not as yet afforded either a remedy for the lesion or a way to avoid it.

The following series of experiments* have been conducted by the writer during the past six months in the study of the problem.

The x-rays were produced by means of the static electric current from a Wimshurst or influence machine having eight circular plates of blown glass each twenty-eight inches in diameter, revolvat a high rate of speed between an equal number of stationary plates. The power was supplied by an one-half horsepower motor of the Crocker-Wheeler type connected with the current used for lighting the building. The apparatus is supplied with Leyden jars, in circuit or not, accessory spark gaps, and all adjustments for perfect regulation to secure the best results from the vacuum tubes. The tubes used were fourteen inches in length, having each a bulb three and one-half inches in diameter, enclosing aluminum cathodes and platinum anticathodes, also provided with an auxiliary potash tube to be connected in circuit by a shunt, so as to reduce the vacuum when it became too high. In this manner the tubes could be so adjusted to the potential of the current as to produce x-rays of the greatest brilliancy and penetration, and maintain their uniform production for an indefinite period without danger of breakage by perforation.

*The experiments mentioned in this paper were conducted in the photographic and x-ray laboratories of the Department of Pathology in the College of Physicians and Surgeons. Medical department of Columbia College in the City of New York, under the guidance of Dr. Edward M. Leaming, F.R.P.S., instructor in photography, photomicography and skiagrapny in the above institution. The microscopic data here presented were supplied by the courtesy of Dr Frederick S. Ward, assistant in Normal Histology in the Department of Pathology.

Two guinea pigs kept upon the same conditions of food, etc., were used—one for the experiments and one for the purpose of normal comparisons. Exposed a pig to the x-rays at a distance of three inches from the tube for a period of twenty minutes in order to accustom her to the slight annoyances of noise, etc., incident to the following experiments.

The only effect of the exposure was a slight drowsiness, which gradually passed away. No further effects of the exposure became apparent during the following week. Accordingly the pig was again exposed to a low vacuum tube giving x-rays of a poor quality, at a distance of one inch from the surface of the tube, for ten minutes; and again to a high vacuum tube emitting intensely brilliant x-rays, at the same distance, for a period of two hours. During this time the pig was confined in a pasteboard box perforated by a window one and one-half inches square, directly opposite the pig's right lateral thoracic wall. She reremained quiet in her box except at intervals she would shift her position as if uncomfortable, but would immediately return to her former position. Three or four times she appeared to act as if something annoyed her belly and endeavored to reach the spot with her nose, but after some slight effort subsided into quiet.

During this time the table on which the pig rested became strongly electrified, and no doubt the pig was electrified as well.

She acted entirely normal, and no cutaneous or other effects were noticeable for one week after the exposure.

The fur was then clipped from a region one inch square, over the right lateral thoracic wall, which had been previously exposed, and again submitted to action of rays of greatest brilliancy for a period of seventy minutes at a distance of one inch.

In this exposure, although neither the pig nor table came in contact with the electrical apparatus, both became so strongly electrified that a spark was produced between the edge of the table and my finger held near; and the pig started and squirmed when I touched her, as if pricked with a pin, while I could feel the pricking sensations at the tips of my fingers, on touching her body. By the end of the week from the time of this exposure, there appeared on the clipped area two or three dry vesicles of exfoliating epidermis. The lesion gradually grew deeper and continually worse, until at the end of the second week the animal was very ill, showing marked constitutional symptoms of fever and depression. Examination revealed a characteristic "x-ray burn." The skin had vesiculated and peeled off in flakes, leaving a pale, raw surface, moistened with serous exudation. Not much, if any, inflammation was evident, but the lesion was quite sensitive and apparently very painful. Only the small area which had been clipped was at first affected, but the injury rapidly extended, and on the night after the fifteenth day following the exposure the pig died.

On picking up the body by the fur at the back of the neck, a large bunch came out, permitting the body to fall. Body was dissected and portions were reserved for histological examination. The following is Dr. Ward s report:

Examination of Injury to Thoracic Wall of Guinea Pig Due to Prolonged Exposure to Action of X-Rays.

"*Macroscopical.*—Over a circular area of about four c. m. in diameter the hair and skin had been removed and the exposed surface was parched, the subcutaneous tissue and thoracic muscles feeling as though they were partially dried to the underlying ribs.

Microscopical.—Portion for examination taken through the seat of injury and including entire thickness of thoracic wall. Fixed in formalin five per cent; alcohol, ninety-seven per cent. Decalcified in acid. Imbedded in celloidin Stained with Gage's haemotoxylin and alcoholic eosin. The skin and subcutaneous tissue had all disappeared. In the central portion the superficial layers of muscles did not stain. No striations were visible. The blood-vessels were shrunken and contained very little blood. Approaching the margin, the staining of the specimen improved, striations and cell nuclei of the connective tissue were visible. The deep, muscular layers of the central portion were slightly stained with eosin, and the nuclei took on a pale-purple color, but in neither case was the staining that of normal muscle. At the edge of the affected area, about blood-vessels and between muscles, there was a moderate amount of infiltration of small, round cells.

Anatomical diagnosis is that all the structures at the site of the injury have lost their vitality and have become dried. In the closely adjacent parts there is a very moderate amount of inflammation."

The sensation of drowsiness has been mentioned by other writers as following an exposure to x-rays. The statement of Professor J. J. Thomson that "all bodies traversed by Roentgen radiations become conductors of electricity" is perhaps a hint. It is supported by Professors Trowbridge and Burbank. (2) We know that twice were the animal and table charged in our experiments. Tesla states (3) that "by means of an enormous potential and high frequency, the tube was surrounded by a violet luminosity or halo," and that "Lenard also obtained a similar phenomenon in front of the aluminum window."

Mr. Rollin states (4) that the burning from vacuum tubes *not generating x-rays* may be severe, the tube being exhausted to such a degree that no Roentgen light could be produced with the voltage used.

Professor Thomson, of Harvard, demonstrates (5) by experiments upon himself that if the x-rays are ether vibrations of great rapidity, known as ultra-violet light, as we are now led to believe, they could not have produced the "burn" which he induced upon his finger by exposing at one and one-half inches distance from a vacuum tube of blue glass in which was a transparent window of clear German glass, the injury which followed occurred only on that portion opposite the clear glass window, and the part covered, as it were, by the blue glass was unaffected, marked off by a sharp line of demarcation. He says the blue glass would have been transparent to the ultra-violet rays.

In another case (6) of purposely induced dermatitis, no effect was produced where the skin was covered with lead and tin foil, the lesion appearing only on the uncovered area, although exposed at a distance of only five-eighths of an inch. It would appear that only the electricity attacking the area covered by the foil was conducted away, while that attacking the uncovered area was the ultimate cause of the injury. Certainly the x-rays would have penetrated the foil as if it had been paper.

Dr. Monell is authority for the statement (7) that "nothing is more certain than that a sufficiently energetic electric current passing to tissues which it can reach and enter only after electrical energy has been transferred into heat by resistance, such as dry and hair-covered skin or clothing, will vesicate and can be made to produce intense and deep inflammatory action."

All these statements combined with the evidence of direct experiment tend to the conclusion that not the x-rays themselves, but the direct actions of the electric currents upon the fluids and tissues are the real factors in the damage done.

Tesla has stated (8) that he "believes the hurtful action is not due to the x-rays, but to the ozone generated in contact with the skin. Ozone," he says, "attacks the cutaneous surface, its action, no doubt, being heightened by the heat and moisture of the skin. This generation of ozone ceases at a definite distance from the electrical terminal, and the same is true regarding the production of this irritation." He also believes, or did believe that the electrodes became gradually disintegrated by the bombardment of the cathode rays, and that these metallic particles penetrate the walls of the tube. He said, (9) "I am getting more and more convinced that we have to deal with a stream of material particles which strike the sensitive plate with great velocities. If these observations be confirmed by men of keener insight, I shall be still more convinced that material streams of matter actually penetrate the skull. Thus it may be possible to project a suitable chemical into any part of the body."

Professor Ames (10) states: "The radiation in an x-ray tube may be divided provisionally into three classes: Ether waves, which may have wave-lengths from 150 to 800 m. m. approximately; cathode rays, which undoubtedly are streams of matter electrically charged; and x-rays, about whose nature there is no conclusive evidence at the present time. If the walls of the tube are thin enough, and of suitable material, all these radiations will emerge and pass into the surrounding air. It is a matter of doubt if the cathode rays observed outside the vacuum tube are the same as those inside; but the inner ones undoubtedly cause the outer ones. There is no evidence that the x-rays carry with them particles of matter, or that they directly cause a stream of particles; in fact, all known facts serve to point to the belief that they are ether waves of extreme shortness."

If this last statement holds true, then Professor Thompson has proven that the x-rays themselves do not burn. That the "cathode rays are streams of matter electrically charged," gives Dr. Gilchrist (11) sufficient reason to assume that the lesions may be due to the entrance of material particles—of platinum in his case—into the tissues, and that the cathode rays which accompany the x-rays, may be the cause of the trouble and not the x-rays themselves. He endeavored to show that these particles had so accumulated in a given case as to produce an ostitis and periostitis, acting like foreign bodies in the tissues. He produced in evidence of this a skiagraph of the part taken after the injury was developed, which he said showed a marked increase in the density of the bones. He laid no emphasis on a chemical analysis of the exfoliated skin, which, however, gave a negative result.

Campbell Swinton, Esq., of London, writes: "Cathode rays are generally believed in this country to consist of atoms or molecules of risidual gas, which, being similarly electrified to the cathode, are repulsed by the latter, and travel at an average velocity not much less than one-twentieth that of light, the velocity depending upon the exact potential of the cathode and the molecule at the moment the latter leaves the former, and also upon the degree of the exhaustion of the tube, upon which depends the free path of the molecules, that is, the distance a molecule can travel without coming in contact with another molecule."

It seems strange that Dr. Gilchrist should have so confused the material particles of the cathode rays, which, as we have seen, can be nothing but residual gas, with the unique theory of Tesla, who spoke of metallic particles of the electrodes—aluminum or platinum, as the case might be—which he believed were projected through the walls of the tube and into the densest tissues. Tesla has also informed us (12) that if the part of the body exposed to the x-rays be placed between a metal plate and the tube, the injury would be on the side of the part on which was the metal plate. But that if a thin plate of aluminum, which is practically transparent to the x-rays, or a sheet of wire gauze, be placed between the tube and the exposed part, and at the same time the *metal screen be electrically connected with the ground*, the disturbance to the tissues will be avoided. His latest suggestion (13) is that it is possible for the "electro static influence" which generates the ozone to "decompose the sodium chloride in the tissues, thus giving rise to irritants." It would appear that his statements of the violet halo or brush-discharge around the tube connected with the practical value of a metal screen in dispersing the injurious agents when electrically grounded, and its concentrative power, if placed on the far side of the part and not grounded, point directly to the action of electric currents and nothing else.

Dr. Charles a Lenard (14) states directly that the "burn" is the result of induced electric currents in the tissues, which will be induced capable of destroying their vitality, if the patient is approached sufficiently near to the x-ray tube.

Dr. Monell speaks of the "electrical energy transformed into heat by resistance of dry skin, etc., as causing dermatitis and inflammation. Professor E. Dorn (15) has demonstrated that x-rays do exert very slight heat effects, and he has measured their quantity, but this element is of so small amount as not to be appreciable.

A remarkable fact in nearly all cases of the "burn" is that no sensations of heat are felt at the time of exposure, and only in some cases is there noted any immediate symptoms whatever, as of "a sense of prickling heat, or a tingling followed by itching;" but there is uniformly no sensitiveness or pain. Another characteristic is the time which elapses from the exposure to the appearance of the first symptoms—usually a week to nine or ten days, or even a month or more in some cases. These facts have called forth the statement from several authorities (16) that the lesion is "not a burn," inasmuch as the accepted definition (17) of a burn is "an injury produced by the action of too great heat." It is also useful to note that ichthyol usually gives relief from pain in an ordinary burn, but Dr. Tuttle (18) found that it aggravated the pain of an x-ray injury. Cold water also proves soothing to burns, but in this case it was found the pain increased when moist dressings were applied of a temperature lower than 85 deg. Fahrenheit. Also, in certain cases, where skin grafting had been employed, the severe neuralgic pain still persisted after the part had healed.

It may not be improbable that electrical energy attacking the tissues is transformed into another form of energy than heat, as perhaps electrolysis of chemical substances. Dr. Bardeen (19) regards it justifiable to consider that one of the main causes of death after burns (ordinary) is to be sought in a toxaemia caused by alterations in the blood and tissues, the direct effect of the elevation of temperature; "a view which is further strengthened by chemical evidences and the experimental work of Kijanitzen and others." Since the pathological condition of the tissues in the "x-ray burn" correspond very nearly to, only are worse than those of a severe burn produced by heat, it does not seem unreasonable to suppose that similar chemical alterations and decompositions might be produced by electrical energy or electrolysis as are supposed to be produced by mere action of heat. Tesla hinted at this phase of the question in speaking of the decomposition of the sodium chloride.

It is well known that the static discharge in air produces ozone in a more or less considerable amount. The fact that a sufficient amount to detect by the odor is often produced and inhaled with impunity to the mucus lining of the respiratory passages would cast some discredit on the theory that it might irritate a warm and moist skin.

Tesla has demonstrated, however, that metallic particles of the anticathode do become deposited upon the inside of the tube, by breaking the tube and analyzing the deposit noticed. This deposit is especially noticeable in the tubes that have been in use for some time and at so high tension as to render the anticathode red or white hot. But whether these particles could penetrate the tube and enter the tissues to produce irritation as foreign bodies, is another question.

In order to test this matter, I exposed to the rays of maximum brilliancy four photographic plates superposed, so that if the metallic particles should strike the sensitive film or even pass through it, and one or more of the four glass plates and gelatine films, just as in human tissues Tesla supposed them to do, they would be apt to lodge, some of them at least, in one or more of the films. The exposure in this case was timed and adjusted exactly as in the last exposure of the guinea pig, viz., for seventy minutes at a distance of one inch. If the metallic particles caused the lesion which developed a week later in the case of the pig, they would certainly be deposited in the films of the plates. I therefore removed all the films, after having dissolved out the unchanged silver-salt in a solution of hyposulphite of sodium, and evaporated to dryness. Reduced the residue to an ash which was then digested in aqua regia (HCL, 3 parts to HNO_3 1 part, concentrated), forming from any metallic platinum present, soluble platinic chloride, $PtCl_4$. I then treated this solution with stannous chloride, $SNCl_2$ which reduces platinic salts to platinous salts. The latter are soluble in dilute hydrochloric acid, (HCl) giving a characteristic deep cherry red colored solution. I accordingly added HCl, but no color reaction took place. At the same time, for a check test, I dissolved in 10 c.c. of water two or three small granules of potassium, chloroplatinite, and tested for platinum, as already indicated. The color reaction was characteristic, intense and permanent, in fully 20 c.c. of solution. This experiment proves conclusively that the particles of platinum are not projected into surrounding objects.

It is of quite recent demonstration (20) that the silver salt of the photographic plate which is sensitive to white light, is not affected by the x-rays. Experiments made upon the sensitized collodion film and the Daguerreotype plate produced no image whatever, while upon the gelatin coated plate or film the negative image was produced in the usual manner.

The conclusion drawn was that the x-rays did not produce an electrolytic effect upon the silver salt, nor even the partial decomposition as produced by ordinary light directly; but they did produce a fluorescence of the gelatine film and perhaps of the glass support, if it were of a fluorescent material, which in turn acted upon the silver salt suspended in it, just as ordinary light does. Incidentally the statement was made that plates most sensitive to ordinary light are not necessarily most sensitive to the x-rays, since the result depends upon the kind of gelatine used, and the period of cooking to which the emulsion was subjected. This fact was apparently confirmed by a series of comparative tests conducted by the writer in which he was convinced that the particular brand of plates which happened to be cheapest in the market produced the best x-ray negatives in the shortest time of exposure.

Little attention has been given to the comparative value of the static and induced currents in the production of the x-rays, and it may be worthy of note in this connection that in the great majority of cases reported as "x-ray burns," the current has been generated by the induction coil apparatus. Such an equipment of high potential, even a ten or twelve-inch spark-gap, requires less room, and is less expensive; but the current is characterized by much greater amperage than the static current of the same or even greater potential in volts. The amperage of the static current is very low, while the potential is almost unlimited under proper conditions. Also the distance of the exposed part from the tube in those reports which mention the distance has been invariably small, from three or four to six or eight inches.

The length of the spark-gap is directly proportional to the internal resistance of the tube (21), and is also directly dependent upon the voltage (22), and not the amperage. The greater the internal resistance, the more penetrative are the x-rays produced. Thus it is seen the production of x-rays of the highest penetrative value is directly dependent upon the voltage utilized. And consequently, the lower the amperage, the less danger attends the use of the tube, because a less quantity of electricity per unit of time is free to act upon the tissues; and with a current of higher potential and lower amperage the greater may be the distance from the tube, and only the voltage is important to produce x-rays.

Since the intensity of the x-rays varies inversely as the square of the distance, it follows that the higher the potential in volts, the greater may the distance be, to produce the same results of penetration. I have not been able to see any penetration by the skiascope, from a tube supplied by an induction coil having a six-inch spark gap at a distance of eight feet. While with a tube supplied by the static machine working at a similar sparking interval, the bones of my hand could be seen at a distance of thirty-six feet.

Professor Thomson has already demonstrated that a "burn" may be induced by the use of the static current in the vacuum tube, but no cases on record, to my knowledge, in which injuries have been sustained at so short a distance as six inches, using the static current, while one case I recall was burned by the induction current x-ray tube at a distance of eighteen inches.

If the intensity of the brush discharge is governed by the same law as other form of radiated energy, it would require an exposure of some thirty-two hours at a distance of twelve inches, and fifty-seven hours at a distance of sixteen inches, to produce a lesion as Professor Thomson did while using the static current in his tube for half an hour at one and one-half inches distant, making no allowance, of course, for idiosyncrasies of patients.

The radical treatment that has been employed consists in a complete excision of the lifeless tissues, as in gangrene, thereby producing a healthy granulating surface in the wound, which rapidly heals. One surgeon claims to have cured twenty-five or thirty cases by cutting down clear through the affected part, and then dressing with carbolic acid until granulation sets in. Balsam of Peru was then applied, and healing took place by granulation. Of course the necrotic tissues had to be sloughed off in this latter treatment.

In noting the conclusions of this paper it will be valuable to compare results strikingly similar of a series of experiments (23) by Oudin, Barthelemy and Darier, of Paris.

CONCLUSIONS.

1. The general character of the tissues affected in the "x-ray burn" is that of absolute necrosis and more or lesss exudative inflammation. The resulting alopecia is more or less marked in lesions involving hair follicles.

2. The x-rays themselves exert no appreciable heating effects, and consequently do not burn. All evidence seems to point to the conclusion that the lesion is due to the direct effects of the electric currents upon the tissues and fluids. The nature of this effect is as yet wholly speculative.

3. The ozone irritation theory is not supported by evidence.

4. Metallic particles of the platinum anode are not projected into substances near to x-ray tube.

5. X-rays do not decompose the silver salt of the photographic plate directly, but produce in the gelatine film a fluorescence which in turn acts upon the silver salt as ordinary light.

6. The use of the static rather than the induced electric current in producing the x-rays is less liable to result harmfully, (*a*) because it is of low amperage, and (*b*) being of very high potential comparatively, does not necessitate so short distance between the tube and the exposed part.

7. In all cases where exposure is required at a distance less than twelve inches from the tube an aluminum screen, electrically grounded, should be placed between the tube and the exposed part.—*Medical Review of Reviews*, N. Y.

121 West Sixty-second Street.

BIBLIOGRAPHY.

1. *Chicago Law Journal.*

2. *American Journal of Science*, January, 1898.

3. *Electrical Review*, New York, March 11, 1896, page 131; March 18, 1896, page 147; April 1, 1896, page 171; April 8, 1896, page 183.

4. *Electrical Review*, New York, January 5, 1898.

5. E. Thomson, *Boston Medical and Surgical Journal*, December 10, 1896, vol. cxxxv., No. 24, pp. 610-611.

6. *American X-Ray Journal*, February, 1898, page 170.

7. *American X-Ray Journal*, February, 1898, page 170.

8. Nikola Tesla, abstract in *Public Opinion*, vol. xxi., No. 24

9. *Baltimore American* (extract)

10. *Johns Hopkins Hospital Bulletin* February, 1897.

11. *Johns Hopkins Hospital Bulletin*, February 1897

12. *Medical Record*, April 30, 1898. *American X-Ray Journal*, December, 1897.

13. *Medical Record*, April 30, 1898, page 637.
14. *Journal American Medical Association*, December 4, 1897.
15. Abstract from *Evening Post*, February, 1898.
16. Dr. E. B Bronson, *Medical Record*, April 30, 1898, page 637.
17. Dunglison's Dictionary page 165.
18. *Medical Record*, April 30, 1898, page 637.
19. *Johns Hopkins Hospital Bulletin* April, 1897.
20. *Photographic Journal*, March, 1898
21. *Archives of Roentgen Ray* September, 1897.
22. *American Journal of Medical Science*, January, 1888.
23. *Monatscheste fur Praktische Dermatologie*, November 1, 1897.

THEORY OF ROENTGEN RAYS. Lond. *Elec. Rev.*, May 13.—Stokes suggested a theory several years ago, according to which these rays are aperiodic electromagnetic waves caused by the impact against the anti-cathode of the charged particles in the cathode stream; this theory was recently developed by J. J. Thomson (*Phil. Mag.* page 172). Lord Rayleigh, in *Nature*, April 28, protests against the acceptance of this theory, as it does not carry with it some of the consequences which have been deduced as the distinction between Roentgen rays and ordinary luminous and non-luminous radiation; he does not agree that Roentgen rays are not very short waves, but impulses; he favors the view that the waves differ from ordinary light only in the shortness of their waves.

IF one wishes by a simple optical illusion to obtain an almost perfect imitation of the wonders of radiography, he may take a small turkey feather, and, holding it close to the eye, look through the radiating ribs at the end of the feather at the ends of the outstretched fingers of his hand, held against the window. This done, the flesh will appear to be transparent, with the opaque bone running down in the center as shown by true radiography. If gas light is used, a piece of ground glass must be held before the flame, to diffuse the light.—*Inter-Ocean*.

CATHODE AND ROENTGEN RAY TUBES. Villard. *L'Eclairage Elec.*, May 28; *Electrical World*, New York.—An abstract of a French Physical Society paper describing improvements. One of these is an anticathode which does not blacken the tubes; iridium is very satisfactory if quite pure, but the commercial variety is not pure enough; the new anti-cathode is in the form of a paraboloid with a lateral opening through which the cathode rays enter; this will not blacken the tube, because it never acts as a cathode for the reversed currents; the form of the anode, creating an electrical field which is practically zero in its interior, totally prevents the formation of these new rays. He also describes a tube which may be regenerated; part of the tube consists of a small tube of platinum closed at one end and joined at the open end with a glass tube; nickel or palladium will also answer; to regenerate the tube this metallic tip is heated in a Bunsen flame; at about 1,000 deg., hydrogen passes through the platinum, but it is absolutely impenetrable to air. He also mentions some magic screens on which the images are preserved, but the description is not quite clear.

TREATMENT OF LUPUS WITH ROENTGEN RAYS AND CONCENTRATED LIGHT.—Dr. Kummel (Hamburg) claimed that in selected cases these means were successful, but experience with them was yet too limited to absolutely state the indications and contraindications. He exhibited two advanced cases almost cured, in which he expected a continuance of the treatment to cure radically.

TRANSPORTABLE X-RAY APPARATUS. Levy. *Elec. Zeit.*, July 7.—A reprint of a brief, illustrated paper describing a simple, portable apparatus, devised by him.

ROENTGEN LIGHT NOTES.

BY WILLIAM ROLLINS.

NO. XXX—THE WAVE LENGTH DEPENDS ON THE TEMPERATURE.

In note VIII I stated that the wave length depended upon the velocity of impact. In this note temperature is considered. Fig. 30 shows a modification of the tube described and figured in the *Electrical Review* for December 1, 1897. There is a receptacle for a thermometer to show the temperature of the water escaping from the hollow target. If we keep this water at five degrees centigrade a higher voltage is required to produce Roentgen light of a given wave length than when the water has a higher temperature. On the other hand, by using a lower voltage or vacuum and increasing the number of impacts upon the target by increasing the amperage, we can make an uncooled target so hot it radiates ordinary light, and yet the tube will not yield a ray of Roentgen light because the force of impact is not great enough to heat the individual particles of the cathode stream sufficiently to produce the short vibrations which are Roentgen light. In practice a very high temperature of the target is not desirable, because the shock of impact of the rushing particles of the cathode stream on such a target is less violent and therefore less efficient in producing the enormous temperature of these particles which is essential. That we are unconscious of this temperature is simply because at present we have no means of producing such rapid vibrations in a sufficient number of particles to constitute a mass such as we think of as a source of heat. We can, however, by using a very high vacuum and voltage, produce a temperature perhaps higher even than our sun, one at which we can decompose some of the so-called elements which, at the ordinary temperatures, are gases, and here the vacuum tube opens a new world.

NO. XXXI—ON HAVING THE TARGET SEPARATE FROM THE ANODE AND NEARER THE CATHODE.

In Note XVIII it was said that the wave length depended upon the velocity with which particles from the cathode struck the target. As the force of this molecular projection at any point depends upon the rate of change in the potential, it is less at three inches than at a nearer point. Therefore when as shown in Fig. 2, Note XVI, the target is between the terminals, the velocity should be greater than when the target is the anode. By adopting this construction in two terminal tubes we should be able to take advantage of the high initial velocity due to the difference of potential we can maintain by having the terminals three inches apart, and yet by placing the target at one and one-half inches from the cathode, we should cause the molecules to strike it with a higher velocity than they would if they continued their flight to the anode and used this as a target. So with a given voltage we should be able to generate light of a shorter wave length or of the same wave length with a lower voltage. The latter is a matter of some consequence, as it should enable us to use a smaller generator. Another possible advantage is that the cathode discharge is more shielded from the anode rush described in notes XX and XXI. I have considered two terminal tubes only because this is the type in common use. Mr. Tesla's tubes described in Thompson and Anthony's work on x-rays, though a much more interesting form, are at present so rarely employed outside the laboratory of this great discoverer that I have never seen any of them except those I have constructed for my own use. One of these is shown in Figs. D and DI in previous notes in the *Electrical Review.* This can be used either as a single or double terminal tube, though it was constructed to combine Mr. Tesla's single electrode with the Crookes' and Roentgen plan of bringing the cathode stream to a focus, and to these I added the cooled target. As the statement has been made that the wave length depended upon the voltage, it might be supposed that with the very high potential which can be maintained with such a tube it might not be suitable for generating light of the longer wave length required for distinguishing between the soft tissues of the human body; but this is of no moment, for it is only necessary to use a lower vacuum, thus making the wave length longer by diminishing the velocity of impact. It is practically impossible to get so high a voltage that we can not control the wave length by the degree of the vacuum, and when we can get it high enough we can realize the dream of many now working on this problem and discard the vacuum tube as an essential in the production of this light.

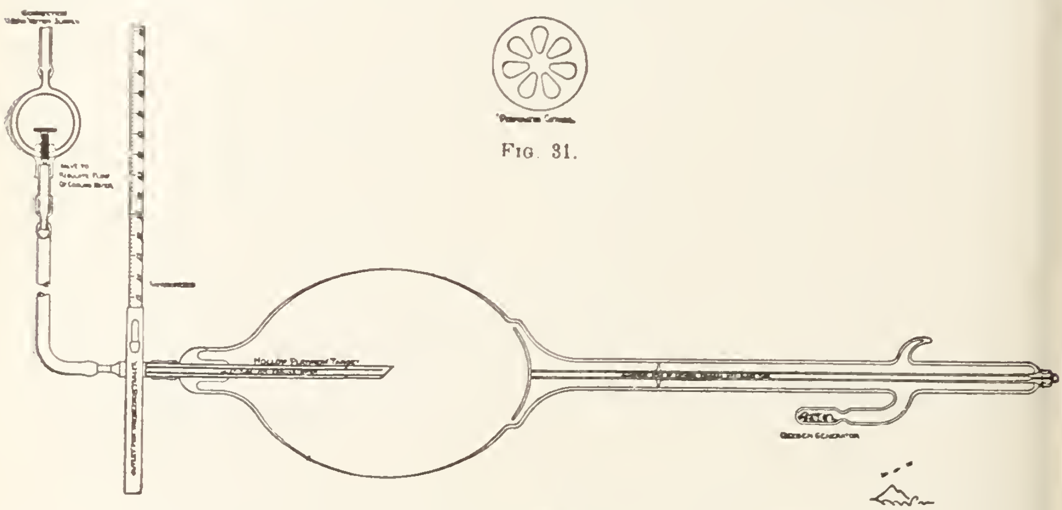


Fig. 31.

Fig. 30. (Scale One-Quarter.)—Modified A-W-L Roentgen Light Tube.

NO. XXXII—ON THE SIZE OF CATHODES.

For Roentgen light to be of much use in medical diagnosis it is necessary to have a generator of sufficient power to send the light through the adult body at a distance of at least three feet from the radiant area on the target of the tube. Shorter distances produce marked distortion of the internal organs, a matter of grave importance in studying the heart and determining its real size in disease. This distortion is also a serious matter in estimating the relative sizes of organs lying in different planes, the one farther away being made to appear relatively too big. Six feet is a much better distance, but, unfortunately, there are no commercial generators powerful enough to furnish a proper light at this distance, and such an apparatus is necessarily expensive, costing $1,000 even when made at home. As three feet taxes the best commercial generators to their limit, it is necessary in using the fluoroscope to economize power by sending the electric surges as slowly as is consistent with a steady light. Two hundred surges a minute are said to do this, but Dr. F. H. Williams and I find it necessary to have 1,200 a minute to have the illumination of the screen appear steady to us. As every surge must give force enough to properly illuminate the body, it is necessary to make each of as large an amperage as possible with the generator employed. We do this by filling the condenser as full as we can in one-twentieth of a second, which is the maximum time we can allow force to accumulate for a single surge. When we attempt to deliver this amperage from a cathode of ordinary size the electricity seems to have difficulty in escaping from the concave side of the cathode in a normal manner. As a result we get the lateral sparking mentioned in Note XXVII;

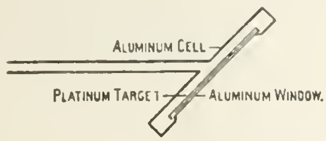


FIG. 32.—"ROENTGEN-LIGHT NOTES."

and if the cathode is placed in a tube at the end of the bulb and near the walls (as in ordinary commercial tubes before I pointed out the defects of this position) the glass is soon broken. To overcome these difficulties the cathode should be placed as shown in Note XXX, Fig. 30, Note XX, Fig. 5, and instead of being less than an inch in diameter, which is common, it should be two inches or more. These large cathodes are not necessary with small generators. In conclusion, I wish to make two things prominent: the cathode acts as a condenser—the size of the cathode should be in proportion to the size of the surges.

NO. XXXIII—PERFORATED CATHODES.

At a certain stage of the vacuum only the edges of the cathode appear active. At a higher vacuum only the center of the cathode seems to be the source. These appearances have led observers and tube-makers to consider a small cathode as good as a large one. In previous notes I have tried to prove the fallacy of this, and I now print a cut of one of the perforated cathodes I have used in my experiments. A glance at Fig. 31 will show that it has a solid center as large as the average cathode, and a wide, solid rim. If only the edges or center of a cathode were active, this one should be as efficient as though it was solid, but it is not. The cathode stream from it is so broken up and so little delivered at the proper point on the target that this is not made red hot by a current which would melt it with a solid cathode of the same size. The appearances of perforated cathodes of different designs are very beautiful, as are the figures they form on the glass walls, and both are worth careful study.

NO. XXXIV—ON THE FALLACY OF USING THE EQUIVALENT AIR SPARK AS A MEASURE OF THE DEGREE OF VACUUM IN A ROENTGEN LIGHT TUBE.

In the writings of men interested in vacuum tubes it is not unusual to find the degree of vacuum in a Roentgen light tube measured by the equivalent spark in air. That other data should

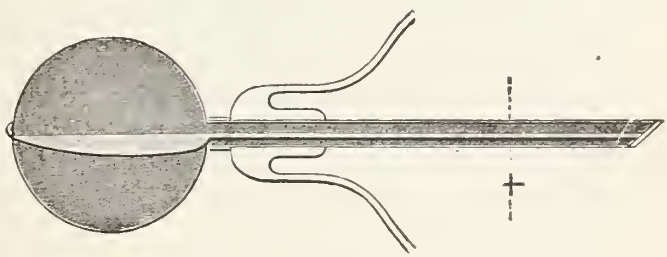
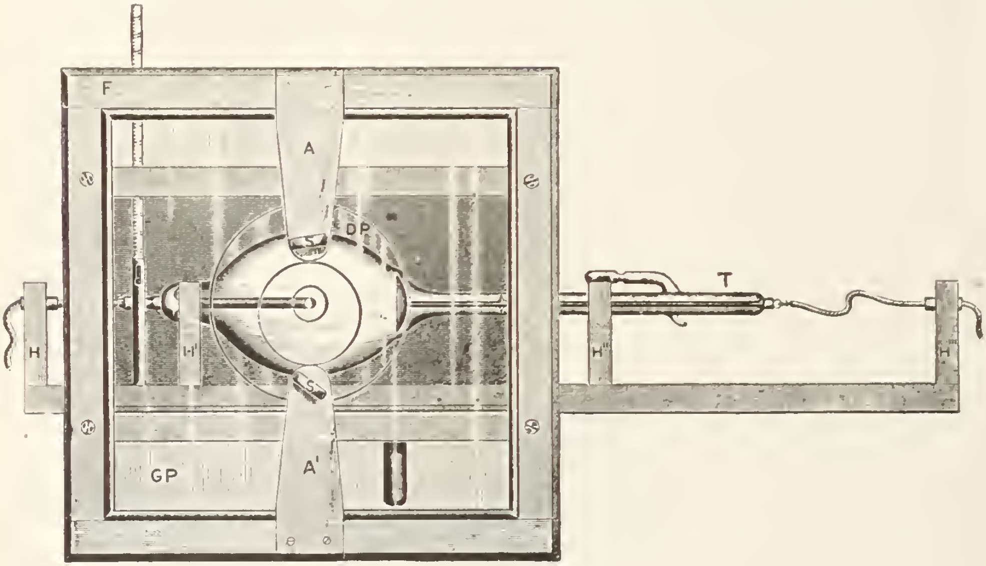


FIG. 33.

accompany this statement is shown by the following experiments. If we keep the temperature of the water at 30 degrees centigrade, in a tube like that shown in Figure 30, Note XXX, and pump the vacuum until the resistance is equal to nine inches of air, when the tube is excited on a large static machine, we shall find on exciting it with a Lawrence and Norton coil and a 20-microfarad condenser, that the equivalent spark in air is much less, usually about three inches. If we now excite the tube on an alternating-currrent dynamo, the length of the equivalent spark in air will be still less. Even with different types of induction coils, the equivalent air spark varies, depending on the mode of winding. As extended description of experiments is out of place in these short notes, I say briefly that at the degree of exhaustion required to produce Roentgen light, the resistance of the tube, as measured by the equivalent spark in air, is inversely as the voltage ; that the lower the voltage, the higher the vacuum must be to produce an equal amount of Roentgen light.

the deposit does somewhat diminish the efficiency of the tube I tried covering the target with a thin layer of aluminum. Such a target is shown in Fig. 32. Fig. 33 shows the same idea applied to a cooled target. I hoped that the platinum would act like the silver coating at the back of a glass mirror and prevent the loss by transmission which was supposed to take place when aluminum was used as a target. I first tried this experiment two years ago and do not now attribute much practical importance to this form of target, believing that the efficiency of



SCALE, ONE SIXTH.
FIG. 34.

NOTE XXXV—COVERING THE TARGET WITH ALUMINUM.

If we examine a Roentgen-light tube having an aluminum cathode and a platinum anode we shall find, after it has been used a considerable time, that the deposit on the walls is of two colors. There is a more generally diffused purple deposit from the cathode and a less generally diffused brown deposit from the platinum. Fortunately, the latter deposit is less in front of the target, otherwise the amount of Roentgen light yielded by the tube would be more rapidly reduced than it is by use. As

aluminum is not so much due to its transparency to Roentgen light as to the fact which this experiment pointed out—that the individual particles of the cathode discharge are not raised to so high a temperature by the same voltage when they strike an aluminum target as when they strike one of platinum or some allied metal, because the shock of impact being less sudden, heat is developed during a longer time and therefore never attains the maximum.

NOTE XXXVI—DIAPHRAGMS FOR ROENTGEN LIGHT TUBES.

So many experimenters, the writer

among the number,* have invented the diaphragm for sharpening the shadows cast by objects in the path of Roentgen light that it is a matter of some difficulty to determine to whom the credit belongs. Very probably it belongs to Roentgen, as almost everything appears to do except Trowbridge's discovery that under a sufficiently high voltage every

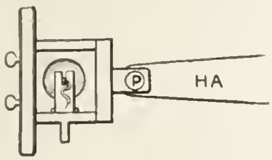


FIG. 35.

part of a continuous metallic conductor gives off Roentgen light. However, the first mention I have found is an article by Leeds and Stokes in the *Western Electrician* for March 14, 1896. Considering the value of diaphragms it is remarkable that within a little over two years of their discovery they should have practically gone out of use. As we increase the power of our generators it becomes more important to employ them because, as stated in Note XVII, a powerfully excited tube gives Roentgen light over a large surface beside the radiant area on the target.

Diaphragms have always been made

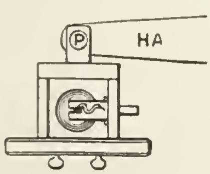


FIG. 36.

of metal, but this is objectionable, because a conductor placed between the terminals of a tube reduces the length of the air-column and consequently the available spark length, besides increasing the danger of puncturing the tube. To overcome these difficulties I use glass half an inch thick. The arrangement is shown in Fig. 34. It is a wood box to hold the tube, and a frame for the glass plate G P, which is one foot square with a three-inch hole in the center. Covering the hole is another circular glass plate D P, with a smaller hole in the center The latter plate can be removed and one with a different size hole substituted. The plates are held in contact by the screws S S on the ends of the two arms A A. As stated in my first article on this subject, this is simply the principle of Zentmayer's microscope stage applied to another purpose. It enables the experimenter to easily bring the opening in the diaphragm in proper relation to the radiant area on the target. The use of glass instead of metal occurred to me from seeing Dr. Williams' glass screen, which he keeps between the tube and his legs when examining patients. Figs.

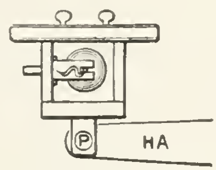


FIG. 37.

34 and 35 show the tube-holder in position for examining a patient in a vertical position, Figs. 36 and 37 its positions above or below the patient when he is lying down. The whole holder has a vertical range of six feet by means of the arm H A partly shown.

NOTE XXXVII—COOLING THE TARGET WITH METAL VANES.

Instead of using water to cool the target when we use moderate amperage, it is sufficient to put a copper stem into the hollow platinum target and expand the end into four vanes, as shown in perspective and section in Fig. 37.—*Electrical Review*, N. Y.

X-RAYS.—The Duke of Newcastle is presenting a complete and valuable x-ray outfit to the North-Eastern Hospital for Children at Hackney.—*The Electrical Review*, London.

*International Dental Journal, August, 1895.

LONDON ITEMS.

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ROENTGEN RAY PRINTING.

M. Georges Izambard, of Paris, who describes himself as a literary man, has devised the following system of utilizing the x-rays as the foundation of a method for superceding typographic printing. We give M. Izambard's description in full, and as nearly as possible in his own words.

THE X BLOCK PRINTING BY MEANS OF THE X-RAYS.

I. PURPOSE OF THE INVENTION.

It is a new process for the simultaneous and instantaneous printing on both sides by means of the x-rays, of numerous sheets (of sensitized paper) superposed in quires or blocks (newspapers, trade papers, &c., whatever their size may be). It purposes to obtain new results analogous to those obtained as yet through typographic printing and other processes derived therefrom. It tends to suppress: firstly, composition; secondly, striking off by the printing machine·

1. It can suppress composition, it allows mere handwriting or any kind of writing machine to supply the place of the long, complicated, and tiresome work of associating and disassociating printing types (composition and distribution). This will cause an economy of time and workmanship, inasmuch as a small number of workmen will be able to do more work in a few minutes than a large number in several hours.

2. It can suppress striking off by the printing machine. The operation of striking off, in spite of the progress realized and the marvelous improvements press machinery has received, remains, nevertheless, very slow work, the sheets having to be printed one by one. Nobody had yet come across the idea that a means might exist of printing them all at the same time. This means it is that starting from the known property of the x-rays I have endeavored to find. I cause these rays to act at one time on a block of sensitized paper, or even on several blocks placed circularly around the radiant center, thence a new saving of time which the plainness of the working stock employed easily accounts for.

II. WHAT MEANS DOES THE PROCESS EMPLOY? THE RAY-PROOF INK, THE RAY-PROOF DUST, THE TYPE SCREEN.

The means, thanks to which the x-rays may be employed, I consider as the very substance of my invention; it consists in a ray-proof substance, be it an ink or a powder, with which characters are to be traced upon a screen. This screen I call "the type screen." It consists of a sheet of paper, pasteboard, thin wood, leather, or tissue drawn over a framework. We place the screen between the radiant center and the block of sheets we wish to act upon at one time. The characters alone, stopping the x-rays on their way, will prevent their acting on the sensitive emulsion spread over every sheet of the block, whereas the remainder of the screen being of paper or wood will let the rays through easily as a plate of glass would any ordinary light. The type screen here plays about the part of what is called in photography a "phototype." In fact, the type screen will let the x-rays through just as the plate or film of a phototype exposed in a framework will admit the white light or the daylight.

III. THE VARIOUS OPERATIONS.—ALL THE SHEETS FORMING A BLOCK IMPRESSED AT THE SAME TIME.—THE RAY-PROOF INK, THE TYPE SCREEN.—PRINTING AND HANDWRITING REPRODUCED.

We take some photographic paper which an emulsion has sufficiently sensitized (a gelatine-bromide emulsion, for instance). This paper must be cut out into sheets of an equal size, which we will then superpose (the gelatinized side turned upward) in order to form a more or less voluminous quire. This block having to be exposed to the x-rays must be wrapped in black paper, in order that the daylight may not affect it. Before operating, we place above the block, as we would a screen, a sheet of paper, cardboard, or wood, bearing characters of a metallic substance. We can strike out of a sheet of metal the full or hollow characters we want and stick them on the screen in the desired order ; but this would mean much time and patience. It will be better, in order to simplify our task, to compose a page of typography by means of ordinary printing types. We must ink this page and draw a proof of it on the paper or tissue of the type screen. Only, instead of smearing the inking roller with ordinary printing ink (of which the Roentgen rays would leave but insignificant traces on the sensitized paper), we must have recourse to a special sort of ink, much less pervious than this to x-rays, and which must therefore be composed in greater part of metallic or calcareous ingredients. Thus, just as during the exposure the white rays are intercepted by the shades of the phototype, so will the x-rays be during the radiographic process by the ray-proof ink (I shall not speak here of the composition of this ink, considering that I give later on all necessary information regarding it as well as the various manners of preparing it—as the possibility of substituting a likewise metallic or calcareous powder). We are equally free to fill up the page with handwriting, to use the pen or the brush in order to reproduce autographs, drawings, music, &c. We only have to dip our pen or pencil into the specially prepared ink, and, as before, the type screen, thus covered with ray-proof characters or lines, will give us after a few minutes', or even a few seconds', exposure to the x-rays, as many proofs as there are sheets in the exposed block. The number of proofs thus obtained (which must next be "developed" and "fixed" will be in proportion to the time of exposure, to the thickness of the layer of ink, as well as to the radiographic "opacity" of this ink, to the thickness of the sensitized paper, to the degree of sensitiveness of the emulsion, and, above all, to the combined strength of our elements and induction coil and tubes, especially to the length of the spark given by the Ruhmkorff coil.

Optional Use of a Writing Machine.—But why should we take the trouble to compose when any writing machine will do our work with an incomparably greater speed? We need only smear the machine's inking apparatus, be it a tympan or a roller, with ray-proof ink, to be able to draw in a few seconds an unlimited number of copies of the text which will have been directly printed upon the type screen. The idea we have had of using, instead of metal characters, a ray-proof ink, has alone rendered possible, and even easy, the assistance of a writing machine which until now would have been considered totally impracticable, because no other means of striking off was contemplated but the press, with which, indeed the use of a writing machine is incompatible.

The Sheets Impressed on Both Sides.—Until now we have only thought of impressing one side of the sheets contained in the block, the other not having been previously sensitized ; and this with good reason, for, had it been otherwise, all we should have printed on the obverse, would have more or less appeared on the reverse, but inverted, as a drawing on transparent paper would appear were we to look at it on the wrong side. This, however, can be avoided. the sheets remaining, nevertheless, liable to be impressed on both sides, and even simultaneously ; to obtain this result, the lines on the odd page, instead of coinciding with those of the even one, must, on the contrary, alternate with them, the paper having been, of course, sensitized on both sides, not on its entire surface, but by parallel stripes, alternating from one side to the other, the lines of the obverse (sensitized) coinciding exactly with the space lines of the reverse (unsensitized underlines), and, *vice versa.* In consequence, we must adopt a constant space between the lines. This space may be as wide as the total height of the type, or wider, but in no case narrower, or the tops and the feet of the letters would get entangled, thus producing a sort of "fulling."

To prepare the type screen in order to print the sheets on both sides, we write page 2 directly on the back and between the lines of page 1, or else we write page 2 on a separate sheet, which we stick on the back of the other, being careful, however, not to let the lines coincide. Likewise, placing this double screen in front of the block we wish to impress, and which is still protected by its wrapper, we shall have to take all necessary measures in order that the lines on the screen should coincide exactly with the sensitized parts which are to be impressed.

Final Operations: Automatic Developing, Fixing and Rinsing.—I need not describe here the operations, which consist in developing and fixing; these will take place in the usual manner, with use of the best adapted chemicals, doses, and methods. We must grant, however, that the time and care required to develop, fix, and rinse, as these operations are practiced in photography in order to obtain fine proofs, may seem a hindrance in the present case. We must simplify the work, for the reproduction of a photographic page may be carried through with care and taste without requiring, nevertheless, the refinement that a work of art, landscape, or portrait, would. I will therefore point out, should speed be sought for, above all, the simplifying means that can be adopted in developing and fixing.

In a room lighted with a red light some large square vats will be prepared to receive the impressed blocks as soon as they have been rid of their protection wrappers. The bottom of these vats must be provided with taps to let the water run out, while a movable double bottom consisting of a metallic trellis will render the drainage easier. The developing and fixing liquids will, at the right moment and in the needed quantity, flow into these vats through a system of pipes laid on the sides, so as to supply a rotary current. Other pipes will, in the same way, bring us the water required as well for the intermediate as for the final rinsings. After the suitable immersion, and the water having run out, the blocks may be allowed to remain in the vats, where they will drain through the metallic trellis; or else they may be conveyed into a room heated to the purpose, or even exposed to draughts of hot air. Their drying may also be hastened by the immediate neighborhood of quantities of chloride of lime, which is known to absorb dampness very rapidly. We may let the gelatino-bromidized paper drying on over or in front of a clear fire, provided it has been steeped before the rinsing in a solution of ordinary formol at three per cent; the gelatine becomes thus insoluble.

No doubt that in some cases the very weight of the block may prevent the developing and fixing liquids from penetrating entirely between the superposed sheets. This inconvenience will be avoided if the sheets in the blocks are separated one from another by sheets of blotting-paper. The draught printing off by means of the x-rays, as the subsequent bathing will not take us longer for this, as the block can be prepared beforehand in the manner we mention. In this case, however, they will, of course, contain half as much sensitized paper as before, their thickness remaining the same, and the number of drawn proofs will, in consequenee, be smaller by half.

Printing in Black on a White Ground.—The actually manufactured (gelatino-bromide) papers and other similar ones used to reproduce phototypes give, as is usually said, a positive from a negative, and *vice versa*, which means that the portion of their surface reached by the light blacken. If we make use of this sort of paper, our sheets will be printed in white characters on a black ground. Should we wish to obtain the opposite result, black characters on white ground, we must add to the developer some product known to "upset" the image. Such products are mentioned in all the most recent photographic treatises. We might reach the same end by furnishing the writing machine with hollow characters (*caracteres en creux*) instead of full ones (*caracteres en relief*). It would then be the little square surface surrounding the letter that the ray-proof ink would cover and transfer upon the screen, the result being a black impression on a white ground, obtained on both sides of the paper as easily as on only one alone.

It is to be remarked that (to produce a negative on a type screen, and consequently a positive on the sheets composing the block (we can take advantage of the well-known properties of bichromated compounds (gum, gelatine, or albumen), and obtain thus, with the help of photo-collography and without loss of time, the photo-typographic *cliche* we require, for, the radiographic ink we use being like printing ink, a fatty substance, will adhere as the former would to the bichromated parts of the sheet which will have been previously exposed to the sun. (See here below.)

The "Radiographic" or "x-ray-proof" Ink.—The composition of this ink will vary according to the use we wish to make of it, but in all cases it may be composed in greater part of a very divided or calcareous powder, in order that it may form with the other ingredients a close mixture. To produce this powder we can use bronze or copper, white zinc, or white lead. For handwriting white lead in a solution of gum will be very suitable. The powder may be mixed preferably with boiled linseed oil for the writing machine or ordinary typography. White lead well ground down, as it is manufactured for painting purposes, will be found preferable. The various compounds may also contain some alkaline bromide, like bromide of potassium, which opposes a pretty strong barrier to the x-rays. I form there a weighty claim regarding the appropriation of this ink to constitute what I call the type screen. There are two kinds of radiographic ink; one is fatty, the other non-fatty. Besides, we may add, with either in several cases, a bichromatic mucilage. But we need not do it always; not even with employ of the photo-collography, as in the following instance:

Let us prepare, instead of ordinary ink, a bichromatic mucilage (that has not been previously exposed to the action of light wherewith we write by means of a pen, or wherewith we print by means of a type-writing machine. We roll thereupon and ink-roller that is coated with fatty radiographic ink; therefore the letters, having not taken the fatty radiographic coat (by virtue of their preventive mucilage), remain alone permeable to the x-rays, whilst all the page is elsewhere impermeable. Here is the requisite negative type screen for the printing in black on a white ground.

Another Way of Proceeding; the Impervious Powder Employed Separately.—One need not necessarily use a ready-prepared ink or paste; but wet the pen, the brush, the tympan, or pad, or ball, or roller, or ribon of a type-writing machine with any unmetalized substance, provided it be sufficiently gummy or sticky and do not dry too quickly, say, as a solution of gum, a varnish, or ordinary printing ink. We then print the type screen, over which we next sprinkle the pulverized metal as we might to powder ordinary ink in order it should dry quicker. The powder, adhering, of course, only to the inked surfaces, these become at once quite opaque. Should a little powder remain on the uninked surfaces, we remove it with bellows or by any other means of ventilation.

Printing on Large-sized Sheets.— If it is possible to impress simultaneously several blocks by means of a single tube, in some cases, on the contrary, we shall want several tubes to impress one block, and that will be when the size of our paper will be very large, offering a very extensive surface. Indeed the x-ray emanating from a central point, and, as is well known, spreading in a straight line only, without reflection or refraction, would strike perpendicularly the nearest parts, *viz.*, the center of the sheet, and obliquely its furthest extremities. The perpendicular rays would impress the paper as desired, while the oblique ones, working their way in a straight line, would remove the reproduced image more and more from the center as they penetrated further in the block, the last sheets of which would be covered with distorted lines and fringed letters, having perhaps so far lost their shape as to be unreadable. In short, these distortions would recall the spherical aberrations produced in optics by certain defective lenses. This defect might, in a certain measure, be remedied by curving the block provided with its type screen so far as to place all the points of its median line at an equal length of radius, in order that it should form a portion of a circumference, having the radiographic tube as its center. This, however, only shifting the difficulty, for theoretically we should have to give the block not a semicircular, but a hemispherical curvature. Fortunately, we can do better. If we have, for instance, a large sized newspaper to print, we can set several induction tubes to do the work simultaneously, increasing, of course, at the same time their respective batteries. We must be careful, however, to separate the tubes from each other by sufficiently thick metallic partitions, in order that the rays, issuing from different sources, should not by crossing each other impede their respective effects.

Correcting the Proofs—The proofs obtained with the type-writing machine will be almost faultless, provided we be sufficiently attentive. This is not the case with manual composition, where mistakes are often made in distributing, letters often placed upside down in the composing stick, &c. Nothing takes more time and is more wearisome than the overrunning required to correct typographical proofs, not to speak of the delays that may be consequent on a slip of a letter-packet, of a column or an entire page "falling into pi" at the last moment. With the new process nothing of the kind is to be feared. We scratch out on the screen the defective words and use the writing machine to write them over again, an operation which will leave no trace upon the proofs. Is an intercalation necessary? We use a second sheet of paper, upon which we write the lines and paragraphs required to complete the text, even as the additional readings proceeding from the authors. The passages which are to be suppressed or lengthened having been previously cut out of the text with a pair of scissors, we take advantage of the making up and stick the corrected passages in the spaces left vacant for them. This will not require, as might be thought, a minute cutting out; for, provided the additions be adjusted to the text of the proof, a little more paper necessary for them to coincide exactly with the empty spaces may jut out without inconvenience, whereas all paper untouched by the ray-proof ink, remains absolutely permeable to the x-rays.

Making-up and Paging.—The properly called making-up is easy enough ; it consists in sticking in a given order and dividing into columns and pages the proofs drawn with the machine according to the "measure" adopted ; next, when superposing the twin pages which form the double screen, in alternating the obverse and reverse lines, as I explained before.

A Curious Cryptographical Appliance.—Governments and their agents might employ our process to print, under sealed envelopes, State papers, diplomatic documents, confidential circulars, in fact all so-called "secret" documents, which could not until this day be kept strictly secret, considering they had to be composed and struck by third persons. This is how to operate: The high functionary in his office need only use our ray-proof ink to write out with an appropriate writing machine his original text. He next encloses it (unfolded, of course) in a large-sized envelope or bag bearing his seal on one of its corners. It is then sent with his orders to the establishment appointed for official publications. There are kept already sensitized blocks of a known size and capacity, wrapped and sealed in an untearable wrapper. Before these we need only now place the envelope, sealed as it has remained, and expose the whole to the action of the x-rays, in order to obtain the desired number of copies. The operation being thus centralized, all scattering avoided, and no third persons interfering, takes place rapidly enough to be superintended, from beginning to end, by the manager of the establishment, who is aware of his responsibility. Immediately afterwards, the envelope and their blocks, their seals yet unbroken, are returned to him who gave the order, and who may either do himself the developing and fixing automatic work, or let it be done before him in a dark room attached to his office ; or, better still, enclose each paper in a thick envelope and leave the care of developing to the person to whom the circular communication is sent, what will certainly cost to them a less time than to read a cipher.

Recapitulation,—Any sort of writing machine the inking roller of which is provided with a ray-proof ink, may serve to write on a single sheet ray-proof letters. This single sheet is placed as a screen between the x-rays and a block of sensitized paper. Thereof results a simultaneous and instantaneous print-impression on numerous sheets ; there remains to develop and to fix. Such is, in substance, my "block-printing process."

This elementary combination suffers different readings, viz. :—

I. If we use an ordinary writing machine, the characters of which are in *relievo*, a white text appears on a black ground, as would a negative proof ; but. if we furnish the writing machine with characters in hollow, viz., if we reserve on the tip of the keys a little metallic cube, wherein the letters are scooped, indeed the type screen is figured by a continued series of lines, and the lines by a series of little opaque squares ; each square in its middle contains a clear letter permeable to the x-rays. It is really a negative, the final result, after the radiographic operation, will be positive pages, viz., a black text on a white ground.

II. If we use, to prepare the type screen, an unmetalized ordinary ink, provided it be sufficiently gluish, it will suffice to sprinkle pulverized metal over the screen sheet. The inked places will become thereby quite impervious to the x-rays.

III. If we use, to write on the type screen, the bichromatized mucilage not being previously insolated; and thereupon set in motion an inking roller coated with "fatty" radiographic ink, this fatty coating will adhere to the unwritten surface of the page, which becomes opaque, while the letters, not receiving this ink, remain permeable to the x-rays. The text, as before, appears black on a white ground.

III. *bis.* Here, again, the metalline powder can be separately sprinkled on the screen, and adhere to the unwritten surface, the letters excepted, which will remain permeable and appear black.

IV. If we use for the blocks a paper partially sensitized on both sides, viz., by parallel allotments, alternated in order that the sensitized lines of the right page coincide exactly with the non-sensitized interlines of the back page, our blocks are thereby enabled to be impressed on both sides.

V. We are at liberty not to use one radiant center alone, but may place suitably several induction tubes in front of the same block, separáting the tubes from each other by metallic partitions. We shall thus print large-sized blocks, and avoid spherical aberration.

VI. We may, by virtue of our method, put in execution such-and-such an appendant operation as, for example, the copying of sealed documents on sealed blocks. There is the method with its different readings. Hereafter are the results.

The method gives us in general :—

Not merely, as with current radiography, some negative phototypes on glass, or film, requiring a subsequent drawing or insolating, ... but even immediate positives on paper, without subsequent drawing or insolating, these copies being similar to those obtained by the printer's work, and as readable, as numerous, but rid of typographic composition and press machinery; and therefore more rapidly produced.

The method gives us in particular :—

Not merely, as with current radiography, (*a*) drawn silhouettes of opaque bodies or autographical writings (*b*) in white strokes on a black ground (*c*) on one side alone (*d*) on small-sized sheets, ... but also (*a*) characters printed with the writing machine (*b*) in black on a white ground (*c*) on both sides (*d*) on large sixed sheets, as used for newspapers, and so forth.

The method is therefore a combination of various means, some of which are already known, others either entirely new or renewed by partial improvements, but aim all, however, at an entirely new result, "the simultaneous and instantaneous printing of numerous sheets."

RAYS AND VEGETABLE LIFE.—A good deal has been written upon the Roentgen rays, perhaps *ad nauseum*, but experiments on their action upon vegetable life have, up to the present, produced no satisfactory result. Signor G. Tolomei, writing to the *Atti Dei Lincei*, is led to the conclusion that their action is identical with that of light. On exposing branches of *Elodea canadiensis*, immersed in water charged with carbon anhydride, to the action of the rays, evolution of bubbles took place, as in the presence of sunshine, electric or magnesium light. The same similarity was observed in the effects on the lower vegetable forms, both Roentgen rays and light causing retardation in the absorption of oxygen by *Mycoderma aceti*. Again, in their action on *Bacillus anthracis* the Roentgen rays behave in the same way as sunshine, but in a minor degree. When a photographic gelatine film was exposed for twenty-four hours to the radiations from a Crookes' tube with the interposition of a zinc screen having an X-shaped aperture, the letter appeared transparent on an opaque background. That the action was due to the destruction of the germs, and not to the generation of any toxic quality in the agar, was proved thus: When a sterilised film was partially exposed to the rays, and subsequently brought into contact with a stratum of dried spores, the spores began to germinate all over the film, but when the stratum of spores was exposed to the rays, the screen with the letter X being interposed, and the photographic film subsequently brought into contact with them, only those spores which had been protected from the Roentgen rays developed, and the letter X was distinctly seen. Signor Tolomei attributes the previous failure to obtain such effects to the short duration of the exposures.

X-rays. [41319.]—A few days ago I wished to see if the x-rays would pass through an ordinary glow electric lamp. I was working with a 6 in. coil and 12 volts; the tube was a "Penetrator," made by Watson. It was inclosed in a wooden box, the cover being made of thin wood. The current was taken from the coil to the tube by ordinary covered telephone wire. The wires passed through thick glass tubes about 6 in. long; these were inclosed in second glass tubes, kept steady by india rubber.

Directly I placed the glow-lamp on the box, it became luminous. I found if the lamp was placed on its side, and the brass collar or the glass itself touched with a finger, it glowed brightly, or *vice versa*, if the brass collar was placed on the box, and the glass touched, the same light appeared, similar somewhat to the light produced in an exhausted flask by frictional electricity. I next put a piece of thick plate-glass on the box, and stood the lamp on it. Still the light appeared. I then placed a piece of sheet-lead on the box, and stood the lamp on it. This plan increased the light. Sometimes a small spark could be seen passing between the lead and the lamp. If the lead was touched with the finger while the lamp was on it. the light immediately ceased.

The lamp was held against various parts of the box—not only touching it, but some inches off, and also on the table fully 3 ft. away from the tube and coil. The same glow appeared brighter, or less bright acccording to the distance from the box. The light differed in brightness when the lamp was placed in various positions. There were especially two bright spots; but, strange to say, there was a diagonal line across the top of the box, along which the lamp remained almost completely dark, and in one place absolutely no rays were given off at all, and the lamp remained dark.

I then tried about a dozen other glow-lamps. Most gave no trace of light, a few glowed slightly. Decidedly the best were a 25-volt obscured lamp, a 10-volt lamp, two Maxim 50-volt lamps.

I then used three x-ray tubes instead of the glow-lamp. Two of them gave occasional flashes of light, but quite different to the light given by the lamp. The one that produced a slight glow similar to that given by the glow-lamp was a tube made in the very earliest days of x-ray work. I think it was an ordinary Crooke's tube. It is known among my friends as the "fat pig" tube, from its shape.

These experiments prove—First, that the tube inside the box is giving off rays in all directions which travel directly through wood, glass, lead, and other substances, or else cause these substances to give them off, but that to a great extent they are arrested by the wood itself, as is shown by the lamp glowing better when it touches the wood.

Secondly, that in all probability the glow only takes place if the degree of rarefaction is suitable.

So far, I do not think this glow is caused by the x-rays, for the lamp glowed behind the anode, where, according to the screen, no rays are given off, but I believe it is not unlikely that a suitable vacuum may be produced, the air of which will be caused to glow only by the x-rays.

I next took the tube away from the inside of the box, and simply let the coil spark across the gap, but no rays were given off. I then separated the wires beyond sparking distance, but still no light. Afterwards I replaced the tube, and stood the box on a thick glass plate, to insulate it. This made no difference. Next I stood on a glass stool, so as to insulate myself, and then touched the glow-lamp. I found the insulation made no difference. I then tried the coil alone, and placed the terminals beyond sparking distance. I found that the lamp, when placed a few inches from the coil, glowed to a certain extent, but not brightly, and no rays were given off by the table and surrounding objects. I also found that, just as with the box, there were certain positions in which the lamp remained absolutely dark. I tried two other tubes instead of the Penetrator (both of earlier type). In one case there was no trace of light ; in the other a very faint glimmer.

The above experiments seem to me to prove that there is a vast amount of electric energy going on all around a highly exhausted tube, and this electricity may be the cause of the sensation often felt by persons being x-rayed, if they are not caused by the x-rays themselves, and may account for the bad effects *said* to be caused by continued exposure to x-rays.

Since writing the foregoing I have placed ordinary vacuum tubes on the box, and find that they glow quite brightly. Two containing respectively hydrogen and argon show easily the distinguishing colors of these gases.

A. E. Murray.

From *The English Mechanic*, of 29th July, 1898.

M. Becquerel's Dark Light.—We have on many occasions brought before our readers accounts of M. Becquerel's investigations into the radiations of what he terms dark light, which possesses properties very similar to the Roentgen rays, capable of the penetration of thick pieces of wood and other opaque bodies. He found, it will be remembered, that these radiations were inherent to the metal uranium and its salts in a very remarkable extent, and further investigations in the same field by M. and Madame Curie have led to the remarkable result of the probable discovery of a new element. These investigators had already discovered that certain minerals contain uranium and thorium (pitchblende, &c.) emitted the Becquerel rays to a marked extent. A large number of experiments were made in the endeavor to separate the particular constituent of the minerals alluded to that were active in the emission of the rays, and eventually a body was extracted which was more active than uranium to the remarkable extent of 400 times. The experimenters searched among all known elements for one that had an action at all comparable with this, but had no success, and they therefore state their belief that they have discovered a new element, and they propose to term it polonium (from the birthplace of one of them). The only objection to this theoretical body is that the active substance extracted does not give any spectral line except such as are due to impurities.—*British Journal of Photography.*

The Librarian of the Roentgen Society, London, England, will be glad to receive and acknowledge from authors and others gifts of books, pamphlets, &c. Contributions should be forwarded to the Society Library. Address:

Dr. Barbour,
Nevern Road, Earls Court,
London, Eng.

ROENTGEN LIGHT NOTES. Rollins. *Elec. Rev.*, August 17.—In this continuation of his long serial he shows the fallacy of using the equivalent air spark as a measure of the degree of vacuum in a Roentgen tube; other data should accompany this statement; for instance, the striking distance will be different whether a static machine or induction coil is used, also with different types of induction coils; at the exhaustion required the resistance of the tube as measured by the equivalent spark in air is inversely proportional to the voltage; the lower the voltage the higher the vacuum must be to produce an equal radiation. He shows that covering the target with aluminum gives no better results than platinum. The diaphragm for sharpening the shadows cast he now makes of glass half an inch thick instead of metal, as usual. Instead of using the water to cool the target it is sufficient for moderate currents to use a copper stem attached to the target to carry off the heat.

ROENTGEN RAY.—Drs. Boas and Dorn report that they found that if an ordinary gelatine capsule filled with metallic bismuth is swallowed, its course through the alimentary canal may be outlined by the Roentgen ray. In cases of obstruction of the pylorus, or some portions of the intestines, this capsule is found arrested at the certain locality for days. They have made this observation by testing this procedure on fourteen patients with gastric affections, and recommend it as an excellent means of diagnosis.

THE advantages of a routine use of the x-ray as a necessary part of an office equipment, should appeal to every surgeon. So numerous are the occasions for the use of the apparatus that today we would feel at a loss without it. No surgeon can dispense with this diagnostic aid, and the same necessity in the near future will appeal to the physician. —Dr. A. V. L. Brokaw, in the "Annals of Gynecology and Pediatry."

Transparency of Various Substances For Roentgen Rays.

Battelli and Garbasso have compiled the following table for the relative transparency of equal thicknesses of various substances, taking that of water as unity. Isenthal and Ward have added in their Practical Radiography, for better comparison the specific qualities:

Material	Specific Gravity.	Trans-parency.
Pine Wood	0 56	2 21
Walnut	0 66	1.50
Paraffin	0 874	1 12
Rubber	0 93	1 10
Wax	0.97	1.10
Stearine	0 97	0.94
Cardboard	....	0.80
Ebonite	1 14	0.80
Woodcloth	....	0.76
Celluloid	....	0.76
Whalebone	....	0.74
Silk	....	0 74
Cotton	....	0.70
Charcoal	....	0.63
Starch	....	0.63
Sugar	1 61	0.60
Bones	1.9	0.56
Magnesium	1 74	0.50
Coke	....	0.48
Glue	....	0.48
Sulphur	1.98	0.47
Lead ointment	....	0.40
Aluminum	2·67	0.38
Talcum	2 6	0.35
Glass	2.6	0.34
Chalk	2.7	0.33
Antimony	6.7	0.126
Tin	7 28	0.118
Zinc	7 20	0.116
Iron	7 87	0.101
Nickel	8.67	0.095
Brass	8.70	0.093
Cadmium	8.69	0.090
Copper	8.96	0.084
Bismuth	9 82	0.075
Silver	10.5	0.070
Lead	11.38	0.055
Palladium	11 3	0.053
Mercury	13.59	0.044
Gold	19 36	0.030
Platinum	22 07	0.020
Ether	0.713	1.37
Petroleum	0.836	1 28
Alcohol	0 793	1 22
Amylalcohol	....	1.20
Olive oil	0.915	1 12
Benzol	0.868	1.
Water	1.	1.
Hydrochloric acid	1.240	0 86
Glycerine	1 260	0 76
Bisulphate of Carbon	1.293	0.74
Nitric Acid	1 420	0.70
Chloroform	1.525	0.60
Sulphuric Acid	1 841	0.5c

TABLE SHOWING VIBRATION RATES OF PERIODIC PHENOMENA.

Reprint from a table by T. H. MURAS in Electrical Review, April 25, 1896, and extended to the Roentgen Ray Octave

Complete Vibrations per Second.	Octaves.	Observations.
288,224,000,000,000,000....	58	Roentgen Rays. (Volle's Rays.)
144,112,000,000,000,000....	57	......
2,251,799,813,685,248....	51	Ultra violet photographic limit, in vac. 3×10^{15} per sec (Schumann)
1,125,899,906,842,625....	50	Photographic limit of solar spectrum, 1.053×10^{15} per sec (Coruu)
562,949,953,421,312....	49	Green light near thillium line
281,474,976,710,656....	48	Infra red, photographic limit. (Abney).
70,368,744,177,664....	46	Heat rays of solar spectrum, lowest direct measurement (Langley)
17,592,186,044,416....	44	Heat rays from substances below 100 deg C. (Langley)
...	..	Eleven octaves unobserved.
8,589,934,592....	33	Electric oscillation in small spheres. (Righi.)
67,108,864....	26	Electric oscillation in Hertz Resonator, 70 cm. diameter
8,388,608....	23	Electric oscillations for flying bullets—photographs. (Boys.)
262,133....	18	Electric oscillations in Lyden Battery (Fedderson)
32,768....	15	Audible vibrations, extreme upper limit
16,384....	14	Electric alternator and turbine. (Ewing.)
8,192....	13	Electric oscillations in Leyden battery. (Fedderson)
4,096....	12	Music, highest note.
512....	9	Electric oscillations in Leyden jar. (Lodge)
32....	5	Music, lowest note
16....	4	Water surface waves of minimum velocity
....	1	......
....	0	......
Seconds per complete vibration...............	..	......
2....	1	Second-beating pendulum
32....	5	Air pulsations in wind. (Langley)
65,536....	16	Mean solar day, 86,400 seconds.

THE much debated question whether the rays are able to stimulate the retina, or the optic nerve, or certain optical brain centers, has been revived by the description of a case in which the patient who was absolutely unable to perceive even the strongest light could make out the color of the fluorecscence and the shape of the x-ray tube. Another report concerns a man who, 12 years ago suddenly lost his sight, and who, by continued treatment with the x-rays recovered part of his sight.—*Practical Radiography*, page 139.

These points were probably gleaned from THE AMERICAN X-RAY JOURNAL, Vol. 1. No. 5. Although investigation had been made along this line by the editor of this journal, yet the only full and comprehensive report of the study and discoveries of the practical use of the x-ray for the blind were made by Dr. Francisco de P. Astudillo, of Habana, Cuba, and printed in full for the first time in the November, 1897, issue of THE AMERICAN X-RAY JOURNAL.

LONGEST HEAT RAYS. Rubens and Aschkinass. *Wied. Ann.*, No. 6; abstracted in the Lond. *Elec.*, August 12. *Electrical World*, N. Y.—They entered a step further imto the region where the spectrum joins the Hertzian wave system and attained a wave length of 0.067 mm, which is 100 times the wave length of red light and 60 or 70 times smaller than the smallest electromagnetic waves yet produced—namely, 4 mm; The gap between these, therefore, remains to be bridged. The property of these long heat rays is more closely akin to those of electromagnetic waves than to waves of light.

THEORY OF THE ETHER. Larmor. *Proc. Roy. Soc.*, No. 398; abstracted briefly in the Lond. *Elec*, August 12. *Electrical World*, N. Y.—An article in the form of a supplement to his third memoir on the electrical theory of the ether, in which he deals with a priori difficulties encountered in the conception of orbital systems of electrons moving through a practically stagnant ether.

PRACTICAL X-RAY NOTES.

BY JOHN DENNIS.

When the practical electrician is called upon to tune a discordant x-ray apparatus, there are many conditions confronting him which are not present in a lame motor, or indeed, in any other electrical contrivance which needs mending.

In the first place, it must be kept in mind that a vacuum tube, in perfect condition, is useless if the coil or static machine upon which it depends is out of order, and that the most perfect generator of current will not produce satisfactory x-ray effects from a tube in which the vacuum is too high or too low, or which has been "sparked."

The first necessary step, logically, is to ascertain the condition of the coil or glass machine, as the case may be. To do this in the case of a Rhumkorff coil, the first essential is to connect it up with the spark rods pretty close to each other at first, and with the vacuum tube out of circuit. If, when the rods are separated, the spark obtained is below the normal capacity of the coil, you may be sure that you have trouble, regardless of the condition of the tube, and that, for immediate purposes, that freaky instruments may be left out of the equation. You must, then, first devote your attention to putting the coil in proper condition, and, in a broad way, this is true in the case of a static instrument.

In looking for trouble in a coil, the electrician will naturally examine first the source of power, and at once try all of the connections. In cases in which the 110 or 220-volt current is used, with resistance, you must look carefully to all of the connections of the rheostat and controller, and it is well right here to connect in a low reading voltmeter and ampere meter. If the current delivered to the vibrator is normal the next step is to examine the brake wheel or vibrator, as the case may be ; for if, in either case, these are bucking you will fail to interrupt your continuous current properly, and will, of course, obtain no action in the secondary. If all of these conditions are right and still you can not obtain a spark between the coils, there would be ground for a strong suspicion that the insulation of the coil had broken down. If, as before, the conditions described are normal and a spark much below the normal only is obtained, there will be a strong probability that something is wrong with the condenser. All recent coils for x-ray purposes have their condensers stepped in microfarads, and a persistent rearrangement of the plugs may remedy the difficulty, and it may not. In most of these recent coils, the condenser is more accessible than in the earlier machines, and they are easily reached by turning the case containing the coil on its side and removing the bottom screws. The condenser is easily removable, and taking it out will give an opportunity of examining as to the integrity of the connections inside the coil case. These connections are a bit complicated and can easily cause trouble. Care must be taken in removing and replacing the condenser, as its lips are necessarily tender. Of course the great cause of trouble in the condenser is puncture from overload. Whether you care to venture on the somewhat delicate work of dissecting the condenser of a high-grade coil and attempting its repair will depend upon your confidence in your skill as an electrician to replace that particular condenser by one of your own construction. The work is delicate, if not difficult, but there is no logical reason why you should not undertake it. At the same time, as I have intimated, I should not care to open up a condenser on a modern high-grade coil unless I felt qualified to construct one to replace it.

It is, of course, impossible to detect a puncture, or other defect, without actual examination. Without this examination the condition of the condenser would be left to a process of reasoning based upon eliminating every other possible cause of trouble in the coil and its connection as a whole.

Personally, basing my conclusions upon experience, I should prefer sending the coil back to the factory, unless I was very certain that the trouble was in the condenser, and that I could readily find it by examination and remedy it myself.

If all connections are found to be right and a normal condition exists at the brake wheel and vibrator, and I could not determine that the condenser had gone wrong, I should be forced to the conclusion that the insulation of the coil had been impaired.

Right here I might mention a curious experience of my own. I had been operating a coil for several months with excellent results when the tube went out one night in the midst of a critical observation. From the action of the tube I knew that the trouble was in the coil or its connections. After trying for a time to discover the fault, I gave it up. The next morning I gave the coil a severe jar with my hand, and for an hour or more I had normal effects in my tube. My experience of the night before was repeated and the same thing occurred several times. My conclusion was that the fine secondary wire had become broken and that jarring the coil caused a temporary connection to be established. I shall never know, other than theoretically, whether this view was correct. The coil was sent back to the factory, and on its way it plunged into the Hudson river in a railway wreck and remained there several days. The condition of the coil was such that it was sent to the scrap heap and practically a new coil was substituted. But I shall believe that my conclusion was correct until I am convinced otherwise.

I shall not consume space by attempting to go fully into the causes of the failure of insulation of a Rhumkorff coil under the conditions existing in x-ray work. Sometimes it is gradual, in which case the trouble is owing to the melting of the paraffine in which the coil proper is embedded. Sometimes it is weakened in this way by prolonging its operation with the spark points near together. Sometimes it goes out suddenly under der an overload on the line, and oftener it gives out under circumstances which can not be readily ascertained without spending much time necessary for the investigation. In any case it is idle to spend any time in repairing a coil in which the insulation is broken down. Send it back to the factory where it was made, and the owner will have an object lesson in the vexations of x-ray work when the bill is sent in. You should not, however, form your conclusions too hastily and send a coil back unnecessarily.

It is to enable my friends among the practical workers to avoid this unpleasant and expensive experience of sending coils away, with the vexatious wait involved, that the writer is giving his experience and suggestions.

I am thoroughly seized of the opinion that much money and time can be saved to the x-ray operator, and many shekles transferred to the pockets of practical electricians, if an intelligent effort is made by them to doctor the outfit, and only send it home for repair when this is impossible.

If you have succeeded in your efforts to establish a normal spark between the terminals of the coil: if the spark is not only of normal length, but of the proper body, you will be ready to announce that the trouble is not in the coil or its connections, but must be looked for in the vacuum tube and its accessories; for the cathode glow in the tube is produced by connecting the terminals of the tube in place of the air gap between the coil terminals.

It is, of course, essential that the delicate connections with the tube should be made carefully and properly and that the connections at the binding posts of the coil should be bright and good. Then results depend upon the conditions of the tube. Broadly speaking, these effects will depend upon the width to which the spark rods are separated, all other conditions of coil having been rectified, as I have tried to explain. When these have been properly established, the responsibility for x-ray effects remain with the tube ; and it is difficult to find a more cranky instrument than a modern x-ray vacuum tube, and these peculiarities can only be properly considered at length in a separate paper. There are certain facts, however, which may be properly mentioned here.

If the vacuum in an x-ray tube is either too high or too low, results will be unsatisfactory. If the terminals in the tube are too close to each other, or, on the other hand, are too widely separated, the x-rays emanating from the tube (in some way yet to be clearly ascertained) will be of little penetration. If, when connected up, a pink glow shows between the terminals in the tube, it is punctured and useless for any other purpose than an interesting and expensive exhibition of pyrotechnics. In either of these cases the usefulness of the tube is at an end.

A somewhat extensive experience with x-ray vacuum tubes of types selected as the best, all things considered, has taught me that it is not good economy to send a tube back for repairs. The better way is to learn the best method of prolonging the useful life of a tube and knowing when its end has come. I consider it more economical, all things considered, to strip the tube of its platinum and throw the glass in the ash barrel. The life of a repaired tube is of few days and full of trouble, and it will certainly break down just at the time when it is most needed.

As I have said repeatedly, I consider it desirable that electrical workers should be thoroughly posted in the manipulation of x-ray apparatus, and I shall therefore take up the subject of the handling of tubes after I have considered the nature and repair of the glass machine, which in its evolution has now become an important, powerful and expensive bit of apparatus, which is not only utilized for x-ray work, but for many new and varied therapeutic purposes.—*Electrical Worker*, Rochester, N. Y.

Dermatitis, &c., From X-rays.—Dr. N. A. Clive suggests that the power of electricity applied to the skin for driving remedies into the tissues (cataphoresis) has become one of the most useful means in neuralgias and other nervous disorders as well as for anasthesia in dentistry. But the x-rays does not destroy germ life as does electricity. It may be said to be entirely stripped of this power. But it does possess the power to penetrate all the tissues, rendering the hitherto darkened recesses of the human body as light as day. May it not carry with it the cataphoric effect to a certain extent, and drive into the skin the excretory products of that organ and other unclean things finding lodgment there, as well as disease germs themselves? Some experimentation along this line would not, at least, be amiss. We may not get the cataphoric effect to the extent of producing the taste of a remedy applied to the skin treated with the ray as with the direct current ; but we may possibly get it to a sufficient degree to produce a dermatitis when the things capable of producing the trouble find lodgment on the skin. The writer is sufficiently possessed of this idea to believe that with properly enforced surgical cleanliness of the member to be treated with the x-ray, we would never cause the troublesome dermatitis so often complained of in its employment. And that at some time in the future it will be considered unscientific to apply the ray through an unclean skin, to say nothing of the clothes, dressing, &c., that may envelop the member.—*Health*, London.

QUITE recently Dr. Hermann Rieder, of Munich, took up the experiments to prove or disprove the effect of x-rays upon bacteria, and arrived at the following results: Bacteria suspended in a jar, blood serum or gelatine, were destroyed after about an hour's continued exposure to Roentgen rays; cultures of cholera bacillus in bouillon require for their destruction a longer time (over two hours). Dr. Rieder believes that even if it should prove impossible to entirely destroy the bacteria in the human body, a partially destructive effect upon them by the Roentgen rays should greatly assist the organism in its natural protective struggle against the further development of the intruding microbes.—*Practical Radiography*, page 137.

Food and Teeth.

George W. Williams, D. D. S., of Richmond, Indiana, one of the leading dentists of that State and a popular writer on dental subjects, in a recent article says:—"Many of the prepared foods sold for children are destitute of the qualities necessary to form sound and painless bones and teeth, and there is a great difference in growing up with fine grained, well glazed teeth in comparison with having the brittle, chalky teeth we commonly see. Diet is of the first importance in promoting the upbuilding of the bony system, and incidentally we would state that as a food for this purpose there is nothing that will equal 'Imperial Granum.' It is a pure, unsweetened food, made from the most nutritious portions of the finest growths of wheat. No derogatory word has ever been uttered by the medical or dental professions against Imperial Granum and its bone-building qualities. Perhaps the most important period in childhood is when the first set of teeth are erupting. It has been calculated that one child in ten has its life destroyed in consequence of diseases which have their origin at this time. Thus it is evident that children should be watchfully cared for, and I believe that besides those who die from diseases readily traced to irritation during the eruption of the first teeth, a number are the victims of diseases superinduced by general neglect of the mouth and the consequent tooth decay and improper mastication of food."

Intestinal Antisepsis in Fevers.

Though the typhoid, malarial and yellow fever epidemics in Cuba have not yet reached this country, it is well to guard against them by taking precautionary measures. If it be true, that the *materies morbii* of these diseases belong to the bacillus group, the remedies manifestly are an antiseptic and an antipyretic. As an intestinal antiseptic we have nothing better than salol. The consensus of opinion is in this direction. When we add the antipyretic and anodyne effects of antikamnia, we have a happy blending of two valuable remedies, and these can not be given in a better or more convenient form than is offered in "Antikamnia and Salol Tablets," each tablet containing 2½ grains antikamnia and 2½ grains salol. The average adult dose is two tablets. Always crush tablets before administering, as it assures more rapid assimilation. It is not our desire to go into the study of bacteriology here; our aim is simply to call attention to the necessity of intestinal antisepsis in the treatment of this class of diseases. If in the treatment of these diseases, an intestinal antiseptic is indicated, would not the scientific treatment of the conditions preceding them be the administration of the same remedies? Fortifying the system against attacks is the best preventive of them.

THE TREATMENT OF DISEASE BY ELECTRIC CURRENTS.

A handbook of plain instructions for the general practitioner. By S. H. Monell, M. D., Brooklyn, N. Y. Published by William Beverly Harison, 3 and 5 West 18th Street, New York. 1088 pages.

Another extremely valuable work on electro-therapeutics has been launched by the same author as the recent publication, "Manual of Static Electricity in X-Ray and Therapeutic Uses," which has attracted world-wide reputation thus early for its clearness of description, and usefulness to the general practitioner.

It would be impossible for us to specialize the headings of the 70 chapters in this volume in the space allotted for this review, therefore it must suffice to state that every known modern employment for faradic, galvanic and static electricity and their therapeutic indications are detailed in this volume with conciseness of language and minute directness of application, so that the general practitioner may read and understand.

Probably no book on electro-therapeutics, and we say it conservatively, has ever equaled this volume for value to those of the profession who would use electricity as a therapeutic agent, and he who does not use it at this age is certainly not up to the times in his profession.

We therefore heartily recommend this volume to our readers, believing that they will not be disappointed in adding it to their libraries.—*Medical Times and Register*, Phila., Pa., January, 1898

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LOCALIZATION AND THE X-RAYS.

The application of the x-rays to medicine and surgery has encountered many checks in its progress to the important results at first prophesied. The responsibility for these reverses lies almost entirely with the surgeons who have overlooked the fact that they are dealing with a shadow which depends for its appearance and situation upon the three essential adjuncts of every shadow—the source of the light, the object and the plane on which it is projected.

In a large x-ray practice only a small percentage of the cases are those requiring the localization of foreign bodies, but when the occasion arises there should be available a method which will give a quick and accurate result. Many have taken two skiagraphs at right angles and after an examination of them, have entered the operating room with the idea that they knew exactly where the foreign body was situated only to hunt for a long time and perhaps find it finally at some distance from the place where they thought it should have been.

The disrepute into which the x-rays have been thrown by such experiences —altogether too common—might have been avoided if the operators had remembered to apply their geometry to interpret the shadow. While there have been many articles written on the subject of localization by means of the x-rays the author has not been able to find but very few which have been entirely correct from a geometrical standpoint and no one which while mathematically correct could be applied without expense with the apparatus at hand. To be efficiently equipped it is not necessary as some instrument makers would have you believe, to purchase apparatus as expensive as our generator, although perhaps such an instrument may economize time to a certain extent.

Thinking there might be some who would be interested to know what has been used with success, the following three methods have been briefly set forth. The first method requires no outlay for apparatus but is the least accurate of the three. With care, however, the error should not exceed the distance of a centimeter, which will be sufficiently accurate for many of the cases. The second and third methods make use of the same principle but with simple apparatus which increases the accuracy and ease of application.

FIRST METHOD.

The plate is placed on the table and the patient upon it in such a way that the region in which the bullet is thought to be is over the plate. The positions of two adjacent edges of the plate are marked on the surface of the skin. The relation of plate and body now fixed must not be disturbed until the exposure has been made. The tube is placed above the part in such a way that a perpendicular from it will fall on the plate nearer to one side.

The plate, patient and tube being placed in position the radiograph is taken. Before anything is disturbed a perpendicular is let fall from the centre of the tube to the surface of the patient, and the point there marked with indelible ink. The subject is then removed without disturbing either the plate or the tube and this perpendicular is continued to the wrapping of the negative and there marked with a pencil. This point is pricked through the film below with a pin, and the perpendicular distance from the focus of the tube to the plate is carefully measured. It is best to develop the plate at once so that if the suspected positions of the projectile is far from correct an error in placing the second plate may not be made.

After the development of the first plate and while fixing, a fresh negative is placed on the table and the patient upon it. By using the marks on the skin as guides the plate and patient may be made to occupy the same relative position that they occupied when the first exposure was made. The position of the tube relative to the plate and subject is changed, care being taken that it is not placed in the perpendicular plane which contains the projectile and the point occupied by the focus of the tube when the first exposure was taken. If, however, the focus should be placed in this plane the problem may still be solved by a slight modification of the method given.

The second skiagraph is taken, and the measurment and marks determined as before. After development as soon as the plates are dry, prints are taken from them. It has been found convenient to use a printing frame and paper larger than the negatives so that its edges which are to be used for orientation may be clearly defined on the prints. If one desires to get the results in the shortest possible time, the following method may be used which is more expeditious than drying with alcohol; a piece of "Velox" or of bromide paper is printed directly from the wet plate after having washed off the fixing solution. The paper is wet and smoothed down on the film surface, the glass back is wiped dry and the correct exposure made. In a few moments the print may be developed and made ready for use. The plate will not be injured in the least by the process.

Having obtained the two prints, they are placed with their reference edges together, the centre of the shadow of the projectile, and the point which indicates the foot of the tube, are pricked through both prints. The under print is then taken and a needle is thrust through the corresponding points shown on it. On the *back* of this second print will appear four pin holes occupying the same relative positions to each other that the shadows of the projectile and the projections of the foci of the two sources of the x-rays have on the plane of the photographic plate. Now these four pin holes are joined by two intersecting lines and the point of intersection will be perpendicularly below the place occupied by the projectile.

In Figure 1, S and S' represent the position of the shadows when the rays originate from the points F and F', and A and C are the points where the perpendiculars let fall from F and F' meet the plane of the photographic plate. P, the position of the projectile, will be seen to be directly over the intersection of the lines joining the points A S and C S'. The distance above this plane or

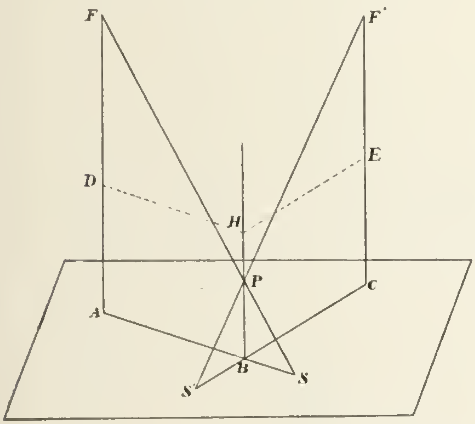

Fig. 1.

the length of the line P B may be readily obtained from the right angled triangles F' C S' and P B S' in which F' C has been measured and the lines S' B and S' C can be measured directly from the back the print, P B will be equal to F' C times S' B divided by S' C. It is best to obtain the value of P B also from the triangles F A S and P B S in order that an error in the work may be apparent at once by a difference in results which should be the same or nearly the same. It will require only a very few minutes with the print to obtain the position of the projectile with reference to these four points in the plane of the negatives. It now remains to apply this knowledge to the patient. The points where the perpendiculars met the patient have been marked with indelible ink and with these as centres and with radii equal to A B and C B, arcs are described. Their intersection will be on the perpendicular P B at H directly over the projectile. Knowing the thickness of the body at this point the distance down to the object sought may be found by subtraction. The point H may also be found by laying the print on the surface film down so that the points A and C will be over the points D and E, marked there when the skiagraphs were taken. Then H will be directly under the point B on the print.

The accuracy of this method depends upon the operator's ability to place the patient and the plate in the same relative position for the second exposure as that occupied during the first. Rotation of the affected part should be carefully looked for and avoided. It is very easy to overlook this and it may introduce a large error. If the focus of the tube is determined to be three centimeters from its correct position it will, provided the other factors are correct, place the bullet but a centimeter from its real position. So it is seen that this factor is not quite as important as the first mentioned. The point directly under the focus has been found by holding a bicycle ball against the glass as near perpendicularly below the desired place as could be determined by the eye, in two positions at right angles to each other and then dropping it. When it struck the plate several times in the same place this place was marked as the foot of the perpendicular required. The altitude was measured at the side of the tube.

This method has been used several times at the Lionel Laboratory of the Washington D. C. Emergency Hospital and has been found to give quite accurate results in every case.

SECOND METHOD.

In this method we undertake to correct the inaccuracies of the above by making use of some simple apparatus. The same principle is used as a foundation.

First in order to have the plates fixed more exactly with reference to the patient and to each other the following device is used: Two strips of wood are screwed to the table at a distance from each other equal to the length of the plate to be used. From the inner side of each strip two pieces of metal, having a small hole in them, project. These pieces of metal placed as near as possible to the negatives will cast their shadows on them and appearing on all the skiagraphs will serve as points for orientation. Resting on these strips is a thin board and the patient is placed on this. Thus without moving the patient the plates may be changed and yet their images be exactly oriented through the fixed points of reference.

Secondly, two adjustable wooden arms having at their extremities a piece of metal with a hole in the centre are placed upon the surface of the patient opposite the plate. These arms are fastened to a frame which is screwed to the table but which may be removed and replaced again without disturbing the adjustment of the arms.

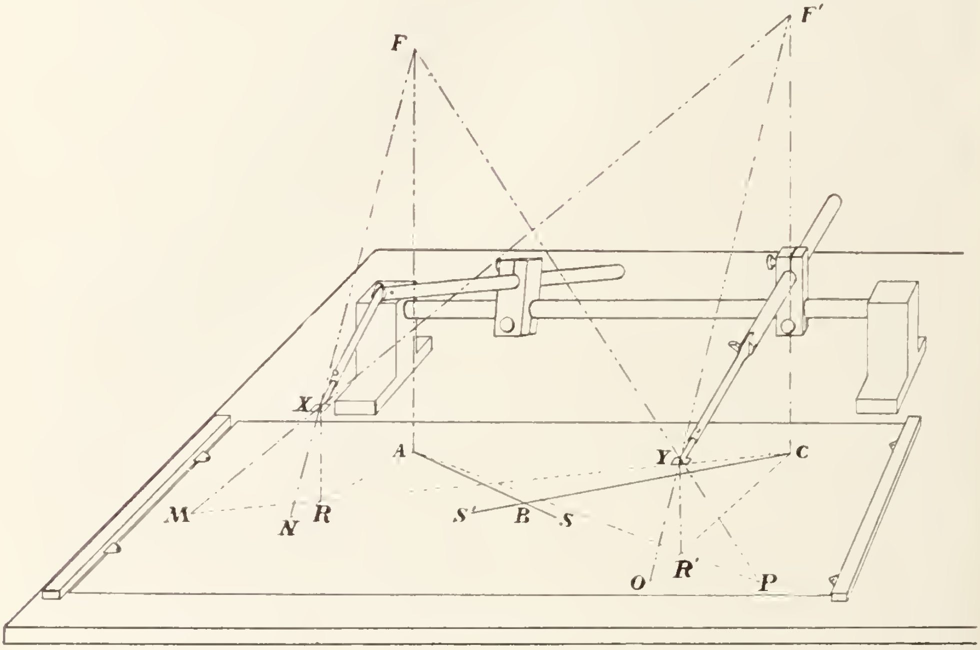

Fig. 2.

Now having the patient fixed immovable over the plate and under these reference arms, the tube is placed in position above and an exposure made. The tube is moved to a new position and with a fresh plate a second skiagraph is taken. The position of the holes in the discs at the ends of the reference arms are marked on the skin with indelible ink. Then the frame holding these arms is unscrewed from the table to allow the patient to be removed, after which it is replaced. A plumb line is let fall from the centre of each hole in the reference discs to the envelope of the last negative which has not been moved, and the points marked through the film with a needle. The exact altitude of these discs is also measured.

These measurements complete the necessary data and it remains simply to make the computations. The print from the last negative is taken first and from it the perpendicular distances to the focus of each tube and the point where these perpendicular lines meet the plane of the negative are to be found first.

Figure 2 represents the back of this print with the construction lines to be used, and the reference discs above it in the position they occupied when the skiagraph was taken. On the print we have the four points M, N, O, P, which represent the positions of the shadows of the two reference discs, M and O being cast by the tube when its focus is at F', and N and P when it is at F. Straight lines from M and O through the points R and R' will meet directly below F' and thus give a means of locating this point. The altitude of the focus may now be computed from the triangles F' C M and X R M, three of the elements, X R, M R and M C being now known. After finding the altitude of the second focus in the same manner the position of the projectile is found as in the first method.

In applying this method to the patient the points under the reference discs are used to measure from instead of the points D and E (Fig. 1) made use of before. It is true that geometrically two reference points alone cannot determine a third point, (P Fig. 1), in space, but that is not just what is done here. The plane, containing these two reference points X and Y, from which we measure the depth to the bullet is considered to be parallel to the table and to be a known factor in the problem. Occasionally it will coincide with the surface of the body at the point from which we wish to measure down to the bullet. In which case the problem is simple and may be very accurately applied. But if—as is most often the case—the points X and Y are at different distances above the table, this plane is not parallel and if the determination is to be applied to a limb or to a portion of the body which is much curved, the application will be subject to some error. This error will be one of depth, not of location in any other direction and it may be entirely eliminated by making use of M. Contremoulins' "operating compass" as explained in the following or third division of this paper.

THIRD METHOD.

The method of MM Remy and Contremoulins (Comptes Rendus Nov. 22, 1897,) has the great advantage over all other systems with which the author is acquainted, in that it may be taken to the operating room and a needle attached to a sterilized compass frame guides the surgeon's knife directly to the object sought. This arrangement may be easily used in connection with the second method given above by adding a third reference disc. This disc need not necessarily cast its shadow on the plate nor have its altitude determined. Its position should, however, be marked on the skin. The compass is adjusted for the operating room by placing its three feet in the centres of these reference discs and placing the needle so that it will lead along the most desirable path to the object sought. The position of the bullet in space is determined for this purpose by placing the diagram of the projections of the bullet and the reference discs in the place beneath these discs which the plate occupied when the first skiagraph was taken, and then measuring the computed distance from the projection of the object to the object itself.

It is necessary of course that these three discs should not be in the same straight line. But aside from this they may be placed where most convenient, preferably some distance from each other and over places where the bone is subcutaneous or as near so as can be found in the vicinity. This is desirable in order that the compass may be as firmly placed as possible.

The "operation compass" of M. Contremoulins is described in substance as follows:

This compass consists of a frame and four branches, three of which have double joints allowing adjustment in any direction. These act as feet to hold the frame of the compass in a fixed position. In our case they are adjusted to the three reference discs from above and thus may be placed upon the three points which have been marked upon the skin of the patient.

The fourth branch, which is movable in all directions, carries a guide through which slides a blunt needle. This branch is fixed in the proper position and the needle is made to slide until it touches the point in space which we have found that the bullet occupied during the exposures with reference to the references discs, and by means of a screw ring one fixes upon the needle the point at which it stops in the guide when its extremity is in contact with place the bullet occupied.

Now the "operating compass" being adjusted it only remains to transfer it to the patient and the surgeon guided by the needle may begin his work. In order to do this the needle is first removed, and the compass feet are placed on the register points already marked on the skin. The needle is placed in its guide, and by sliding indicates the direction in which the ball is to be found. The depth is indicated by the distance between the guide and the ring which was screwed upon the needle.

The branch holding the needle, being adjustable at will, may be so placed that the surest, safest and shortest way to the object sought may be selected. Whatever the path selected, the needle will always indicate the exact direction and depth, and during the operation the

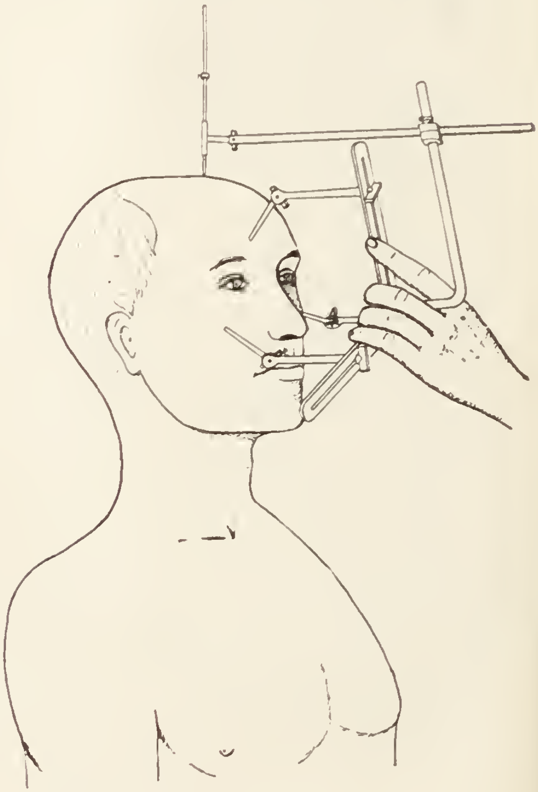

Fig. 3.

needle will constantly indicate through the distance of the ring from the slide the exact distance at which the operator is from the projectile. The compass held in position on the head is shown in Figure 3.

M. Contremoulins claims that his method when applied with his complete and expensive apparatus will find the centre of a projectile in the brain with an error not greater than a half a millimeter. If his "operation compass" is used in the manner just described with the same care an equal degree of accuracy ought to be obtained, although a half a millimeter is a very small error. This method has the further advantage of not requiring his expensive pieces of auxiliary apparatus.

Walter H. Merrill.

LUPUS TREATED BY X-RAYS.

BY J. RUDIS-JICINSKY, A. M., M. D.

We all read about the risk of setting up x-ray dermatitis, etc., and know, that the powerful x-ray has an influence upon tissue causing inflammation of the conjunctivae, lips and of the skin of the face. This has been recorded by more than one experimenter as the result of exposure to the Roentgen ray. This being the case we have in the x-ray the best means for producing irritation for an artificial inflammation and converting unhealthy ulceration into open and healthy granulation, proving that the x-ray may have in some cases an actual therapeutic value.

After a few tests in application of the x-ray in cases of lupus, in which most favorable results were obtained, the writer began to treat all such affections with x-ray. This was done upon the basis of actual personal experiments and encouragement given by the splendid results obtained by Kummel, Gochl, Schiff, Mracek, Albers and Schoenberg.

J. D. had for years a lupus erythematosus on the left leg, characterized by the appearance of pinkish patches covered with yellowish adherent scales. It began as a pin head, slightly elevated spot, later more spots were observed, forming regular patch, elevated, and distinctly outlined against the healthy skin, loss of tissue and subsequent cicatricial formation. Sometimes the lupus was quite amenable to treatment, but reappeared again near the old scars. I tried at last the x-ray.

Having tested the tube with the screen to see that it was working at its best and working with 8-inch coil, I tried to obtain good result with comparatively short exposures. Healthy tissue was oiled (Olive oil) and protected with Staniol and the tube removed about 15 to 18 inches, to avoid the danger of too intense action of the rays. At the first trace of brownish coloration of the skin, the treatment must be stopped at once. It must be certainly systematically employed to secure a complete cure. After the first application of the x-ray, nodules previously invisible, become visible, finally fall off and infiltrated lymphatic glands diminished in number. Later the unhealthy ulceration under the action of the rays, producing a general inflammatory reaction (Schiff), were changed to open and healthy granulation. This was six months ago. The patient is now completely cured.

F. C. had for months lupus vulgaris on the right side of his face. In the beginning there was an appearance of yellowish, deep papules. They gradually extended and appeared in the form of yellowish tubercles and apple-jelly like nodules, with abundant secretion forming crust, irregular and unhealthy ulceration. This facial lupus was exposed to the x-ray and also in this case, there can be no doubt about the curative action and influence of the x-ray. Gochl explains the action of the x-rays on lupus by the fact that they determine a non-infectious inflammation, which extends into the subcutaneous tissue (cellular) and destroys the tubercle bacilli. Certainly it yet remains for us to determine whether the powerful x-rays of today possess a germicidal action. Its employment in cases of lupus is worthy of extended trial.

Crete, Neb., Sept. 6, 1898.

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, BRISTOL, 1898.

Abstract of Presidential Address* By Sir William Crookes, F. R. S., V. P. C. S., President.

*Owing to the exigencies of space, only that portion of the Address that touches directly or indirectly upon electrical science is given.

For the third time in its history the British Association meets in your City of Bristol. The first meeting was held under the presidency of the Marquis of Lansdowne, in 1836; the second under the presidency of Sir John Hawkshaw, in 1875. Formerly, the President unrolled to the meeting a panorama of the year's progress in physical and biological sciences. To-day, the President usually restricts himself to specialties connected with his own work, or deals with questions which, for the time, was uppermost. To be President of the British Association is undoubtedly a great honor. It is also a great opportunity and a great responsibility; for I know that, on the wings of the press, my words, be they worthy or not, will be carried to all points of the compass. I propose, first, to deal with the important question of the supply of bread to the inhabitants of these islands, then to touch on subjects to which my life work has been more or less devoted. I shall not attempt any general survey of the sciences; these, so far as the progress in them demands attention, will be more fitly brought before you in the different sections, either in the addresses of the presidents or in communications from members.

Some years ago Mr. Stanley Jevons uttered a note of warning as to the near exhaustion of our British coal fields. But the exhaustion of the world's stock of fixed nitrogen is a matter of far greater importance. It means not only a catastrophe little short of starvation for the wheat eaters, but indirectly, scarcity for those who exist on inferior grains, together with a lower standard of living for meat eaters, scarcity of mutton and beef, and even the extinction of gun-powder.

There is a gleam of light amid this darkness of despondency. In its free state nitrogen is one of the most abundant and pervading bodies on the face of the earth. Every square yard of the earth's surface has nitrogen gas pressing down on it to the extent of about seven tons—but this is in the free state, and wheat demands it fixed. To convey this idea in an object-lesson, I may tell you that, previous to its destruction by fire, Colston Hall, measuring 146 feet by 80 feet by 70 feet, contained 27 tons' weight of nitrogen in its atmosphere; it also contained one-third of a ton of argon. In the free gaseous state this nitrogen is worthless; combined in the form of nitrate of soda it would be worth about £2,000.

For years past attempts have been made to effect the fixation of atmospheric nitrogen, and some of the processes have met with sufficient partial success to warrant experimentalists in pushing their trials still further; but I think I am right in saying that no process has yet been brought to the notice of scientific or commercial men which can be considered successful either as regards cost or yield of product. It is possible, by several methods, to fix a certain amount of atmospheric nitrogen; but to the best of my knowledge no process has hitherto converted more than a small amount, and this at a cost largely in excess of the present market value of fixed nitrogen.

The fixation of atmospheric nitrogen, therefore, is one of the great discoveries awaiting the ingenuity of chemists. It is certainly deeply important with its practical bearings on the future welfare and happiness of the civilized races of mankind. This unfulfilled problem, which so far has eluded the strenuous attempts of those who have tried to wrest the secret from nature, differs materially from other chemical discoveries which are in the air, so to speak, but are not yet matured. The fixation of nitrogen is vital to the progress of civilized humanity. Other discoveries minister to our increased intellectual comfort, luxury, or convenience; they serve to make life easier, to hasten the acquisition of wealth, or to save time, health, or worry. The fixation of nitrogen is a question of the not far distant future. Unless we can class it among certainties to come, the great Caucasian race will cease to be foremost in the world, and will be squeezed out of existence by races to whom wheaten bread is not the staff of life.

Let me see if it is not possible even now to solve the momentous problem. As far back as 1892 I exhibited, at one of the soirees of the Royal Society, an experiment on "The Flame of Burning Nitrogen." I showed that nitrogen is a combustible gas, and the reason why when once ignited the flame does not spread through the atmosphere and deluge the world in a sea of nitric acid, is that its igniting point is higher than the temperature of its flame—not, therefore, hot enough to set fire to the adjacent mixture. But by passing a strong induction current between terminals the air takes fire, and continues to burn with a powerful flame, producing nitrous and nitric acids. This inconsiderable experiment may not unlikely lead to the development of a mighty industry destined to solve the great food problem. With the object of burning out nitrogen from air so as to leave argon behind, Lord Rayleigh fitted up apparatus for performing the operation on a larger scale, and succeeded in effecting the union of 29.4 grammes of mixed nitrogen and oxygen at an expenditure of one horse-power. Following these figures it would require one Board of Trade unit to form 74 grammes of nitrate of soda, and, therefore, 14,000 units to form one ton. To generate electricity in the ordinary way with steam engines and dynamos, it is now possible with a steady load night and day, and engines working at maximum efficiency, to produce current at a cost of one-third of a penny per Board of Trade unit. At this rate one ton of nitrate of soda would cost £26. But electricity from coal and steam engines is too costly for large industrial purposes; at Niagara, where water-power is used, electricity can be sold at a profit for one-seventeenth of a penny per Board of Trade unit. At this rate nitrate of soda would cost not more than £5 per ton. But the limit of cost is not yet reached, and it must be remembered that the initial data are derived from small scale experiments, in which the object was not economy, but rather to demonstrate the practicability of the combustion method, and to utilize it for isolating argon. Even now electric nitrate at £5 a ton compares favorably with Chili nitrate at £7 10s. a ton; and all experience shows that when the road has been pointed out by a small laboratory experiment, the industrial operations that may follow are always conducted at a cost considerably lower than could be anticipated from the laboratory figures.

Before we decide that electric nitrate is a commercial possibility, a final question must be mooted. We are dealing with wholesale figures, and must take care that we are not simply shifting difficulties a little further back without really diminishing them. We start with a shortage of wheat, and the natural remedy is to put more land under cultivation. As the land cannot be stretched, and there is so much of it and no more, the object is to render the available area more productive by a dressing with nitrate of soda. But nitrate of soda is limited in quantity, and will soon be exhausted. Human ingenuity can contend even with these apparently hopeless difficulties. Nitrate can be produced artificially by the combustion of the atmosphere. Here we come to finality in one direction; our stores are inexhaustible. But how about electricity? Can we generate enough energy to produce 12,000,000 tons of nitrate of soda annually? A preliminary calculation shows that there need be no fear on that score. Niagara alone is capable of supplying the required electric energy without much lessening its mighty flow.

The future can take care of itself. The artificial production of nitrate is clearly within view, and by its aid the land devoted to wheat can be brought up to the 30 bushels per acre standard. In days to come, when the demand may again overtake supply, we may safely leave our successors to grapple with the stupendous food problem.

And, in the next generation, instead of trusting mainly to food stuffs which flourish in temperate climates, we probably shall trust more and more to the exuberant food stuffs of the tropics, where, instead of one yearly sober harvest, jeopardized by any shrinkage of the scanty days of summer weather, or of the few steady inches of rainfall, nature annually supplies heat and water enough to ripen two or three successive crops of food stuffs in extraordinary abundance. To mention one plant alone, Humboldt—from what precise statistics I know not—computed that, acre for acre, the food productiveness of the banana is 133 times that of wheat—the unripe banana, before its starch is converted into sugar, is said to make excellent bread.

Considerations like these must, in the end, determine the range and avenues of commerce, perhaps the fate of continents. We must develop and guide Nature's latent energies, we must utilize her inmost workshops, we must call into commercial existence Central Africa and Brazil to redress the balance of Odessa and Chicago.

Having kept you for the last half hour rigorously chained to earth, disclosing dreary possibilities, it will be a relief to soar to the heights of pure science, and to discuss a point or two touching its latest achievements and aspirations. The low temperature researches which bring such renown to Prof. Dewar and to his laboratory in the Royal Institution have been crowned during the present year by the conquest of one of Nature's most defiant strongholds. On May 10th last, Prof. Dewar wrote to me these simple but victorious words: "This evening I have succeeded in liquefying both hydrogen and helium. The second stage of low temperature work has begun." Static hydrogen boils at a temperature of 238 deg. C. at ordinary pressure, and at 250 deg. C. in a vacuum, thus enabling us to get within 23 deg. C. of absolute zero. The density of liquid hydrogen is only 1-14th that of water, yet in spite of such a low density it collects well, drops easily, and has a well-defined meniscus. With proper isolation it will be as easy to manipulate liquid hydrogen as liquid air.

The investigation of the properties of bodies brought near the absolute zero of temperature is certain to give results of extraordinary importance. Already platinum resistance thermometers are becoming useless, as the temperature of boiling hydrogen is but a few degrees from the point where the resistance of platinum would be practically nothing, or the conductivity infinite.

Several years ago I pondered on the constitution of matter in what I ventured to call the fourth state. I endeavored to probe the tormenting mystery of the atom. What is the atom? Is a single atom in space solid, liquid or gaseous? Each of these states involves ideas which can only pertain to vast collections of atoms. Whether, like Newton, we try to visualize an atom as a hard, spherical body, or, with Boscovitch and Faraday, to regard it as a centre of force, or accept the vortex atom theory of Lord Kelvin—an isolated atom is an unknown entity difficult to conceive. The properties of matter—solid, liquid, gaseous—are due to molecules in a state of motion. Therefore, matter, as we know it, involves essentially a mode of motion; and the atom itself—intangible, invisible, and inconceivable—is its material basis, and may, indeed, be styled the only true *matter*. The space involved in the motions of atoms has no more pretension to be called matter than the sphere of influence of a body of riflemen—the sphere filled with flying leaden missiles—has to be called lead. Since what we call matter essentially involves a mode of motion, and since at the temperature of absolute zero all atomic motions would stop, it follows that matter, as we know it, would at that paralyzing temperature probably entirely change its properties. Although a discussion of the ultimate absolute properties of matter is purely speculative, it can hardly be barren, considering that in our laboratories we are now within moderate distance of the absolute zero of temperature.

I have dwelt on the value and importance of nitrogen, but I must not omit to bring to your notice those little known and curiously related elements which, during the past 12 months, have been discovered and partly described by Prof. Ramsey and Dr. Travers. For many years my own work has been among what I may call the waste heaps of the mineral elements. Prof. Ramsey is dealing with vagrant atoms of an astral nature. During the course of the present year he has announced the existence of no fewer than three new gases—krypton, neon, and metargon. Whether these gases, chiefly known by their spectra, are true unalterable elements, or whether they are compounded of other known or unknown bodies, has yet to be proved. Fellow workers freely pay tribute to the painstaking zeal with which Prof. Ramsey has conducted a difficult research, and to the philosophic subtlety brought to bear on his investigations. But, like most discoverers, he has not escaped the flail of severe criticism.

There is still another claimant for celestial honors. Prof. Nasini tells us he has discovered in some volcanic gases at Pozzuoli, that hypothetical element Coronium, supposed to cause the bright line 5,316.9 in the spectrum of the sun's corona. Analogy points to its being lighter and more diffusible than hydrogen, and a study of its properties cannot fail to yield striking results. Still awaiting discovery by the fortunate spectroscopist are the unknown celestial elements Aurorium, with a characteristic line at 5,570.7—and Nebulum, having two bright lines at 5,007.05 and 4,959.02.

The fundamental discovery by Hertz of the electro-magnetic waves, predicted more than 30 years ago by Clerk Maxwell, seems likely to develop in the direction of a practical application which excites keen interest—I mean the application to electric signalling across moderate distances without connecting wires. The feasibility of this method of signalling has been demonstrated by several experimenters at more than one meeting of the British Association, though most elaborately, and with many optical refinements, by Oliver Lodge at the Oxford meeting in 1894. But not until Signor Marconi induced the British Post Office and Foreign Governments to try large scale experiments did wireless signalling become generally and popularly known or practically developed as a special kind of telegraphy. Its feasibility depends on the discovery of a singularly sensitive detector for Hertz waves—a detector whose sensitiveness in some cases seems almost to compare with that of the eye itself. The fact noticed by Oliver Lodge in 1889, that an infinitesimal metallic gap subjected to an electric jerk became conducting, so as to complete an electric circuit, was rediscovered soon afterwards in a more tangible and definite form and applied to the detection of Hertz waves by M. E. Branly. Oliver Lodge then continued the work, and produced the *vacuum filing-tube* coherers with automatic tapperback, which are of acknowledged practical service. It is this varying continuity of contact under the influence of extremely feeble electric stimulus alternating with mechanical tremor, which, in combination with the mode of producing the waves revealed by Hertz, constitutes the essential and fundamental feature of "wireless telegraphy." There is a curious and widely-spread misapprehension about coherers to the effect that to make a coherer work the wave must fall upon it. Oliver Lodge has disproved this fallacy. Let the wave fall on a suitable receiver, such as a metallic wire, or, better still, on an arrangement of metal wings resembling a Hertz sender, and the waves set up oscillating currents which may be led by wires (inclosed in metal pipes) to the coherer. The coherer acts apparently by a species of end-impact of the oscillatory current, and does not need to be attacked in the flank by the waves themselves. This interesting method of signalling—already developing in Marconi's hands into a successful practical system, which inevitably will be largely used in lighthouse and marine work—presents more analogy to optical signals by flash-light than to what is usually understood as electric telegraphy, notwithstanding the fact that an ordinary Morse instrument at one end responds to the movements of a key at the other, or, as arranged by Alexander Muirhead, a siphon recorder responds to an automatic transmitter at about the rate of slow cable telegraphy. But although no apparent optical apparatus is employed, it remains true that the impulse travels from sender to receiver by essentially the same process as that which enables a flash of magnesium powder to excite a distant eye.

The phenomenon discovered by Zeeman, that a source of radiation is affected by a strong magnetic field in such a way that light of one refrangibility becomes divided usually into three components, two of which are displaced by diffraction analysis on either side of the mean position, and are oppositely polarized to the third or residual constituent, has been examined by many observers in all countries. The phenomenon has been subjected to photography with conspicuously successful results by Prof. T. Preston in Dublin, and by Prof. Michelson and Dr. Ames and others in America.

It appears that the different lines in the spectrum are differently affected, some of them being tripled with different grades of relative intensity, some doubled, some quadrupled, some sextupled, and some left unchanged. Even the two components of the D lines are not similarly influenced. Moreover, whereas the polarization is usually such as to indicate that motions of a negative ion or electron constitute the source of light, a few lines are stated by the observers at Baltimore, who used what they call the "small" grating of 5 inches width ruled with 65,000 lines, to be polarized in the reverse way.

Further prosecution of these researches must lead to deeper insight into molecular processes and the mode in which they affect the ether; indeed, already valuable theoretic views have been promulgated by H. A. Lorenz, J. Larmor, and G. F. Fitzgerald, on the lines of the radiation theory of Dr Johnstone Stoney; and the connection of the new phenomena with the old magnetic rotation of Faraday is under discussion. It is interesting to note that Faraday and a number of more recent experimenters were led by theoretical considerations to look for some such effect; and though the inadequate means at their disposal did not lead to success, nevertheless a first dim glimpse of the phenomenon was obtained by M. Fievez, of the Royal Observatory at Brussels, in 1885.

It would be improper to pass without at least brief mention the remarkable series of theoretic papers by Dr. J. Larmor, published by the Royal Society, on the relationship between ether and matter. By the time these researches become generally intelligible they may be found to constitute a considerable step towards the further mathematical analysis and interpretation of the physical universe on the lines initiated by Newton.

In the mechanical construction of Roentgen ray tubes I can record a few advances, the most successful being the adoption of Prof. Silvanus P. Thompson's suggestion of using for the anti-cathode a metal of high atomic weight. Osmium and iridium have been used with advantage, and osmium anti-cathode tubes are now a regular article of manufacture. As long ago as June, 1896, x-ray tubes with metallic uranium anti-cathodes were made in my own laboratory, and were found to work better than those with platinum. The difficulty of procuring metallic uranium prevented these experiments from being continued. Thorium anti-cathodes have also been tried.

Roentgen has drawn fresh attention to a fact very early observed by English experimenters—that of the non-homogeneity of the rays and the dependence of their penetrating power on the degree of vacuum; rays generated in high vacua have more penetrative power than when the vacuum is less high. These facts are familiar to all who have exhausted focus tubes on their own pumps. Roentgen suggests a convenient phraseology; he calls a low vacuum tube, which does not emit the highly penetrating rays, a "soft" tube, and a tube in which the exhaustion has been pushed to an extreme degree, in which highly penetrating rays predominate, a "hard" tube. Using a "hard" tube he took a photograph of a double-barrelled rifle, and showed not only the leaden bullets within the steel barrels but even the wads and the charges.

Benoit has re-examined the alleged relation between density and opacity to the rays, and finds certain discrepancies. Thus, the opacity of equal thicknesses of palladium and platinum are nearly equal, whilst their densities and atomic weights are very different, those of palladium being about half those of platinum.

At the last meeting of the British Association visitors saw—at the McGill University—Profs. Cox and Callendar's apparatus for measuring the velocity of Roentgen rays. They found it to be certainly greater than 200 kilometers per second. Majorana has made an independent determination and finds the velocity to be 600 kilometers per second, with an inferior limit certainly of not less than 150 kilometers per second. It may be remembered that J. J. Thomson has found for cathode rays a velocity of more than 10,000 kilometers per second, and it is extremely unlikely that the velocity of Roentgen rays will prove to be less.

Trowbridge has verified the fact, previously announced by Prof. S. P. Thompson, that fluor-spar, which by prolonged heating has lost its power of luminescing when re-heated, regains the power of thermo-luminescence when exposed to Roentgen rays. He finds that this restoration is also effected by exposure to the electric glow discharge, but not by exposure to ultra-violet light. The difference is suggestive.

As for the action of Roentgen rays on bacteria, often asserted and often denied, the latest statement by Dr. H. Rieder, of Munich, is to the effect that bacteria are killed by the discharge from "hard" tubes. Whether the observation will lead to results of pathologic importance remains to be seen. The circumstance that the normal retina of the eye is slightly sensitive to the rays is confirmed by Dorn and by Roentgen himself.

The essenttal wave nature of the Roentgen rays appears to be confirmed by the fact ascertainnd by several of our great mathematical physicists, that light of excessively short wave length would be but slightly absorbed by ordinary material media, and would not in the ordinary sense be refracted at all. In fact, a theoretic basis for a comprehension of the Roentgen rays had been propounded before the rays were discovered. At the Liverpool meeting of the British Association, several speakers, headed by Sir George Stokes, expressed their conviction that the disturbed electric field caused by the sudden stoppage of the motion of an electrically charged atom yielded the true explanation of the phenomena extraneous to the Crookes high vacuum tubes—phenomena so excellently elaborated by Lenard and by Roentgen. More recently, Sir George Stokes has re-stated his "pulse" theory and fortiffed it with arguments which have an important bearing on the whole theory of the refraction of light. He still holds to their essentially transverse nature, in spite of the absence of polarization, an absence once more confirmed by the careful experiments of Dr. L. Graetz. The details of this theory are in process of elaboration by Prof. J. J. Thomson.

Meantime, while the general opinion of physicists seems to be settling toward a wave or ether theory for the Roentgen rays, an opposite drift is apparent with respect to the physical nature of the cathode rays; it becómes more and more clear that cathode rays consist of electrified atoms or ions in rapid progressive motion. My idea of a fourth state of matter, propounded in 1881,* and at first opposed at home and abroad, is now becoming accepted. It is supported by Prof. J. J. Thomson;† Dr. Larmor's theory‡ likewise involves the idea of an ionic substratum of matter; the view is also confirmed by Zeeman's phenomenon. In Germany—where the term cathode ray was invented almost as a protest against the theory of molecular streams propounded by me at the Sheffield meeting of the British Association in 1879—additional proofs have been produced in favor of the doctrine that the essential fact in the phenomenon is electrified radiant matter.

The speed of these molecular streams has been approximately measured, chiefly by aid of my own discovery nearly 20 years ago, that their path is curved in a magnetic field, and that they produce phosphorescence where they impinge on an obstacle. The two unknown quantities, the charge and the speed of each atom, are measurable from the amount of curvature and by means of one other independent experiment.

It can not be said that a complete and conclusive theory of these rays has yet been formulated. It is generally accepted that collisions among particles, especially the violent collisions due to their impact on a massive target placed in their path, give rise to the interesting kind of extremely high frequency radiation discovered by Roentgen. It has, indeed, for some time been known that whereas a charged body in motion con-

*Phil. Trans., Part 2, 1881, pp. 433-4.
†Phil. Mag., October, 1897, p. 312.
‡Phil. Mag., December, 1897, p. 506.

stitutes an electric current, the sudden stoppage, or any violent acceleration of such a body must cause an alternating electric disturbance, which, though so rapidly decaying in intensity as to be practically "dead beat," yet must give rise to an ethereal wave or pulse traveling with the speed of light, but of a length comparable to the size of the body whose sudden change of motion caused the disturbance. The emission of a high-pitched musical sound from the jolting of a dustman's cart (with a spring bell hung on it) has been suggested as an illustration of the way in which the molecules of any solid not at absolute zero may possibly emit such rays.

If the target onto which the electrically charged atoms impinge is so constituted that some of its minute parts can thereby be set into rhythmical vibration, the energy thus absorbed reappears in the form of light, and the body is said to phosphoresce. The efficient action of the phosphorescent target appears to depend as much on its physical and molecular, as on its chemical constitution. The best known phosphori belong to certain well-defined classes, such as the sulphides of the alkaline earthy metals, and some of the so-called rare earths, but the phosphorescent properties of each of these groups are profoundly modified by an admixture of foreign bodies—witness the effect on the lines in the phosphorescent spectrum of yttrium and samarium, produced by traces of calcium or lead. The persistence of the samarium spectrum in presence of overwhelming quantities of other metals, is almost unexampled in spectroscopy; thus one part of samaria can easily be seen when mixed with three million parts of lime.

Without stating it as a general rule, it seems as if, with a non-phosphorescing target, the energy of molecular impact reappears as pulses so abrupt, and irregular, that, when resolved, they furnish a copious supply of waves of excessively short wave lengths; in fact, the now well-known Roentgen rays. The phosphorescence so excited may last only a small fraction of a second, as with the constituents of yttria, where the duration of the different lines varies between the 0.003 and the 0.0009 second, or it may linger for hours, as in the case of some of the yttria earths, and especially with the earthy sulphides, where the glow lasts bright enough to be commercially useful. Excessively phosphorescent bodies can be excited by light waves, but most of them require the stimulus of electrical excitement.

It now appears that some bodies, even without special stimulation, are capable of giving out rays closely allied, if not in some cases identical, with those of Prof. Roentgen. Uranium and thorium compounds are of this character, and it would almost seem from the important researches of Dr. Russell, that this ray-emitting power may be a general property of matter, for he has shown that nearly every substance is capable of affecting the photographic plate if exposed in darkness for sufficient time.

No other source for Roentgen rays but the Crookes tube has yet been discovered, but rays of kindred sorts are recognized. The Becquerel rays, emitted by uranium and its compounds, have now found their companions in rays—discovered almost simultaneously by Curie and Schmidt—emitted by thorium and its compounds. The thorium rays affect photographic plates through screens of paper or aluminum, and are absorbed by metals and other dense bodies. They ionise the air, making it an electrical conductor; and they can be refracted and probably reflected, at least diffusively. Unlike uranium rays, they are not polarized by transmission through tourmaline, therefore resembling in this respect the Roentgen rays.

Quite recently M. and Mdme. Curie

have announced a discovery which, if confirmed, cannot fail to assist the investigation of this obscure branch of physics. They have brought to notice a new constituent of the uranium mineral pitchblende, which, in a 400-fold degree, possesses uranium's mysterious power of emitting a form of energy capable of impressing a photographic plate, and of discharging electricity by rendering air a conductor. It also appears that the radiant activity of the new body to which the discoverers have given the name of Polonium, needs neither the excitation of light nor the stimulus of electricity; like uranium, it draws its energy from some constantly regenerating and hitherto unsuspected store, exhaustless in amount.

It has long been to me a haunting problem how to reconcile this apparently boundless outpour of energy with accepted canons. But as Dr. Johnstone Stoney reminds me, the resources of molecular movements are far from exhausted. There are many stores of energy in nature that may be drawn on by properly constituted bodies without very obvious cause. Some time since I drew attention to the enormous amount of locked up energy in the ether; nearer our experimental grasp are the motions of the atoms and molecules, and it is not difficult mentally so to modify Maxwell's demons as to reduce them to the level of an inflexible law, and thus bring them within the ken of a philosopher in search of a new tool. It is possible to conceive a target capable of mechanically sifting from the molecules of the surrounding air the quick from the slow movers. This sifting of the swift moving molecules is effected in liquids whenever they evaporate, and in the case of the constituents of the atmosphere, wherever it contains constituents light enough to drift away molecule by molecule. In my mind's eye I see such a target as a piece of metal cooler than the surrounding air acquiring the energy that gradually raises its temperature from the outstanding effect of all its encounters with the molecules of the air about it; I see another target of such a structure that it throws off the slow-moving molecules with little exchange of energy, but is so influenced by the quick-moving missiles that it appropriates to itself some of their energy. Let uranium or polonium, bodies of densest atoms, have a structure that enables them to throw off the slow-moving molecules, of the atmosphere, while the quick-moving molecules, smashing onto the surface, have their energy reduced, and that of the target correspondingly increased. The energy thus gained seems to be employed partly in dissociating some of the molecules of the gas (or in inducing some other condition which has the effect of rendering the neighboring air in some degree a conductor of electricity) and partly in originating an undulation through the ether, which, as it takes its rise in phenomena so disconnected as the impacts of the molecules of the air, must furnish a large contingent of light waves of short wave length. The shortness in the case of these Becquerel rays appears to approach without attaining the extreme shortness of ordinary Roentgen rays. The reduction of the speed of the quick moving molecules would cool the layer of air to which they belong; but this cooling would rapidly be compensated by radiation and conduction from the surrounding atmosphere; under ordinary circumstances the difference of temperature would scarcely be perceptible, and the uranium would thus appear to perpetually emit rays of energy with no apparent means of restoration.

The total energy of both the translational and internal motions of the molecules locked up in quiescent air at ordinary pressure and temperature is about 140,000 foot-pounds in each cubic yard of air. Accordingly the quiet air within a room 12 feet high, 18 feet wide, and 22 feet long contains energy enough to propel a 1-horse engine for more than 12 hours. The store drawn upon naturally by uranium and other heavy atoms only awaits the touch of the magic wand of science to enable the twentieth century to cast into the shade the marvels of the nineteenth.

Whilst placing before you the labors and achievements of my comrades in science, I seize this chance of telling you of engrossing work of my own on the fractionation of yttria, to which, for the last 18 years, I have given ceaseless attention. In 1883, under the title of "Radiant Matter Spectroscopy," I described a new series of spectra produced by passing the phosphorescent glow of yttria, under molecular bombardment *in vacuo*, through a train of prisms. The visible spectra in time gave up their secrets, and were duly embalmed in the *Philosophical Transactions*. At the Birmingham meeting of the British Association in 1886 I brought the subject before the Chemical Section, of which I had the honor to be President. The results led to many speculations on the probable origin of all the elementary bodies—speculations that, for the moment, I must waive in favor of experimental facts.

There still remained for spectroscopic examination a long tempting stretch of unknown ultra-violet light, of which the exploration gave me no rest. But I will not now enter into details of the quest of unknown lines. Large quartz prisms, lenses, and condensers, specially sensitized photographic films, capable of dealing with the necessary small amount of radiation given by feebly phosphorescing substances,* and above all tireless patience in collating and interpreting results, have all played their part. Although the research is incomplete, I am able to announce that among the groups of rare earths giving phosphorescent spectra in the visible region, there are others giving well defined groups of bands, which can only be recorded photographically. I have detected and mapped no less than six such groups, extending λ 3.060.

Without enlarging on difficulties, I will give a brief outline of the investigation. Starting with a large quantity of a group of the rare earths in a state of considerable purity, a particular method of fractionation is applied, splitting the earths into a series of fractions differing but slightly from each other. Each of these fractions, phosphorescing *in vacuo*, is arranged in the spectograph, and a record of its spectrum photographed upon a specially prepared sensitive film.

In this way, with different groups of rare earths, the several invisible bands were recorded—some moderately strong, others exceedingly faint. Selecting a portion giving a definite set of bands, new methods of fractionation were applied, constantly photographing and measuring the spectrum of each fraction. Sometimes many weeks of hard experiment failed to produce any separation, and then a new method of splitting up was devised and applied. By unremitting work—the solvent of most difficulties—eventually it was possible to split up the series of bands into various groups. Then, taking a group which seemed to offer possibilities of reasonably quick result one method after another of chemical attack was adopted, with the ultimate result of freeing the group from its accompanying fellows and increasing its intensity and detail.

As I have said, my researches are far from complete, but about one of the bodies I may speak definitely. High up in the ultra-violet, like a faint nebula in the distant heavens, a group of lines was de-

*In this direction I am glad to acknowledge my indebtedness to Dr. Schuman, of Liepzig, for valuable suggestions and detail of his own apparatus, by means of which he has produced some unique records of metallic and gaseous spectra of lines of short wave-length.

tected, at first feeble, and only remarkable on account of their isolation. On further purification these lines grew stronger. Their great refrangibility cut them off from other groups. Special processes were employed to isolate the earth, and using these lines as a test, and appealing at every step to the spectrograph, it was pleasant to see how each week the group stood out stronger and stronger, while the other lines of yttrium, samarium, ytterbium, &c., became fainter, and at last, practically vanishing, left the sought-for group strong and solitary. Finally, within the last few weeks, hopefulness has emerged into certainty, and I have absolute evidence that another member of the rare earth groups has been added to the list. Simultaneously with the chemical and spectrographic attack, atomic weight determinations were constantly performed.

As the group of lines which betrayed its existence stand alone, almost at the extreme end of the ultra-violet spectrum, I propose to name the newest of the elements monium, from the Greek term, alone. Although caught by the searching rays of the spectrum, monium offers a direct contrast to the recently discovered gaseous elements, by having a strongly marked individuality; but although so young and wilful, it is willing to enter into any number of chemical alliances.

Until my material is in a greater state of purity I hesitate to commit myself to figures; but I may say that the wave lengths of the principal lines are 3,120 and 3,117. Other fainter lines are at 3,219, 3,064, and 3,060. The atomic weight of the element, based on the assumption of R_2O, is not far from 118—greater than that accepted for yttrium, and less than that for lanthanum.

I ought almost to apologize for adding to the already too long list of elements of the rare earth class—the asteroids of the terrestrial family. But as the host of celestial asteroids, unimportant individually, become of high interest when once the idea is grasped that they may be incompletely coagulated remains of the original nebula, so do these elusive and insignificant rare elements rise to supreme importance when we regard them in the light of component parts of a dominant element, frozen in embryo, and arrested in the act of coalescing from the original protyle into one of the ordinary and law-abiding family for whom Newlands and Mendeleeff have prepared pigeon-holes. The new element has another claim to notice. Not only is it new in itself, but to discover it a new tool had to be forged for spectroscopic research.

Further details I will reserve for that tribunal before whom every aspirant for a place in the elemental hierarchy has to substantiate his claim.

Atmospheric Discharges. Montel. *L'Eclairage Elec.*, July 30. *Electrical World*, N. Y.—When lightning strikes near a closed circuit the latter becomes the seat of a temporary current, representing a certain amount of power: in the present article, which is of a theoretical and highly mathematical character, he discusses the power developed in that close circuit; this is based on the known laws of discharge of condensers. He concludes that if in the case of an atmospheric discharge it is possible to measure two integral values of the square of the current by the differential of the time induced in each of two circuits, in one of which the ratio of the resistance to the co-efficient of self-induction is very small, while in the other it is very large, it becomes possible to find out, by comparison of these two integrals, the nature of the atmospheric discharge.

Discharge by X-rays. Sagnac. *L'Eclairage Elec.*, July 23. *Electrical World*, N. Y.—An Academy note on the mechanism of the discharge by x-rays.

EXPERIMENTS ON THE APPLICATION OF THE ROENTGEN RAYS TO THE STUDY OF ANATOMY.

BY ERNEST AMORY CODMAN, M. D., BOSTON

This paper is the report by the author to the Committee on the Bullard Fellowship of the Harvard Medical School, May, 1, 1897. After adverting to the fact that in pathological conditions of bone the x-ray can reveal what the dissecting-knife and frozen sections can not, the author proceeds:

In looking at skiagraphs there are several distortions and inaccuracies which must be borne in mind. One essential for a good skiagraph is an accurately focussed tube. The cathode rays are focussed by a concave aluminum electrode on the center of a disc of platinum or the anode. The point where the stream of cathode rays strikes is the point from which the x-rays are generated. That this point should be as small as possible is important, in order that no penumbra should be formed.

We may consider, then, that the x-rays proceed from practically a single point. In looking at a skiagraph, we must consider it as a complete whole, made up of the shadows of the different parts of the object. The size and shape of the shadow of each part will depend upon the relations of the distances between the point of light, the part of the object, and the plate. Thus the distance between the light and the plate remaining the same, the farther an object is from the plate, the larger will be its shadow; and the farther an object, or part of an object, from the base of a perpendicular from the point of light to the plane of the plate, the more will its shadow be distorted, the distortion being due to elongation in the direction of a line from the base of the perpendicular through the object.

When the object is at the same time away from the plate and away from the base of the perpendicular, both of these distortions will take place. Further, since each object or part of an object contains only a certain amount of shadow-casting material, the farther it is from the plate, the greater will be the size and the less the density of the shadow.

An important corollary follows from this. A picture of a less dense object may be taken through a more dense, *e.g.*, the ear through the skull. This can be done when the densities of the two objects are not greatly contrasted; but when one object is so dense as to be practically impenetrable to the rays, its shadow will of course obliterate the shadows of anything either in front of or behind it. This is generally true of metallic objects.

Another source of inaccuracy of these pictures is the fact that the rays, in penetrating large objects, are more or less diffused. This diffusion tends to blur the outlines of the parts of the object at a distance from the plate. It may also assist in making more distinct the objects in direct contact with the plate; for instance in the picture of the ear taken through the skull, the diffused rays from the other parts of the head may help to take the picture of the ear, because they blur all those parts of the plate which are not protected by the ear, which comes in close contact with the wrapper.

It will be seen from the foregoing that in order to reduce these inaccuracies to a minimum the distance from the plate to the tube should be as great as possible, and that from the object to the plate as short as possible. The distance, therefore, must be gauged by the intensity of the rays and convenient time of exposure. We must also remember that the wider the object, or the deeper the object, the greater must be the distance between the plate and the tube. For instance, the skiagraph of a hand at 10 inches is very little distorted, while that of two hands side by side would be considerably distorted, because the rays would strike the outer fingers at more acute angles.

A knee at 10 inches, though little wider than a hand, would yet be considerably distorted, for it is so thick that the parts furthest from the plate would be much enlarged ; the external condyle of the femur (the knee being on the inner side, for instance) would appear much larger than the internal.

In order to reduce these distortions to a minimum, the tube should be put as far away as is possible with a convenient time of exposure.

On the other hand, however, advantage can be taken of this distortion in taking a photograph of the patella. If the plate is put to the posterior side of the knee, the shadow of the patella will be hardly, if at all, distinguishable. This would be true also if the plate were on the anterior side and the light far away, for the shadow of the femur would be dense enough to overshadow that of the patella. If, however, the plate be on the anterior side, and the tube very near the posterior, the shadow of the femur will be broadened and diminished in density, so that the shadow of the patella, which is but little magnified and as dense as before, will be seen through it.

The use of the fluoroscope is a practical way of determining the intensity of the rays. In determining the distance, we must remember that the intensity of the light varies inversely as the square of the distance. In determining the time, we can calculate that what we lose by doubling the distance we gain by multiplying the time of exposure by four.

THE STUDY OF THE MECHANISM OF THE JOINTS.

This has been undertaken in two ways. First, by skiagraphing the normal joints in their forced extreme positions, extreme flection, adduction, etc. Secondly, by watching the movements with the fluoroscope. As the parts of the object near the plate show best, it has been necessary to take each position from both sides.

One thing which will at once arrest attention is the great distance that apparently intervenes between the bones. This is in part due to the fact that the articular cartilages, being easily traversed by the rays, do not cast a shadow.

The wrist-joint has proved most interesting in this study, and the points brought out will be found in the following description :

For convenience, we may consider the wrist-joint to be made up of four immobile and two mobile elements.

I. Immobile (*i. e.*, those made up of single bones or of a group of bones, the components of which can not change relative positions). These are :

1. Metacarpal of thumb.
2. Metacarpal of ring-finger.
3. Metacarpal of little finger.
4. Metacarpal of index and middle finger with trapezium, trapezoid, os magnum, and unciform.

This last group are so firmly attached to one another that they move as a whole, practically as one bone. No doubt, however, their ligamentous attachments allow of more or less spring in strained positions of the hand brought about by external force.

II. Mobile (the components of which change relative positions).

1. The intermediate row of carpal bones composed of scaphoid, semilunar, cuneiform, and pisiform.
2. Radius and ulna.

From skiagraphs it is found that the carpus and metacarpus are, in any of the extreme positions, in practically the same relation to the radius, no matter what the relation of the radius to the ulna, whether pronation or supination. This is due to the more or less flexible fibrocartilage, which in any position completes the cup of the radial joint. The question of mechanism, then, is further simplified by leaving out the ulna, which really does not enter into the construction of the joint except as a pivot. The pisiform also does not enter the mechanism, serving only as a sesamoid for the ulnar tendons.

Proceeding to eliminate other accessory elements, we can disregard the metacarpals of the thumb, ring and index fingers, each of which moves independently on the large fixed element composed of the os magnum, etc. The thumb forms a typical saddle joint with the trapezium, with the pommels of the saddle so low that motion is allowed in a small circle, either as rotation within the circumference or straight motions on any of the radii. The metacarpal of the ring-finger is allowed a slight antero-posterior motion of a few degrees. That of the little finger the same of slightly greater extent, with possibly a degree of adduction. This leaves us with :

I. The large compound fixed element of os magnum, etc.

II. The radius with fibro-cartilage.

III. The intermediate element of scaphoid, semilunar, and cuneiform.

These constitute the real wrist joint.

New Radio-Active Substances. P. and S. Curie. *L'Eclairage Elec.*, August 6. *The Electrical World*, N. Y.—A reprint of an Academy paper. They found that certain minerals containing uranium and thorium are very active in the emission of Becquerel rays, the activity being even greater than that of uranium or thorium, and it was thought that this was due to some other very active substance included in these minerals, as, for instance, pitch-blende, the protoxide of uranium. They suggested this may be a new element, and if its existence can be confirmed the discovery of it was due to its production of Becquerel rays.

THE X-RAY IN LAW.

BY HUGO WINTNER, B.S., L.L.B

A discussion of this topic must, to a great degree, of necessity be speculative in its nature; for but few actual cases have been passed upon by the courts, in which the x-ray has been an element. Naturally the question which propounds itself first is whether an x-ray picture may be introduced in evidence on the trial of a case, as proof of the existence of the condition by it shown. Thus in an action for personal injuries, may the x-ray picture of a fractured limb be put in evidence to show the existence, the nature and the extent of the fractures It is now the best opinion that it may be so introduced and that the jury may be permitted to inspect it, provided always that the condition to be shown by the photograph is in issue or relative to the issue at bar. Furthermore, a photograph being from its nature secondary evidence merely, as contradistinguished from the best evidence, the proper foundation for its reception as evidence must first be laid by the party introducing it. Thus the expert must first testify to the reliability of the x-ray machine, its nature and process, the degree of exactness, etc. The reason that it is at all of any legal value in the trial of a case, is the fact that science and human experience have proven that the machine is capable of giving an exact reproduction, if properly and scientifically used. Hence the necessity of first showing, and this carefully, that the machine and the working of it in the particular case at bar were all that was necessary for its complete effectiveness. The sufficiency of the proof first required to verify the picture is a preliminary question of fact for the judge presiding at the trial, and is not open to exception.

The statutes of New York State provide

(Sect. 873, C. C. P.) that in an action for personal injury, the court, on the defendant showing certain facts by affidavit, and applying therefor, may direct the plaintiff to submit to a physical examination by one or more physicians or surgeons to be designated by the court; and such examination shall be had and made under such restrictions and directions as to the court shall seem proper.

Quaere I.—Granted the fact that the x-ray machine has certain dangerous qualities inherent in its workings, may the court nevertheless order a plaintiff to subject himself to its dangers?

II.—Suppose that upon subjecting himself to the machine, if so desired by the court, he were injured thereby: has he redress for his injuries, and to whom could he look for such redress?

I.—It will be noted that the section referred to gives the court power to make such restrictions and directions as it may deem proper. It will be seen, therefore, that whether or not a plaintiff must submit himself to x-ray examination, is discretionary with the court. It could not well be argued that the plaintiff could object to the use of a temperature thermometer, for instance, or a stethoscope in the hands of the examining physician. Why then to the use of any other instrument recognized by the medical and scientific world and necessary to the examiner in acquiring the information sought? No case touching the subject has yet been brought before the courts for adjudication; hence one opinion is good until another be ventured. It has, however, been decided that the section so far as the ordering of a physical examination is concerned is not violative of any Constitutional inhibition.

II.—In case of injury to plaintiff by use of the x-ray machine, he would have redress. The judge ordering the examination would incur no liability. He acts merely in a judicial capacity, in which he is called upon to exercise his discretion; and he is not liable for error of judgment, even though it be alleged that he acted without due care and prudence (Lange vs. Benedict, N. Y., 35). The injured plaintiff's remedy must be sought against the physician, under whose charge the instrument was at the time of the accident. Ayers vs. Russell et al., decided in N. Y. State in 1888, was an action brought against two physicians for damages arising out of plaintiff's confinement in a mad house. The physicians, acting pursuant to certain statutes of lunacy then in force, had signed a certificate that the plaintiff was a lunatic. On appeal from the order of the judge committing him, which order was based on such certificate, the plaintiff was judicially declared compos mentis. The defendants sought to defend on the ground that as they were acting pursuant to statute, they were judicial officers. The court, however, decided that their duty must be measured by the trust reposed in them by the statute, and by the consequences flowing from its improper performance. They assumed the duty by accepting the trust. They were merely medical experts and not clothed with judicial immunity, and were chargeable with that negligence which attaches to a professional expert who does not use the skill and care which his profession per se implies that he will bring to bear. Hence, if it be charged and proved that the physician in charge of the machine did not use proper care and prudence in handling it, he must respond in damages to the one injured through such negligence. —*Journal of Electro Therapeutics.*

ARC BETWEEN ALUMINUM ELECTRODES. Lang. *Wied. Ann.*, December; abstracted briefly in *L'Eclairage Elec.*, July 30. *Electrical World.* He determined the counter E. M. F. of the arc between aluminum electrodes.

SURGERY AND THE X-RAY.

In the concluded report of surgical operations in the Private Surgical Infirmary of Drs. C. S. and Samuel S. Briggs, the following extracts are of interest:

CASE LXXVIII.—*Tuberculosis of the Great Trochanter.* J. L. S., æt. 37, male, Erin, Tenn., entered February 7. Ankylosis of the right hip joint, the hip very much swollen and numerous fistulae, gave a history of traumatism. The probe failed to touch necrosed bone. The x-ray was used and radiographs made, they showed marked hypertrophy of the trochanter major and the neck. Under A. C. E. two and a half ounces, nausea and vomiting, an incision was made over the trochanter, exposing it well, and an opening was made with the chisel into the bone, considerable disease was found and removed by curetting. The sinuses were all laid open and packed with gauze, and dressed daily. The patient was relieved entirely of pain and tenderness and went home greatly improved.

CASE XCIII.—*Amputation of Toes.* F. W. B., æt. 64, male, Nashville, entered March 10. Obliterative endarteritis, beginning senile gangrene. Under A. C. E., two and a half ounces, amputation of little toe was done. The wound was partially closed, failure of healing. Recurrence of mortification, amputation of the leg at the point of election was required later, terminating fatally. X-ray showed calcareous degeneration of the tibial arteries.

CASE XCVI.—*Removal of Bullet.* Mrs. R., æt. 40, Nashville, entered March 15. Was accidentally shot in the left calf, difficulty was experienced in efforts to locate the ball with the probe. With the x-ray the bullet was clearly seen and its location marked with silver nitrate, also a radiograph was made. Guided by these markings an incision was made large enough to admit the fingers and the ball, which was found wrapped in cloth, accounting for the difficulty of locating with a probe, was removed. The wound was lightly packed with gauze.

CASE CXIX.—*Laminectomy.* R. A. W., æt. 30, male, Hartsville, Tenn., entered May 16. Paraplegia from a fracture of the vertebrae, from an injury which occurred two months previously. The deformity had been reduced at the time of injury, the paralysis had not progressed. Examination with the x-ray showed some irregularity and thickening about the 11th and 12th dorsal, and 1st lumbar vertebrae. Fecal and urinary incontinence were not complete. Under A. C. E., two ounces, vomiting, laminectomy was done, an eight inch incision was made over the spinous processes, and the muscles were pushed off from the vertebrae with a periosteal elevator, exposing the laminae and spines, which were removed with the ronuer forceps, exposing the cords nicely, and removing the pressure. The cord was in good condition; the canal was explored for further pressure with a probe. The muscles were closed over the cord with buried catgut sutures, and the wound closed over a drainage tube. The hemorrhage was slight. The wound discharged freely for some time. Improvement was slight at first but sensibility gradually increased, and he was able to return home July 15.

CASE CXXII.—*Medio-bilateral Lithotomy.* S. W. T., æt. 24, male, Winchester, Tenn., entered May 26. The symptoms of vesical calculus had existed for some time, but repeated examinations failed to disclose stone. In an examination a few days before the operation the water was forcibly ejected along the sides of the searcher, during which the stone was drawn against the instrument. The presence of stone was further demonstrated by the cystoscope and the x-ray. Under A. C. E., one ounce, no nausea, the calculus was removed by the medio-bilateral method, a drainage tube was inserted, and the wound was lightly packed with gauze. Urine passed per vias naturaeles on the sixth day, and the wound healed rapidly.

CASE CLX.—*Coxitis*. K. C., æt. 12, F., Nashville, entered July 18. An extreme case of hip joint disease. Examined with the x-ray to determine the advisability of excision. Two radiographs were made showing the absorption of the head of the femur, but no sequestra could be located.—*Nashville Journal of Medicine and Surgery.*

The Influence of the X-ray Method of Diagnosis Upon the Treatment of Fractures.

In remarking on the benefits which this new method of diagnosis has conferred upon the treatment of fractures, Leonard (*Therapeutic Gazette*, March, 1898,) says: "It can not be expected of any new method of diagnosis that it will replace or at first even equal methods which have attained accuracy and scientific precision by the study of generations of observers, and yet this new method of diagnosis has already produced results which markedly affect the treatment of certain forms of fractures."

The greatest value in the determination of the exact nature of injuries and the point where danger is to be expected from exuberant callus, or the blocking of the joint by overlapping of the fragments. In many instances fractures that lie wholly within the capsule of the joint, and thus escape detection, are distinctly shown and are rendered amenable to treatment other than that for "bad sprains."

"Many fractures which have been described as rare have been shown by this method to have been rarely detected, while the exact determination of the form of fracture and the recognition of minute comminuted fragments have rendered coaptation more precise and the result of treatment more perfect."

One of the greatest influences of this method upon the treatment of fractures is the change it is bringing about in prognosis. Antisepsis has robbed the compound fracture of its gravity and the skiagraph has shown that in many cases the simple fracture is much more dangerous and liable to be followed by greater deformity and loss of function, and that its name is often a misnomer. The author advocates the change suggested by others of the terms open and closed for simple and compound; and advises in many instances the treatment of simple fractures by open operation, claiming that under aseptic precautions there is no danger commensurate with the advantages gained.

Of the medico-legal value of the skiagraph he says: "There seems to be no doubt that the only ground for damages in suits for malpractice must be, as formerly, based upon expert testimony as to the amount of deformity and functional disability of the patient. . . . There is, however, reasonable ground for holding that unless a skiagraphic examination of the fracture has been made, or at least suggested by the practitioner and declined by the patient, it can not hereafter be said that where functional disability exists the practitioner has employed all reasonable and ordinary means, to the best of his ability, in the treatment of the fracture."—*Nashville Journal of Medicine and Surgery.*

DARK CATHODE SPACE. Wehnelt. *Wied. Ann.* No. 7; abstracted briefly in Lond. *Elec.* July 29. *Electrical World*, N. Y. He investigated the nature of the discharge in the dark cathode space, by means of a coherer. The results go to prove that the discharge through the dark space has a disruptive character, just as though this space was a dielectric like paraffin oil.

LONDON ITEMS.

J. W. BARBOUR, M. D.,
Librarian Roentgen Society, London, Correspondent.

The Roentgen Rays in the Treatment of Hypertrichosis.

Dr. Eduard Schiff and Dr. Leopold Freund have recently published in the *Wiener Medizinische Wochensch*, (Nos. 22-24, 1898) a description of the removal of superfluous hairs (hypertrichosis) by means of the Roentgen rays. It appears from the cases which they give in their paper that hypertrichosis may be successfully relieved by this means. In order to avoid the production of inflammation they use a current which does not exceed a maximum of 2 amperes, the maximum tension being 11½ volts, and the source of the light is placed at a distance of 20 to 25 centimeters from the skin which is to be subjected to the influence of the rays, which are not allowed to act for a longer period than ten minutes. (When it is desirable to produce inflammation for some therapeutic purpose 3½ amperes, 12¾ volts, and a distance of 10 centimeters are employed.) The apparatus which they used is supplied by M. Kohl, in Chemnitz. They report the result of treatment in two lupus cases and seven cases of epilation. In their cases of epilation they obtained the best therapeutic result after seventeen to thirty sittings of short duration. In several of their cases they noticed that from one to two days before the hair fell out the skin showed a brownish discoloration, which disappeared in three to four days after the hair fell out. In several brunettes the hair became, before it fell out, snow-white. They confirm the observation of Freund, and later of Foster and others, that the effect of the rays is cumulative. Schiff was the first to publish a case in which lupus seemed to be cured by the x-rays, and the cases reported by the authors seem to confirm the result. In the parts treated, where there were previously lupus nodules, there is now small red depressed cicatrices under the level of the skin. From the report of Dr. Schiff and Dr. Freund it appears to be established that hair may be loosened and removed from the skin by the influence of the x-rays, and they append to their paper a footnote, in which they state that Dr. Joseph Jutassy has, since Freund's first publication, treated forty cases of hypertrichosis by the x-rays, and in some of them there had been no regrowth of hair after a year.

A Photographer's Skin Disease.—Dr. Leopold Freund has called attention to an affection of the skin of the fingers which in recent years he had observed in photographers. In a well-marked case the flexor surface of all the fingers of both hands was the seat of a diffuse dark blue-redness, which disappeared under the pressure of the fingers. The skin felt hard and thickened, and the fingers looked larger than normal. The appearance of the skin was as if the hands were lacquered, and both hands felt cold and dry to the touch. This change extended as far as the wrists; the backs of the hands were slightly affected. The nails and the secretion of sweat were not affected. In the early stage of this affection there is a feeling of numbness and anasthesia; later the fingers become stiff and are the seat of a disagreeable feeling of tension. There is no itching or pain. The cause of this peculiar affection is believed to be metol, a sulphate of metyl-para-amidophenol, which is now largely used for developing negatives. The condition is similar to what has been described as local asphyxia of the skin, and Dr. Freund emphasizes the peculiar varnished-looking appearance of the skin, which is produced by contact with this substance. Recovery takes place spontaneously in two or three weeks, when the workmen abstain from touching metol, the cure being hastened by the use of the ordinary ointments and plasters employed for an inflammatory condition of the skin.

ROENTGEN RAYS IN THE SOUDAN.—The daily press says that for the recent campaign two sets of Roentgen ray apparatus were provided. One of these, which was to be taken up the Nile by Major Battersby and be established at Abadieh. Considerable difficulty, and the greatest care had to be exercised to get the apparatus to the hospital in good order. At Korosko the temperature was between 115 deg. and 120 deg., but by dint of keeping the covers of the apparatus damp, it was got to its destination in good order, and, to the great relief of everybody concerned, was found to work well. Major Battersby has the assistance of Sergeant-Major Bruce, Royal Army Medical Corps, who has made himself an expert in the manipulation of the necessary complicated apparatus. This will be the main depot for Roentgen ray work, but Lieut. Huddleston. R.A.M.C., has taken a small outfit with 6-inch coil to the front.

At the request of the *Times*, Mr. John Le Couteur, the well-known expert, of 16, Brook Street, Grosvenor Square, left on Monday for Egypt, with the Roentgen ray apparatus, to meet Col. Rhodes, who is on his way from the Atbara to Cairo. Mr. Le Couteur will place his services primarily at the disposal of Col. Rhodes, and subsequently of others if required.

RADIOGRAPHY AND THE PHYSIOLOGY OF THE HEART.—M. Bouchard, at a recent meeting of the Academy of Sciences, reported some observations he had made upon the thoracic organs by means of the x-rays. Amongst other things he has been enabled to assert the existence of a marked dilatation of the auricles when the intra-thoracic blood-pressure is raised during inspiration. This condition is artificially brought about by endeavoring to inspire with the glottis shut, and is naturally brought about by the violent inspirations during a paroxysm of whooping-cough. M. Bouchard has also discovered that a clear horizontal space exists during forced inspiration between the shadow of the heart and that of the diaphragm, but during normal inspiration there is no space visible. This phenomenon, which is remarkable considering that the diaphragm and the pericardium are attached to one another, is explained by M. Bouchard in the following way. During the forced descent of the diaphragm in a large inspiration the inferior surface of the heart is in contact with the diaphragm to a very limited extent. The pericardium tucks itself into the space existing between itself and the heart, forming in front and behind a gutter into which in turn the pulmonary tissue is packed, thus forming a layer of tissue much more penetrable by the x-rays, than those which make up the heart and the diaphragm.—*Lancet.*

CONDENSER FOR INDUCTION COILS. Dubois. *Wied. Ann.*, No. 65, page 86; abstracted, with some of the illustrations, in *Elek. Zeit.*, August 11.—He measured the secondary current with an electro-dynamometer, varying the resistance in the secondary circuit and the capacity of the condenser shutting the brake in the primary. Three of the six curves are reproduced in the abstract; one of them shows that a condenser of too great a capacity can reduce the current below the value which it would have without a condenser; he also showed that a condenser at the spark gap of a primary can increase the current appreciably even doubling it, but that the capacity of the condenser is determined by the resistance in the secondary circuit; with an increase of this resistance the capacity diminishes.

THE VALUE OF THE X-RAY IN MILITARY PRACTICE.

Extract From an Address, "Recent Experiences in Military Surgery After the Battle of Santiago," by Lieut. Col. N. Senn, M. D., U. S. V., Chief of Operating Staff With the Army in the Field.

The value of the probe as a diagnostic instrument in locating bullets has in modern military service been almost entirely susperceded by dissection and the employment of the x-ray. If from the nature of the injury and the symptoms presented the bullet is located in a part of the body readily and safely accessible to the knife, and it is deemed advisable and expedient to remove it, this can often be done more expeditiously and with a greater degree of certainty by enlarging the track made by the bullet than by relying upon the probe in finding and on the forceps in extracting the bullet. If, as is often the case, the whereabouts of the bullet is not known, its presence and exact location can by the use of the x-ray be determined without any pain or any additional risks to the patient. All of the bullets removed on board of the hospital ship Relief were located in this manner. Dr. Gray, an expert in skiagraphy, who has charge of the scientific work of the floating hospital, has been of the greatest service to the surgeons in enabling them to locate bullets and in guiding them as to the advisability of undertaking an operation for their removal. His large collection of skiagraph pictures will also furnish a flood of new light on the effect of the small caliber bullet on the different bones of the body. Dr. Gray's work will constitute an essential and enduring cornerstone of a much-needed work on military surgery. The skiagraph has enabled us to diagnosticate the existence or absence of fractures in a number of doubtful cases in which we had to depend exclusively on this resource. In fractures in close proximity to large joints the x-ray has been of the greatest value in ascertaining whether or not the fracture extended into the joint. In one case of gunshot wound at the base of the thigh, in which the bullet passed in the direction of the trochanteric portion of the femur, opinions were at variance concerning the extent of the injury to the bone; some of the surgeons made a diagnosis of fracture, while others contended that there was no fracture, but believed that the bullet had made a deep groove in the anterior portion of the bone and had possibly opened the capsule of the joint at the same time. The x-ray picture clearly demonstrated the absence of fracture and the existence of a deep furrow with numerous fragments on each side. The x-ray apparatus also proved of the greatest practical utility in showing the displacement of fragments in gunshot fractures of the long bones, and enabled the surgeons to resort to timely measures to prevent vicious union. The fluoroscope has greatly added to the practical value of skiagraphy. In the light of our recent experience the x-ray has become an indispensable diagnostic resource to the military surgeon in active service, and the suggestion that the chief surgeon of every army corps should be supplied with a portable apparatus and an expert to use it must be considered a timely and an urgent one.

X-RAYS. Smith. Lond. *Elec. Eng.*, July 29. *Electrical World*, N.Y.—A short article in which he claims that there is some connection between the materials used for the anodes and cathodes, and the material which is to be examined by means of the x-rays. Every element or combination gives a certain definite ray or tint; whatever this tint or ray when heated in the Bunsen burner, it will be the same when given off in the x-ray tube; the vapor ray given from flesh is yellow-green, and the yellow-green ray from the platinum must therefore pass through the flesh, but not the bone; if the ray should penetrate the bone the anodes and cathodes should be made of compressed phosphate of lime or a clean piece of bone; if it is desired to see through steel the electrodes should be steel, brass for brass, etc. (It appears to be merely a suggestion as no proofs are given.)

EVIDENCE THAT ROENTGEN RAYS ARE ORDINARY LIGHT. Stoney. *Phil. Mag.*, August. *Electrical World*, N. Y.—A short article supplying an omission in his paper in the June number of that magazine and giving the following summary of the results arrived at in that paper: "Roentgen rays consist of two distinct undulations, which present themselves in succession. They are an irregular progression of independent pulses in the first part of their course—from the target upon which the cathode rays impinge up to the object which is being skiographed. Beyond that object, between it and the fluorescent screen, they are a different undulation. For, as proved in the June number of the magazine, the radiation from the target is the same *physical* (and not merely kinematical) event as the simultaneous advance over the same ground of trains of waves, some of long, others of short wave lengths. Since the resolution into these trains of waves is physical the trains advance independently of one another; so that if, by any contrivance, some of them can be stopped, the rest will be unaffected and will proceed. Now the flesh of the human hand is a contrivance of this kind; it is opaque to the wave lengths of all visible light and of much ultra-violet light, but allows waves that are below a certain limit of shortness to pass through it. Accordingly the trains of sufficiently short wave lengths are the only physical constituents of the first undulation which can get past this obstacle; and are what produce, by their co-existence in the space beyond, that second part of the Roentgen undulation which lies between the object and the fluorescent screen."

PROPERTIES OF THE VAPORS FROM THE CARBON ARC. Merritt and Stewart. *El'ty.*, September 7. *The Electrical World*. N. Y.—A brief abstract of an A. A. A. S. paper. They found that the vapors from an arc light behaved almost exactly like gases which have been acted on by x-rays, with respect to their power of discharging an electrified body, the only difference being that these gases retain their discharging power longer. When the vapors are drawn from the arc through a tube and caused to pass between a charged body and one which is grounded the former will gradually lose its charge, but the discharging current is not proportional to the voltage, as it increases less rapidly than the latter and approaches a limiting value. The discharging property is greatly increased if the vapor of water is introduced into the arc. The phenomena observed may be explained on the assumption that the air is ionized by passing through the arc—that is, the molecules of the air are to some extent torn apart so as to form positive and negative ions like in electrolysis. It is thought that the experiments probably have an important bearing on the theory of conduction in the electric arc.

RADIOGRAPH TUBES. Bonetti. *L'Ind. Elec.*, August 12. *Electrical World*, N. Y.—A very short Academy note. By varying the state of the gas in the interior of the bulb he succeeded in obtaining a lower resistance and thereby was enabled to use tubes which had become "hard" and were no longer of use. The method he used was to maintain a platinum wire at a red heat inside of the tube; the current was 2 to 3 amperes at 4 volts, and with this he obtained excelent results.

THE FALLACIES OF X-RAY PICTURES.

BY EDWARD A. TRACY, M. D., BOSTON.

Roengen's marvelous work on the properties of the x-rays (their nature is as yet unknown) has already been productive of much good in surgery and medicine—almost entirely in the field of diagnosis. The application of his discovery necessitates the rewriting of the text-books on fractures and dislocations. Facts, heretofore "smothered in surmise" are clearly set forth by the radiographs. For example, no writer, of which I am aware, on fractures, suspected the frequency, with which fracture of the ulnar styloid process accompanies Colles' fracture; yet this frequency has been demonstrated by radiographs of Colles' fracture.

While much has been gained in accuracy of diagnosis by the aid of x-ray pictures, there is one branch of practical medicine where harm is threatened by their employment. I refer to medical jurisprudence. X-ray pictures have been already admitted as evidence in some courts. Their indiscriminate admission will hurt the cause of justice—because they can easily lead to fallacy or error. Their use as evidence of injury, is only safe when certain conditions have been fulfilled, in their taking and presentation. I shall briefly indicate further on what these conditions are.

In all x-ray pictures there is distortion. The reason is x-rays emanate from a point, and are not parallel. Interference with these rays follow the ordinary physical and mathematical laws of rays emanating from a point. (Of course it is understood that there is neither reflection nor refraction of the x-ray.) Thus the nearer to the source is an obstruction to the rays, the larger will be the resultant shadow or picture; the size of the shadow depends also upon the nearness of the object to the surface upon which the shadow falls; the further the surface from the object, the larger the shadow. If we had for a source of x-rays a surface as large as the object to be pictured, there would be no distortion, for the x-rays would be parallel. X-ray pictures in that case would be easy of comprehension and never misleading. To read correctly the lesson of an x-ray picture, the obliqueness of x-rays must be kept in mind, and mental correction made for the disproportion and distortion caused by this obliqueness.—*Journal of Electro-Therapeutics.*

Distortion of the picture, in fluoroscopic examinations, caused by divergence of the x-rays can be easily corrected with mathematical certainty by the Dennis fluorometer.—ED.

REMOVAL OF A BULLET FROM THE BODY OF THE AXIS AFTER ITS LOCALIZATION BY SKIAGRAPHY.—In the *Intercolonial Medical Journal of Australasia*, Dr. E. Bird has published a case of this novel operation, which certainly could never have been carried out without the aid of skiagraphy. The operation was performed more than three months after the injury, at the earnest solicitation of the patient, who suffered a good deal from deep cervical pains on the left side and stiffness of the neck. A three inch incision was made along the posterior border of the sternomastoid muscle in order to gain access to the lateral aspect of the second and third cervical vertebra. The dissection was continued until the descending fibers of the first bundle of the levator anguli scapula were well defined in their upper two inches. The great vessels and nerves were held forward and search made for the bullet. It could be neither seen nor felt, but the transverse process of the axis was in advance of the next. On holding the pharynx forward the dark bullet was seen buried in the body of the axis. Bone had to be snipped away before it could be extracted; recovery followed.—*Journal of the American Medical Association.*

Western Surgical and Gynecological Association.

The eighth annual meeting of the Western Surgical and Gynecological Association will be held at Omaha December 28 and 29, 1898. Titles of papers from some of the leading surgeons of the west are already in the hands of the secretary and the coming meeting promises to be the most interesting yet held. The local committee of arrangements at Omaha is actively preparing for the entertainment and comfort of those who attend. Surgeons and gynecologists, and those interested in the progress of these specialties, are cordially invited to affiliate themselves with us. The secretary will be glad to send application blanks. Titles of papers should be sent to the secretary as soon as possible, but not later than November 20, to insure a place on the program.

GEO. H. SIMMONS, Secretary,
Lincoln, Neb.

D. S. FAIRCHILD, President,
Clinton, Ia.

COLORED PHOTOGRAPHS BY ACTINO ELECTRICITY. Delvalez. *L'Eclairage Elec.*, August 13. *The Electrical World.*—A short Academy note describing the following process: If a plate of brass forming a parasitic electrode is immersed in a mixture of the acetate of copper and lead and a current be passed through the liquid colored images will be produced, due to the deposition of the peroxide of lead; if different points of a plate of brass are unequally illuminated, local currents will circulate in the liquid, the circuits of which are closed through the plate; these currents produce electrolysis—that is, will deposit peroxide of lead at certain parts and those points which are equally illuminated will have identical colors; the colors vary with the amount of illumination. Experiments verified this deduction. The deposits observed were not caused by differences of temperature.

LUPUS TREATED WITH THE ROENTGEN RAY AND HOT AIR. E. Schiff reports two children with lupus completely cured to date by the application of the Roentgen ray, and Lang has also had similar success with the Hollander apparatus, a coiled metal tube connected with a Bunsen burner, from which a stream of hot air at a temperature of 228 degrees C. at a meter's distance was directed upon the patches. The scab and blister formed were only superficial, and the resulting cicatrization proved much smoother and more esthetic than after any other process.—*Munch. Med. Woch.*

CATHODE RAYS. Merritt. *El'ty.*, September 7. *The Electric World.*, N. Y.—A brief abstract of an A. A. A. S. paper on the magnetic deflection of diffusely reflected cathode rays. He measured the deflection of the so-called para-cathodic rays in a given magnetic field and compared it with the magnetic deflection of the direct cathode rays in the same tube, but could detect no difference in the behavior of these two sets of rays. He is therefore of the opinion that the para-cathodic rays are really the same as cathode rays, and result from diffuse reflection.

RADIOGRAPHS OF ENCAPSULATED TRICHINA.—Radiographs of encapsulated trichina in the muscle of a cadaver have been secured at Wurzburg, the birthplace of the Roentgen ray.

CATHODE RAYS. Villard. *L'Eclairage Elec.*, August 6. *The Electrical World.*—A reprint of an Academy paper on the emission and propagation of these rays.

INDIVIDUAL IDENTIFICATION SHOWN BY THE X-RAYS.

BY DOCTOR FOVEAU DE COURMELLES,
Laureate of the Academy of Medicine; Vice-President of the Society of Hygiene of France, etc.

Translated from the French by L. S. Newman, M. D., St Louis, Mo., for THE AMERICAN X-RAY JOURNAL.

The differences in transparency, even in opaque bodies, made apparent by the use of the Roentgen rays permit us to note important and useful differences of appearance as well as certain points of resemblance, thus allowing us to make certain standards for comparison. For the same Crookes' tube operating under similar conditions at two different times there will be differences in intensity, which it will not do to interpret as real in the examination of objects submitted to the radiations.

But, with these exceptions, it has been demonstrated that the capacities of different subjects vary greatly according to the age and structure of their osseous systems.

These are very important elements from a medico-legal standpoint. The age of the subject notably showing the tissues in process of formation is easily differentiated in the first twenty years of life, as the bones are not yet completely formed and present solutions of continuity allowing of an easy diagnosis. We can thus draw average standards by taking them from series of radiographic pictures taken at different ages.

The bearing of the application of the x-rays in estimating the gravity, the importance and the prognosis in fractures is also very great.

Eighteen months ago I was given an opportunity to examine a roofer, who, during the course of his labors had sustained injury. It was at this time that Roentgen's discovery was first made use of in the courts of France. The fibula had been broken and the fracture had been well reduced, but the subject complained of pain and weakness in walking, which, he claimed, prevented him from climbing upon roofs and carrying the materials used in his business.

If he was examined he cried out with pain, but if his attention was detracted, it was easy to make out a well formed callus and the patient said nothing. For this reason he was thought to be simulating. We submitted him to the x-rays and were then able to judge of the importance, to him, of the fracture, which undoubtedly constituted a partial disability on account of the character of the patient's occupation, in which the slightest mis-step might reproduce the fracture. The medico-legal importance of this fact from the particular point of view for which I was consulted naturally leads to a process of research in connection with the identification of individuals.

Knowing of the existence of a fracture in a person, who has been burned or mutilated beyond recognition, we can hope to identify him by the x-ray and conclude therefrom that a member found really belongs to the person supposed to have disappeared.

In the accident of the Bazar de la Charite, of May 4, 1897, at Paris, it would have been possible in certain doubtful cases to utilize this method, and deduct from certain callus formations then mapped out, the identity of the missing party, understanding of course that we know of the existence of certain bony lesions, even though as old as ten years.

In the case of criminals it might be possible to connect the complete skeletal description of the parties under arrest to the anthropometric examination; although it is true that it would be long and expensive and for this reason its application is not likely to occur soon.

Certain congenital luxations, visible it is true by the immobility and loss of function, might be examined in this way with a view towards making a prognosis.

During the maneuvers of obstetric operations the traction practiced might cause a scapulo-humeral or a coraco-clavicular disarticulation, which is difficult to map out and for which the surgeon would require radiography and thus easily and immediately show the lesions.

Acute Inflammation of the Prostate Gland.—*The Journal of the American Medical Association,* for August 20th, contains a report on inflammation of the prostate gland, which was presented to the Section on Surgery and Anatomy at the Forty-ninth Annual Meeting of the American Medical Association, held at Denver, Colo., June 7-10, 1898, by Liston Homer Montgomery, M.D., of Chicago, Ill. His plan of treatment in acute inflammation of the prostate gland is to wash out the abscess cavity with hydrogen peroxide, give copious hot water enema and hot hip baths frequently, avoid morphine internally and advise care lest the patient strain at stool or during micturition. On the theory that toxins are retained in the circulation and within the gland, and to prevent degeneration in the gland substance, he administers triticum repens or fluid extract tritipalm freely, combined with gum arabic or flaxseed infusion. Along with these remedies the mineral waters, particularly vichy with citrate of potash, go well together. Hydrate of chloral or this salt combined with antikamnia are the very best anodyne remedies to control pain and spasms of the neck of the bladder. These pharmacologic or medicinal remedies are the most logical to use in his judgment, while externally, applications of an inunction of 10 or 20 per cent iodoform, lanoline, as well as of mercury, are also of value.

CURIOUS REVERSED ACTION IN A TUBE.

BY ERNEST PAYNE

While experimenting with a tube a month or two ago, I noticed a curious effect, as if the action of the tube were in some way reversed, the current remaining in the same direction. I had connected a sheet of tin foil (mounted on a glass plate) to the cathode terminal, to see whether it would have any effect on the action of the tube by retarding, as it were, the arrival of the charge on the cathode side, and having an effect analagous to a condenser. When first started, the light and shade in the tube were reversed, x-rays were given off behind the cathode and from the back of the anode, causing the usual green fluorescence; the part usually illuminated remained dark, and no rays could be detected by the screen. The rays from the back of the anode were strong, and the bones of the hand were visible on the screen, while those from the back of the cathode were much feebler, although strong enough to show fluorescence two feet away and a shadow of the hand, but not to distinguish the bones.

The tube ran like this for about half a minute, and then suddenly reversed to its normal mode of action. I again tried it, without the sheet of tin foil, and the same reversed effect was produced; but it only lasted a few seconds, and then ran in the usual way.

I could not account in any way for this action, as the tube had been working the day before in the usual manner. The anode of the tube was composed of a disc of aluminum, with a thin plate of platinum attached to it, and with the usual form of cathode. The effect seems to show the very unstable condition of things prevailing in a tube when in action.—*Archives of The Roentgen Rays.*

Radiography in Coxalgia, Especially in Its Beginning. Congress of Science of Nantes, August 4 to 12, 1898. M. Redard.—Radiography renders valuable service in the study of alterations of the articulation of the hip, which are accessible with difficulty to clinical exploration because of their depth, and the thick muscular masses that cover them. It is particularly at the beginning of coxalgia that this method of investigation permits certain diagnosis, and, inversely to establish the fact of the integrity of the joint in false coxalgia. As respects treatment, radiography furnishes also valuable indications, by making it possible to recognize the exact seat of articular or osseous lesions, to determine displacements, deformities of the femoral head and the pelvis, the presence of sequestra or of purulent collections and periarticular modifications and changes. —*The Medical Times*, N. Y.

Dr. Wm. M. Gray, the microscopist of the Medical Museum at Washington, was detailed by that institution for surgical work in the war, with special reference to the diagnosis of gunshot wounds by the Roentgen rays. In giving the results of his observations Dr. Gray says:

"One thing this war has taught is that the probe in all its forms has gone out of use. No more searching blindly in a man's body for the bullet; no more danger of blood poisoning from the introduction into the wound of instruments of search. The fluoroscope tells us instantly where the projectile has imbedded itself, and we have only to cut it out as if it were there before our eyes. The ingenious electric probe and all similar devices have seen their day. In all future battles experts in skiagraphy will be attached of necessity to the Medical Corps, and the work of the surgeons will be materially assisted by their precise indications. We took out bullets by the pint on board the Relief, and almost without exception they were located by the x-rays.

"It is all done in a few moments; five seconds for a wound in the hand, thirty seconds for one in the foot, and not over ten or fifteen minutes for a wound through the thick pelvis. The patient is stretched out on a table, the x-ray bulb adjusted over the wound, the plate put under the limb or part where the wound is, and the thing is done. The plates are developed almost instantly. In many cases we save hours of vain searching; not infrequently we save the soldier's life."

Air Under Powerful Electric Stress. Trowbridge. *Phil. Mag.*, August. *Electrical World, N. Y.*—A short article on the behavior of air and rarefied gases under powerful electric stress. He lately increased the number of his condensers to 120, thus obtaining an E. M. F. of 3,000,000 volts. The initial resistance of air under these circumstances is greatly reduced, and the curve representing the relation between spark length and voltage departs from a straight line beyond 1,200,000 volts, approaching the axis expressing the voltage; thus the extreme length of spark in air with 3,000,000 volts is 6.5 feet, whereas it should be 10 feet if the proportionality between spark length and voltage had been maintained. This departure from proportionality is due to the increased conducting power of air; a powerful brush discharge passes to the floor and walls; portions of the discharge are shunted through the surrounding air; with still higher voltages it is probable that the resistance of air would be of the order of metals. The initial resistance also of highly rarefied media diminishes in a similar way; thus a Crookes tube which resisted the passage of an 8-inch spark is brilliantly lighted by 3,000,000 volts; one discharge lasting a millionth of a second is sufficient to obtain a photograph of the bones of the hand. The electrostatic field in the neighborhood of the apparatus is extremely powerful; long sparks can be drawn from neighboring metallic masses. The behavior of air and rarefied gases with powerful electric stress is analogous to that of elastic bodies under mechanical stresses; the initial resistance of air steadily diminishes with powerful electric stresses, and under disruptive discharges sinks to 2 or 3 ohms; this leads to a rapid change of potential producing the electro-magnetic impulses, which we have reason to believe, are the source of the x-rays.

Radiograph Showing an Osteitic Area. *Medical Review of Reviews.*—Dr. Myers exhibited a radiograph which showed an area of diminished density within the head of the radius and increased density about it. A sclerosing osteitis probably surrounded the site of a caseous focus which had been curetted. After many trials this was the first success he had made in locating a diseased area by the x-ray.

Radiography in Dental Surgery has been much improved by the use of the radio condenser (*Jour. of the Am. Med. Ass.*, xxx, 988) and "metallic rubber." Some interesting radiographs were recently presented at the Paris Acad. de Med., among them some that showed the fully-developed canines buried deep in the palatine arch, with no possibility of eruption.

Instructive Exhibits.

"One of the chief attractions at the annual gatherings of The American Medical Association is always the exhibition hall, where the principal drug, instrument and food products of the world, the results of years of experimental research and labor, are placed in view."

"Among the many attractive exhibits at this year's Denver meeting, that of Imperial Granum, recognized by many leading physicians as the standard among prepared foods, occupied a prominent space and the representative in charge was kept busy explaining to the visiting physicians the superiority of this preparation. Handsome sample boxes of the Food, and copies of The Imperial Granum Co.'s valuable clinical record, were presented to each physician in attendance."—From *The Journal of The American Medical Association*, Chicago.

Rheumatism.

There are many cases of rheumatism in its various forms, which otherwise prove most obstinate and unyielding, but which can be corrected speedily and thoroughly by the use of Tongaline Liquid or Tongaline Tablets or Tongaline and Lithia Tablets or Tongaline and Quinine Tablets, as the conditions may indicate, all to be taken at short intervals and washed down with plenty of hot water, as hot as the patient can bear it.

This treatment may be supplemented by the local application of Tongaline Liquid; or what is a very important fact the disturbing effects of internal medication upon an irritable stomach and sensitive nerves can be entirely avoided by the external use of Tongaline Liquid alone.

The affected parts should be sponged first with hot water, then with Tongaline Liquid, and cloths saturated with the remedy held in apposition by oiled silk bandages, applying heat by a hot water bag or other convenient method to facilitate absorption. Tongaline Liquid, in like manner, may be given externally by the aid of electricity.

For Acute Cystitis.—Bromide of Potash oz. ½; fld. ext. gelsemin. gtt. 10; fld. ext. hyoscyam. dr. 2; lithiated hydrangea (Lambert), q. s. ad oz. 4. Mix. A dessert spoonful every four hours. Milk and flax seed tea as drinks.—*Kansas Medical Index.*

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ROENTGEN RAY BURNS.

BY ELIHU THOMSON.

So much difference of opinion has been manifested by various writers who have considered the now rare injuries produced in x-ray experimentation, that it seems desirable that a clear expression of the writer's experience and opinion on this subject should be made. This is particularly the case since, in a number of cases, opinions and conclusions have been attributed to him which are not in his judgment, tenable in view of the facts.

Many writers have put forward with much emphasis the statement that the so-called x-ray burns are not produced by rays from the tube, but by electrostatic discharges to the skin surfaces owing to too close proximity to the tube in working. Others have said that ozone given off near the tube is to blame, &c., &c.

Various preventatives and remedial agents have been recommended, generally based on the idea that radiation of the nature of the x-ray was not the cause of the injury.

The writer's further experiments tend to confirm him in the opinion which he expressed when his first experiments were published, namely: That the burns *are produced chiefly by those rays of the x-ray order which are most readily absorbed by the flesh.* Such rays are sent out in large amount when the vacuum in the tube is too low or when the tube is "soft", to use Prof. Roentgen's recent designation. A "hard" tube or one with a high vacuum and requiring a high potential to work it will give rays that pass freely through flesh, and not being absorbed by the skin, can not of course do injury.

It is now quite well known that a gradation of quality, particularly as to penetrating power, is possessed by x-rays; that every tube in action evolves rays of low and high penetrating powers in varying amount according to the degree of vacuum and other conditions. This means that rays readily absorbed and those not so readily absorbed come together from the same tube.

To avoid any risk of x-ray burns even with prolonged exposures we must work the tube at such a high vacuum as to give rise almost entirely to rays of great penetrating power, or non-absorbability; or we may interpose between the tube and skin surface a screen which will cut off the more injurious rays by absorbing them.

However, with such tubes as are now in use and with the relatively brief exposures needed, the danger of causing injury is indeed practically of no importance. There is in fact no danger except in exposures at quite short range and lasting for an hour or more. The idea that the trouble is due to electrostatic discharges was effectually disposed of by the writer nearly two years ago, when after having made an experiment with the little finger of the left hand with quite severe results, he repeated the experiment with modifications upon the adjoining finger. This was protected by sheet lead which had a window cut in it so as to limit the effect of possible burns to a small elongated spot. This window in the sheet lead was divided by a strip of tin-foil lying close to the finger and in one of the divisions, so made the finger was covered by a double layer of aluminum foil the other division being left bare. An exposure for a short time to the rays of a special tube constructed so as to enable quite close approximation to the platinum anode target was followed in about ten days by two small burns, one on the part which had been under the aluminum foil and the other on the bare spot. It is inconceivable that any electro-static effect could have acted through the aluminum alone more than through the tin-foil, or more than through the sheet lead, as all three of these metal layers were in electrical contact and subjected to the same conditions. Electro-static effect, or electro-discharges were plainly ruled out. These results were widely published and should have settled the question of ozone, chemical effects, electro static discharges, &c., but from the persistency with which some writers attempt to clear x-rays of all kinds from all blame by assuming causes instead of experimenting to find the true cause we have been led to reiterate with emphasis the conclusion that certain kinds of x-ray radiation do cause burns if the exposure has been sufficient

Equal persistency is sometimes displayed in giving publicity to the statement that tubes worked by static or influence machines can not cause burns, while the fact is that a very severe burn was produced in only twenty minutes upon the writer's little finger, by a tube excited only by a static machine but which was of a power in watts of energy comparable with that of a small induction coil. This was more than two years ago, and the present peculiar livid scar still attests the severity as well as the peculiarity of the injury suffered. To meet the issue squarely and face the real facts will advance the science and give less cause for regrets, for in this case as always, "forewarned is forearmed".

The writer more than a year and a half ago exposed a healthy active mouse to the rays of a powerful tube for an hour. Between the mouse and the tube was a stout iron wire netting of about 3/8 inch mesh. This would only stop a small fraction of the rays but would screen the electro-static effects of brush discharges. particularly as the mouse was enclosed in a box covered by the netting. During the exposure the mouse did not seem to suffer discomfort. A few hours after the exposure it seemed to mope, failed to eat or drink and died during the second day. This experiment is of course not conclusive, as other causes may have intervened to cause death; but the result at least raises a presumption of injury by certain of the rays such as would be absorbed in passing through the body of the mouse.

When the rays from a very powerfully excited tube of medium degree of vacuum are passed through sheet iron the thickness of which may be increased gradually by adding sheets, it is found that while the addition of sheet after sheet rapidly cuts down the effect of the rays reaching the fluorescent screen back of the layers, there remains a certain proportion of rays which pass through quite a number of sheets. These are the more penetrating rays. By allowing the vacuum to rise and forcing up the potential so as to keep the tube in work the proportion of rays which get through without absorption is seen to increase greatly. The increase is all the greater no doubt because the highly penetrating rays in passing the fluorescent screen give little fluorescence owing to their not being absorbed by the substance of the screen. They give little photographic effect, and for the same reason. This leads to a curious speculation as to the possibility of obtaining rays of such high penetrating power as actually to pass a fluorescent screen without causing fluorescence or a photographic film without acting upon it. The action on the plate and the fluorescence of the screen are due to energy absorbed and converted into chemical action in the one case or light in the other, and if non-absorption be a characteristic of any order of rays evolved, their presence would be undiscoverable, unless perhaps they retained the property of causing the air to discharge electrified bodies, called ionization.

The injuries to the skin are in like manner due to energy absorbed and those rays which pass through the flesh freely are doubtless incapable of doing any injury.

LYNN, MASS.

ROENTGEN RAY DERMATITIS.

BY CHARLES LESTER LEONARD, A. M., M. D.,
OF PHILADELPHIA.
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In accounting for the inflammatory reaction and devitalization of tissue that follows long exposures to the Roentgen rays we must first eliminate all causes that experience has shown are capable of producing like results under different circumstances.

It is an accepted axiom of surgery that in making a differential diagnosis, all known agents shall be excluded before we can logically base an explanation of a new phenomenon upon the hypothetical action of an unknown agent. We must exclude all facts before dealing with hypothesis.

That electricity is capable of devitalizing and destroying tissue is well known. It must be first proved that the Roentgen ray dermatitis is not the result of this devitalizing action, before we have the right to attribute it to an unknown action of the Roentgen rays.

It is a physical fact that high potential currents produce static fields of electricity around their paths. Geissler tubes when introduced into these fields without any direct connection light up, giving visible evidence of the presence of electric currents, strong enough to affect the nutrition of any part exposed to their influence.

The physiological study of the action of electric currents shows that at first they stimulate nutrition, but if employed for too long a period or in too great strength, they devitalize and destroy the tissues upon which they act. High potential currents have a more marked effect on tissue than any other form of electricity and are capable of doing more injury.

The various pathological studies that have been made of the tissues upon which the Roentgen ray has acted, show that the dermatitis produced has nothing in common with the ordinary burn, but that it is a devitalization of tissue which is followed by disintegration and destruction. The long period that elapses before the effects are shown and the longer period that follows before these injuries are healed is strong clinical evidence that it has been a devitalizing agent that has interfered with nutrition and produced the pathological changes.

Whether the Roentgen rays do or do not possess therapeutic properties is still an undecided question; much has been claimed, nothing has been proved. No one has yet produced results that are indisputably the effect of these unknown rays; and until it has been proved that this therapeutic influence is not due to electrical stimulation, and the destruction to its devitalizing action, it ought not to be attributed to the x-rays.

Kummel, of Hamburg, (*cent. fur chirurgie*) showed before the German Surgical Congress the brilliant results which he has obtained in the treatment of lupus or tuberculosis of the skin by exposures to the Roentgen rays. The results are marvelous and show a study of the phenomena attending the Roentgen ray discharge.

If, however, the paper be critically studied we find that all the therapeutic action may be more reasonably attributed to the action of the static currents in the field that surrounds the x-ray tube. Moreover, the whole paper is a series of arguments in support of the therapeutic action of these currents. His best results were obtained by short frequently repeated exposures that never resulted in an active dermatitis. That is, stimulation without devitalization was desired. When any severe symptoms developed the treatment was discontinued until they had entirely subsided. It was noted that when the patient was seated on an insulating stage the effects were more marked and excessive, while long electric sparks could be drawn from all parts of the patient's body.

We thus see that his best results are obtained from the stimulant action of mild currents. That severe effects and devitalization are to be avoided, and that the danger of producing them is increased, and the effect of the exposure exaggerated, by placing the patient on an insulated platform so that the electrical effect is augmented.

It is difficult to understand how the action of the electrical currents so carefully observed could have been overlooked in determining the agent which had produced such valuable therapeutic results.

In discussing the therapeutic action of the Roentgen rays, Edward Schiff and Leopold Freund, of Vienna, state that the intensity of the therapeutic action is dependent upon the volume of x-ray discharge and the intensity and length of its application.

They found that the most energetic action was exerted by a tube of moderately low vacuum energized by a spark of high electro-motive force and amperage, $3\frac{1}{2}$ amp. $12\frac{3}{4}$ volts at a distance of about four and one-half inches and with a long exposure. The best therapeutic effects were produced by short, frequently repeated exposures at a greater distance from the patient and while the tube was energized by a current of less voltage and lower amperage, $11\frac{1}{2}$ volts and 2 amperes.

In spite of the increased severity of the action produced by the higher amperage current the authors can see but one explanation of the therapeutic properties developed, and believe they are due to the action of an unknown property of the Roentgen Rays.

What is the reason for the excessive action which they found in a tube of low vacuum, closely approximated to the patient and energized by a current of high amperage? It is that the higher amperage current, which the lower resistance of such a vacuum permits to pass through the secondary circuit, produces a more intense static field around the tube, while its proximity to the patient produces a more intense action on the tissues, which is again increased by a lengthened exposure.

The conditions under which their best therapeutic effects were produced coincide perfectly with this explanation, for they were produced by frequently repeated, *stimulating* exposures while the tube was energized by a current of lower amperage and voltage, and was at such a distance that the devitalizing action of the static field could not be exerted.

If it is the Roentgen ray *per se* that exerts this therapeutic and destructive action, why is it that they find a high vacuum tube, which we know produces the most intense fluorescent effects and has the greatest penetration or Roentgen value, has the least therapeutic value?

The reason is perfectly clear if we give the static electric field the credit for these therapeutic properties. The resistance of the high vacuum tube is too great to permit the flow of a high amperage current through the secondary, and it thus prevents the formation of an intense static induction field about the tube.

All these confirmations of the electrical causation of the Roentgen ray dermatitis and the therapeutic properties that have been attributed to it, coincide with my own experimentation and experience. So long as the secondary spark employed to energize the x-ray tube was low in amperage no dermatitis was caused. These deleterious effects were not produced until after my coil was rewound so that it gave a secondary current of high amperage, which had been found essential to the detection of all forms of renal calculi.

Since the first few cases were accidentally produced, the employment of an aluminum screen attached to a grounding wire, has prevented further injury. By the interposition of such a screen between the patient and the tube the static charge of electricity is collected in it and conducted to earth, while as it is penetrable by the Roentgen rays the fluoroscopic or skiagraphic efficiency is not altered.

The acknowledged protecting power of these screens, is of itself strong evidence that the agent that is at work and is eliminated by their use, *i.e.* the static electric current, is the cause of the dermatitis and the source of therapeutic action.

The deductions previously reported from my own experiments and cases are additional proofs of the correctness of these views. In two cases where it was desired to produce a therapeutic effect the action of the screen was sharply illustrated. When it was employed and the static currents were conducted to earth no 'burn' was produced. On the other hand when it was omitted the static charge collected in the patient and a deep necrosis was the result of the devitalization of the tissues. All the other conditions were identical and the fluoroscopic and skiagraphic quality of the rays was not impaired.

The Roentgen ray dermatitis is very painful in some of its degrees and heals with difficulty. The slight forms are affected by applications of dilute lead water. *Liquor plumbi subacitas dilutus.* Among the various remedies that have exerted some influence in the severer forms are zinc oxide, ichthyol and boric acid ointments with ten per cent of lanoline. The pain of the severest form is relieved by an ointment containing fifteen grains of antipyrine to the ounce.

The following is a summary of my

views on the so-called destructive and therapeutic action of the Roentgen ray :

1. Static electric currents are capable of producing all the therapeutic and destructive changes ascribed to the Roentgen ray.

2. A static field of sufficient strength is always present, when a tube is said to be capable of producing these results

3. Why should we ascribe to the Roentgen ray therapeutic and pathologic effects which the static charges, always present, are capable of producing.

4. It is impossible to produce a 'burn' when a protecting shield of aluminum is employed which collects the static electricity and conducts it by a grounding wire to earth, although the Roentgen efficiency of the ray is unaltered.

5. It is therefore reasonable to conclude that the devitalizing action attributed to the Roentgen ray is due to long continued or intense static charges or currents, while the therapeutic action is the stimulating effect of a mild and judiciously employed amount of the static charge.

6. The therapeutic results obtained are of undoubted value, but that value will be enhanced and its employment facilitated by the recognition of its true physiological source.

1930 Chestnut Street.

CATHODE RAYS AS CURRENT PATHS. Wiedmann and Wehnelt. *Mitt. Phys. Inst. Erlangen*, March : abstracted in Lond. *Elec.*, Sept. 9. *Electrical World.* —They appear to have established the fact that the great resistance opposed to the discharge by the dark cathode space is greatly diminished as soon as the cathode rays unite the cathode and the anode ; cathode rays, in fact, form a sort of conductor, penetrating the dark space. They also use Roentgen and ultra violet rays, but could obtain no diminution in the resistance. They conclude that it is only the paths of the cathode rays which are concerned in the discharge through the cathode space ; It does not follow, however, that the cathode rays perform the same function outside of the dark space.

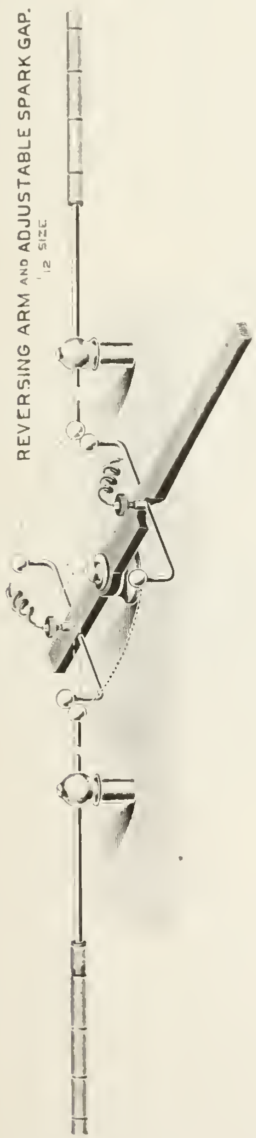
ROENTGEN RAYS. Levy. *Elec. Zeit.* Sept. 22. *Electrical World.*—A reprint of a paper read before the Union of German Electricians, on progress in the technique of Roentgen rays. He first discusses the theory briefly, and then the construction and application of the apparatus as made by him. Regarding the theory, he states that in Germany the tendency is now to favor the theory originated by Crookes, according to which the cathode rays are negatively charged particles, which are discharged at a high velocity from the cathode ; their velocity has been calculated, but the results differ greatly : it is, however, likely that it is much less than the velocity of light. J. J. Thomson suggested that these exceedingly small particles are the subdivision of the atoms, and that the properties of these elementary particles are the same. When these particles strike the anti cathode their velocity is suddenly checked, which produces ether waves of no particular period, which in their properties are analogous to the waves in air due to explosions ; these ether waves having no particular period are the Roentgen rays, light rays being periodic. He then discusses and describes the apparatus as he constructs it, an illustration being given. Among the three methods of producing these rays—namely, with the Tesla transformers, the influence machine and the induction coil—he favors the latter, saying that the former is no longer used in Germany, as there are two centers of omission of the rays ; to influence machines there are a number of objections, but if these could be overcome they would be a very cheap and good source of the rays.

A REVERSING SWITCH FOR STATIC MACHINES.

BY WILLIAM ROLLINS, BOSTON

Before a static machine is started only a prophet can tell which terminal will be positive when the machine is excited. On this account it is necessary to have means of easily reversing the current in using a Roentgen light tube. It is also convenient to have the reversing switch act as a double or single adjustable spark gap in series with the tube, because as stated in my notes in the *Electrical Review*, it is better to begin work with the vacuum a little low and get the necessary velocity of impact on the target from the cathode particles by using a spark gap in series. Then as the vacuum rises the velocity of impact can be kept constant by shortening the spark gap thus keeping the character of the Roentgen radiation constant. The accompanying figure shows a convenient switch which meets the requirements. Unless the static machine is very large so that the spark is painful to the ear it is not necessery to bring the terminals in contact as shown by the dotted lines in the figure before reversing the current in the tube, which operation is easily performed by simply moving the handle of the switch through a small arc. If only one spark gap is required one terminal of the static machine is drawn back a little, the amount being regulated by the length of spark gap desired. I have made for my use during the last five years static machines with plates from two inches to six feet in diameter and find this form of switch convenient for any size. The fact that it has been adopted by one or two makers of static machines would indicate that it was practical, and as it has never been described in print it seems worth while to call attention to it.

REVERSING ARM AND ADJUSTABLE SPARK GAP.
½ SIZE



250 Marlborough Street

CROOKES' CROSS. Villard. *L'Eclairage Elec.*, Aug. 20. *Electrical World*, N. Y.—An abstract of the French A. A. S. paper. In one of the well-known Crookes experiments a metallic cross is placed in a beam of cathode rays and a shadow is formed on the end of the tube; when the cross is then removed a brilliant cross will appear on a darker background, where the former shadow was. Villard explains this by assuming an increase of temperature of the glass, and describes experiments to show this.

THE DYNAMOTOR.

BY JOHN F. PITKIN, M. D., BUFFALO, N. Y.

It may not be an exaggeration to affirm that the electrologist of the present day finds as profound and exhaustless a field for study and investigation in the structural formation and functional activity of the dynamo as the man of medicine in the corresponding branches, the structures, *i. e.*, anatomy, and the functions, *i. e.*, physiology, of the human body.

It becomes expedient in the study of the dynamotor that we should in the most cursory manner pass in review only the salient features of its more common prototype, show how they differ from each other and point out its field of usefulness.

The Dynamo in its simple form consists of (1) *Field magnets*, two in number, either permanent of a horse-shoe shape, composed of magnetized steel. or temporary, consisting of a soft iron core, wound with insulated copper wire of a definite size, with a given number of turns in a prescribed manner, the iron core becomes magnetized whenever the electrical current circulates through the bobbin.

The purpose of the field magnets is to establish an electro-magnetic field, a condition of bound or locked electricity, which when undisturbed by conducting agencies circulates between the poles or extremities, through the intervening air gap, invisible to be sure, but always susceptible of demonstration.

The poles or expanded ends of the field-magnets are named, respectively, North and South, inconsistently from the dissimilar magnetic poles of the earth, but as that fact involves the telling of another story, beyond the scope of this article, we must for the present be satisfied with only mentioning the same *en passant*.

(2) *The Armature*, an electro-magnet, made by winding upon a soft iron core, several bundles or loops of wire of a given size, in a prescribed manner, is mounted upon an axis with another structure next to be described. Its function is to react inductively upon the field-magnets and while being rotated in the air gap intercept the electro magnetic lines of force. In accordance with the law of Michael Faraday which says, "The total electro motive force induced at any moment in a closed circuit is equal to the rate of decrease in the number of magnetic lines of force which pass through the circuit." (The one form of electricity being thus converted into the other).

(3) *Commutator*, several small metallic segments of a ring, insulated from each other, but connected electrically, to the ends of the armature coils, it is placed to one side of, but on the same axis with the armature, much as a ring is worn upon a finger near the body of the hand: its purpose is to render a current otherwise alternating unidirectional.

(4) *Brushes*, two in number, to bear upon the commutator, at two opposite but definite proportions of its circumference; they afford a place for the attachment of wires to conduct the current generated by the other portions of the dynamo into an external circuit.

VARIETIES OF DYNAMOS

Dynamos may be classified according to the method employed in connecting their integral parts, into, (1) *Series wound*, in which the current from one brush may be considered as passing seriatim, through external circuit, field-magnets. second brush, armature to the first brush, the point from which we started, thus completing the entire cycle.

(2) *Shunt wound*, each brush delivering the major portion to the external circuit and a minor portion to the field-magnets.

(3) *Compound wound*, involving a com-

bination of the two preceding methods.

It is almost needless to say that each method has its advantages. Dynamos of the first and second variety are not self regulating, but lose in potential, after a certain limited demand is made upon them. The third variety, the compound wound, on the other hand, maintains a constant potential under ordinary circumstances, irrespective of variations in demand caused by the turning off or on of lights or secondary apparatus, for the why and wherefore the reader is most respectfully referred to text books upon the subject.

A FIELD OF ELECTRICAL FORCE.

The armature of an unexcited dynamo which has been at rest, can for a time be turned upon its axis by a little child, but soon there develops a resistance to rotation which the child can not overcome; a man's strength is required; a little later the man in turn finds himself no longer able to overcome the increasing resistance, a steam engine of several horse-power becomes necessary. What has caused the difference in the amount of mechanical energy requisite for its propulsion?

The electro-magnetic lines of force which increase in number and power, tend by the attraction of opposite poles in the armature and field-magnets, (the former induced, the latter practically permanent,) to hold the armature in a stationary position, in accordance with the law of Lenz which says, "Induced currents are always in such a direction as to tend to oppose the motion that gave rise to them." Nearly the amount of mechanical energy expended upon the excited dynamo above the amount necessary to revolve the armature of one otherwise dormant will correspond, to electrical output, its so-called, transforming or generating capacity, the unit of which is called a kilowatt (one thousand watts). Not because mechanical energy is directly converted into electricity, but rather is employed to cause an electro-magnetic disturbance of equilibrium in the atmosphere sur-

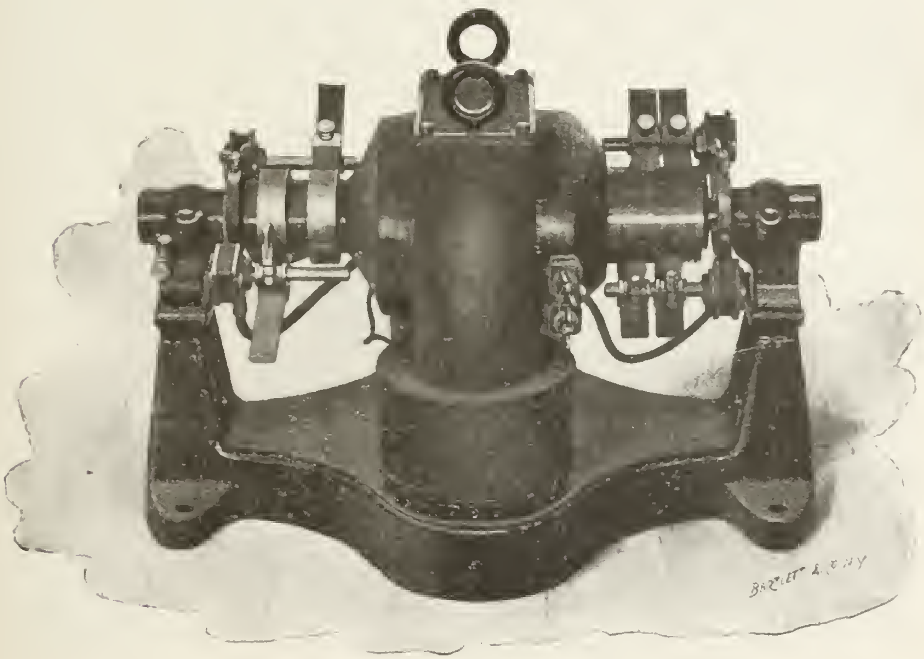


FIG 1

Size 5 C-W Dynamotor, Low Voltage and Low Frequency, Alternating Secondary rounding the apparatus resulting in its excitation or a (so-called) electrical flow.

We are forced to employ the time honored expressions, generate, electrical current or flow. etc., etc., more or less figuratively for descriptive purposes. There probably is not any such process as the terms imply. It has never been proven that there is any electrical flow, and even supposing the condition possible, we would be ignorant as to its direction. There is, however, *a field of electrical force*, consisting of lines and tubes of energy as first explained by the celebrated savant Maxwell, which by its activity causes a condition of charge and discharge, excitation or quietude of the electrical apparatus and its environment.

EXPLAINS THE ACTION OF THE ARMATURE.

As the armature of a dynamo is revolved, its coils of dissimilar phase or polarity are removed farther from the attracting field-magnets and as they are good conductors they become channels of less resistance than the increasing air gaps; thus they divert the electrical energy into an external circuit.

While the armature of a dynamo is quiet its potential may be considered at zero, but it will gradually rise in proportion to the rapidity of revolutions, strength of the field-magnets, and the number of turns of wire upon the revolving axis. It is obvious that increasing the strength of current in the primary, rapidity of its interruptions or the rate of rotation of a secondary coil has within certain limits, the same effect in the production of electro-motor force, by induction, as increasing the number of turns of wire in the armature or secondary; this fact will often enable us to dispense with expensive, cumbersome or multiple secondary coils.

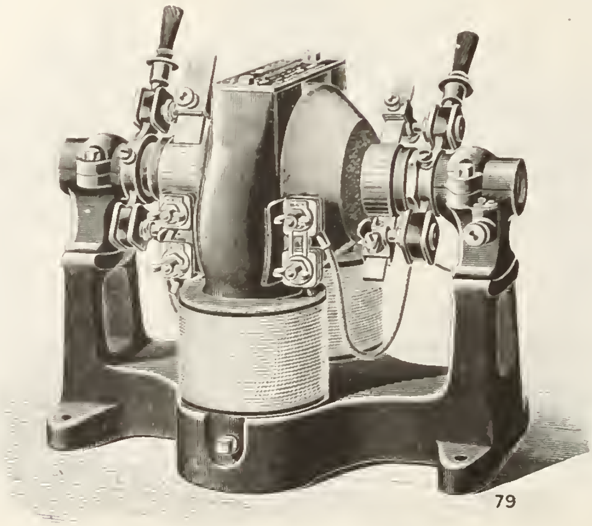


FIG. 2. SIZE 1 DYNAMOTOR

The strength of current from a dynamo, a dynamotor or an induction coil, *i. e.*, its amperage, providing there is not any external resistance, will largely depend upon the size of wires entering into the formation of its armature or secondary, one bearing a direct ratio to the other.

THE ELECTRIC MOTOR.

If a secondary dynamo is placed within an electrical circuit of suitable strength, the electro-magnetic lines of force will cause its armature to rotate; it is then capable of performing mechanical work,

e. g., turning the revolving plates of a static machine, and is called a motor.

When a motor or secondary dynamo has wires attached to the brushes and a current is thereby shunted off from the armature to be employed for various purposes, it is called a dynamotor.

THE DYNAMOTOR AND ITS MODIFICATIONS.

The dynamotor or rotary transformer may have one portion of its armature coils terminate in a commutator, on one side, as usual, and a second set of larger wires terminate in a second commutator on the other, in order to deliver two currents of different strength from the same instrument, or, instead of the second commutator two collecting rings may receive the ends of the coils of wire of opposite phase, giving rise to the alternating or sinusodial current. The former variety of dynamotor is employed in the telegraph, the latter in the telephone service, where they have entirely replaced the great number of chemical batteries formerly used at the central stations. It is in this manner that not only the short lines in the city of Buffalo are excited but the long distance wires between this place and Chicago, New York City, Boston, Philadelphia, Toronto and other remote and intermediate places receive their electrical supply, indirectly from the dynamos of the great Ellicott Square Building, the down-town home of the Buffalo Electrical Sanitarium.

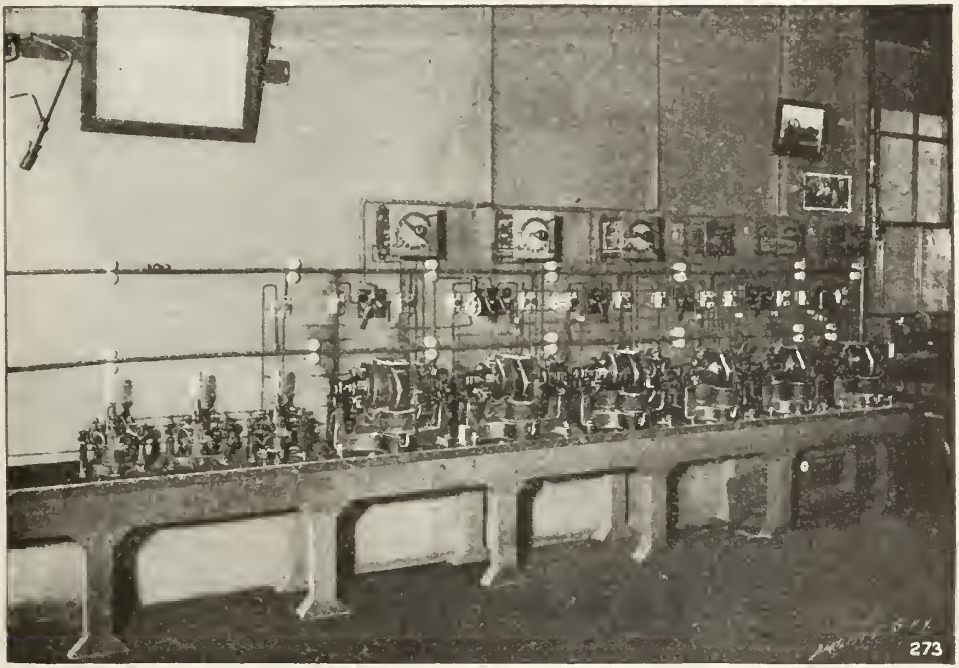


FIG. 3

Electrically Driven Telegraph Plant 20 Dynamotors. Western Union Telegraph Co., Buffalo, N.Y.

Through the intervention of the dynamotor the direct current may be transformed into the alternating or vice versa, (see cut No. 1.) a direct current of high potential and little quantity into one of low potential and greater quantity, (Fig. No. 2.) or any other combination desired by the operator, the number of watts or total electrical energy being always nearly the same, a little energy is necessarily lost during the transforming process by induction, (be it either up or down, in making the interchange.

THE DYNAMOTOR VERSUS THE INDUCTION COIL.

In the study of the structure and function of the dynamotor one may consider it as the modification of the common induction coil, *e. g.* Faradic or Ruhmkorff. The field-magnets are the analogue of the primary coil, and its soft iron core, the armature is the homologue of the secondary, the effect obtained by revolving the armature of a dynamotor results in the induction coil, from making and breaking the primary circuit at the interrupter or rheotome. For the thorough understanding of the process of induction upon all electrical devices we must not only try to comprehend what occurs in the conductors but also the condition of stress, or strain caused by the lines of force in the dielectric atmosphere, in the air gaps surrounding the apparatus and external circuit.

UTILITY OF THE DYNAMOTOR.

When the armature of a dynamotor is at rest its potential is nearly zero, but it will gradually rise with the increase in rapidity of revolution; it is governed in the same manner previously explained for the action of the armature of the dynamo. If a current from a bank of lamps is supplied to the field-magnets, suitably wound, the armature of the dynamotor will revolve with increasing rapidity and if there are many turns of wire entering into its formation, the voltage will rise with each additional lamp turned on, the range of potential being from one to eighty volts, which is all the electro-therapeutist can desire for the galvanic treatment of chronic diseases. It must be borne in mind that the current's strength of any electrical device bears little relation to the same after the resisting tissues of the patient have been placed in the circuit; it becomes in accordance with Ohms' law, a

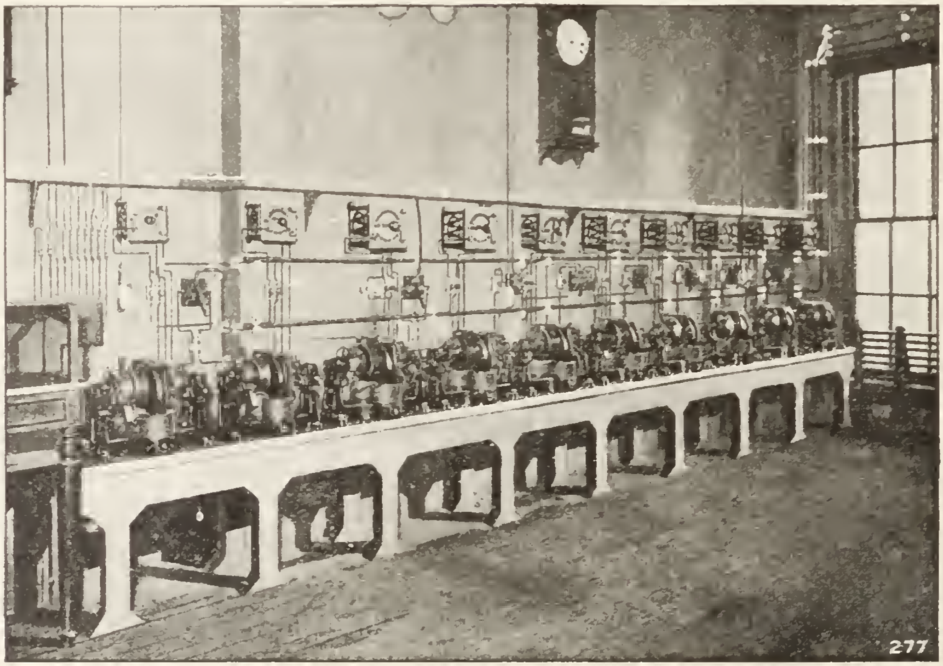


FIG. 4.

Electrically Driven Telegraph Plant 20 Dynamotors. Western Union Telegraph Co., Buffalo, N. Y.

question of voltage or pressure of the current divided by the resistance of the patient's tissues in ohms, interposed between the electrodes. The tissues may be good or poor conductors, depending upon the amount of moisture and salts they contain on the one hand and the tension of the current on the other, the higher the electrical potential the better conductor the human body becomes. When, however, we desire to employ the undulatory or interrupted galvanic treatment, additional strength will increase the so-called extra current, and the amount of shock with each pulsation.

AN IMPROMPTU DYNAMOTOR.

Any ordinary fan motor wound for the one hundred and ten volt direct current of the Crocker-Wheeler, or Lundell make, becomes a dynamotor by attaching conducting wires to the brushes suitable to galvanize the patient, placed in simple series with the electrodes, a milleamperemeter in the circuit will read from one to fifteen milleamperes according to the rate of rotation of the armature and the conductivity of the tissues. This current may be employed in the removal of superfluous hairs. The electrical needle should be attached to the negative or cathodal pole, and inserted into the hair follicle, while the indifferent, positive or anodal pole is held in the patient's hand. The needle may be replaced by the electrical knife, and employed to remove other facial blemishes or the same current used to convey chemical medicaments into the tissues, the poles being selected with a view to their electro-chemical properties, by the process of cataphoresis.

ADVANTAGE OF THE DYNAMOTOR.

As the dynamotor is wound to deliver a given quantity and quality of electricity it does away with costly, wasteful rheostats which reduce the current's strength, by converting a portion of the electrical force into some other variety of energy: it also lessens the danger of shock to the patient, which may result from an accidental overloading of the primary circuit.

HOW TO DETERMINE THE POLARITY.

The polarity of the current from a dynamo, motor or dynamotor can be ascertained by suspending with a flexible cord, a horse-shoe magnet, so that it is free to move in the lines of force an inch or two above the machine: the magnet will first osciliate, then come to rest with its North pole pointing toward the negative brush of the instrument.

In conclusion let me say that the dynamo in all its varied forms finds its place in the armamentarium of the modern electro-therapeutists; it delivers to the patient currents of a definite strength which are employed for definite purposes, with the milleamperemeter and volt meter always in the circuit and before the eyes of the physician informing him as to the quantity, quality and total number of electrical units (watts) of the current, he obtains therapeutical without toxicological effects.

Quantity is used for x-ray and cautery work, preferably from the alternating service. Moderate tension for galvanization of the patient. Unidirectional for polar effects. Sinusodial for the see-saw stimulation of dormant organs, before or after passing through the high potential transformer. "The poor man's electrical bath" of Tesla.

CATHODE RAYS. Jaumann. *Wien. Akad. Sitzber.*, 106, p. 533; abstracted briefly in *Science Abstracts*, June.—He describes more fully the details of his experiments with the interference of electrostatic deflection of these rays.

STRUCTURE OF CATHODE LIGHT. Goldstein. *Berlin Akad. Sitzber*, 40, p. 905; abstracted briefly in *Science Abstracts*, June.—He describes the three distinct kinds of radiation.

Methods of Precision in Locating Foreign Bodies in the Head by Means of the Roentgen Rays, with Special Reference to Foreign Bodies in the Eye.*

BY CHARLES LISTER LEONARD, A. M., M. D.,
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The enthusiasm which greeted Roentgen's discovery of the x-ray has somewhat abated. A reaction has taken place, and we are now in a position to judge more accurately of the true merits of this method of diagnosis.

It is, however, with special reference to its use in determining the location of foreign bodies in the eye that I desire to call your attention. Many instances have been cited by reliable authors in which it was impossible to find the foreign body "located" by the x-ray, and with rather hasty judgment they condemn the entire method, and say that it is only useful in determining the presence or absence of the intruder, and that localizations are often more misleading than helpful.

They condemn the entire method because, in certain specific instances, it has not been employed in a sufficiently accurate manner to produce precise results.

It is impossible to make accurate measurements of any description by inaccurate methods, or with instruments lacking in precision, and until we apply to localization by the Roentgen rays accurate methods and precise instruments we cannot expect precise results. We must not condemn the method because, when improperly applied, it does not produce satisfactory results.

Among the conditions which add to the difficulties of accurate localization by the x-rays is the fact that it does not produce an absolutely true image. The skiagraph is a shadow cast by rays emanating from a point. The bundle of rays which project this shadow is, therefore, made up of rectilinear divergent rays, and the shadow must consequently, be larger than the object. Not only is this true, but the parts lying at a greater distance from a point where the rays strike perpendicularly are more distorted. The farther the tube is placed from the object skiagraphed the less distortion will there be produced, as the rays forming the bundle will be more nearly parallel.

The difficulties met with in applying methods of precision to the location of foreign bodies in the orbit, and in eliminating from such observations all sources of error, have led me to bring before you an apparatus for maintaining the foreign body in a fixed relation to a definite point in a known plane, corresponding to a point marked upon the skin of the patient, while a sufficient series of observation are made by the x-ray upon photographic plates, to determine the relation of the foreign body to the point upon the skin and the known plane containing it. During these observations the tube has an altered, yet definitely determined relation to the known point, and from the data obtained we are able to construct a series of triangles, the relational sides and angles of which can all be determined, while the third sides all contain the foreign body, since they are projections of its shadow.

The location of the foreign body, since it lies in each of the third sides, must be at their intersection, and since all the factors of these triangles are known. the absolute location of the foreign body can be mathematically proved. The principle involved in the calculation of the relation of the foreign body to this point in a known plane, from the data that are thus obtained, is identical with that of the method described by my friend, Dr. C. A. Oliver, before the American Oph-

*Paper read before the February meeting of the Section on Ophthalmology, College of Physicians, Philadelphia.

thalmological Society in May of last year.

The same principle is equally applicable to the location of foreign bodies anywhere in the body and always has the advantages of simplicity and infallible mathematical accuracy. (See *Annals of Ophthalmology*, Vol. VI., No. 4.)

Many other methods have since been brought forward for locating foreign bodies in the eye, based upon mathematical calculations from a series of observations on one or more photographic plates. Their chief fault lies in the fact that the majority of them base their calculations on points situated too near to the plate, so that their calculations are based upon measurements so small that an error that would be inappreciable in greater distances has a very marked effect upon the final result.

The great advantage of this method over any of these is, that the great distance between the points on which the calculations are based, usually twenty inches, minimizes the effect of any slight error made in taking the observations, while the fact that the localizing point is upon the skin of the patient is a marked advantage over all the methods that attempt to measure from any point upon the eyeball.

In this method any error produced by the movement of the eyeball affects only the foreign body, while in methods based on measurements from a point on the ball, the known point will be moved as well as the foreign body, and hence the error would be double in its effect.

In order to avoid the errors introduced by unconscious movements of the patient, as in respiration, the whole apparatus has been constructed in such a manner that its relational parts are rigidly connected, while the whole is firmly fixed to the individual. Any movement communicated to one part must affect the whole equally and does not alter the known relations of the tube, the foreign body, and the known point, or affect the final result.

The apparatus consists of a yoke that is firmly fastened to the shoulders of the patient. Upon the yoke and adjustable in two directions is an upright frame, which serves to hold the head of the patient in a fixed relation to the plate, which it also supports. On the upright frame is an adjustable arm, which carries the x-ray tube. Its angle, relation to the common base (the photographic plates) is variable, in a perpendicular plane and thus it is capable of forming one of the known sides of a successive series of triangles, whose varying third side is the line of the projected shadow of the foreign body.

By a subdivided arc, situated at the juncture of this movable arm and the common base of the triangles, *i. e.*, the frame supporting the plates, the relational angle in any position can be definitely determined, and, consequently, from the two known sides and included angle all the relational sides and angles of any one of the series of triangles may be constructed.

The apices of these triangles are at a point on a line connecting two lead ferrules that slide upon an aluminum wire, and at a known distance from the ferrules. The wire and ferrules are situated in the planes of the movable arm and the frame, and determine the apices of the successive angles made by them, by casting the shadow of the lead ferrules on the photographic plate outside of the field of observation.

This point is, therefore, readily determined upon the plates, and its distance from the upper lead ferrule, when added to the distance of the ferrule from the lower surface of the movable arm, should equal the distance of the focal point of the tube from that surface. The tube is thus placed in a plane of this known point, perpendicular to the surface of the photographic plates. From this known relation of the tube to the known point on the plane of the plates we are able to determine the distance of the foreign body above or below this plane.

The device for holding the plates permits the interchange of the series without any disturbance of the fixed relation of the foreign body, the tube, and the known point. The fixed relation of the tube, patient and plate, gives the skiagraph increased definition, as every movement communicated to the head, or plate, is equally communicated to the tube.

By using this rigidly connected form of localizing apparatus we have eliminated from our observations errors which might arise from the following sources alterations in the relation of the foreign body to the fixed known points, alterations in the relation of the tube to this point, during an observation, through unconscious movements of the patient, alterations produced in the interchange of the photographic plates, and errors due to the obscuring of any portion of the field by the localizing apparatus.

The only remaining source of error is the unconscious motion of the eye. This is a frequent source of error, which I have seen entirely destroy the image of an object whose presence a succeeding series of observations absolutely demonstrated. The best method of overcoming this error is, as many writers have shown, the closure of the eyes.

Attempts to fix the eye upon a definite point are generally failures, as the eye does not sustain the strain readily, and unconscious movements, as in winking, are certain to occur. With the eyelids closed, the eye remains quiet, and its position can afterward be readily determined by observing the prominence of the cornea through the eyelid.

The great advantage of this method is its simplicity and infallible mathematical accuracy.

The method of employing the apparatus is the following: The patient is seated in a chair, the yoke fastened to his shoulders, and the upright frame placed tightly against the temple, with

FIG I

the head held in position by the band attached to the frame. The fixed point is marked and the tube adjusted in a plane perpendicular to the photographic plate at the known point. The plate is then placed in position. The tube upon the adjustable arm is placed at an angle appropriate to the individual case, the angle noted, and an exposure made; a second plate is then substituted, the angle changed and noted and the exposure made. These exposures are repeated at different angles as often as may be necessary; two, however, usually suffice to give absolute localizations. After the plates are developed the distance of the shadow of the foreign body from the known point is carefully determined, and with the angle and known side in each observation give the data upon which the calculations are based.

The practical determination of the location of the foreign body is greatly simplified by substituting for the mathematical calculations the following graphic method:

The common side of the successive series of triangles, *i. e.*, the series of photographic plates is represented by a part of the line P.P.', (Fig. I.) A point, A, represents the location of the common apices of the series of triangles; on known sides, the distance of the tube on the adjustable arm, is represented by the known sides A B and A C of the series of triangles having for each triangle a known relational angle to the base line, *i. e.*, the angles P' A B and P' A C, etc. The distances, A D and A D', are found by measuring the perpendicular distance of the shadow of the foreign body, in the respective plates, from the line that connects the known points. Lines connecting these points B and C represent the projection of the shadow of the foreign body, which must, therefore, lie at the point of their intersection, X.

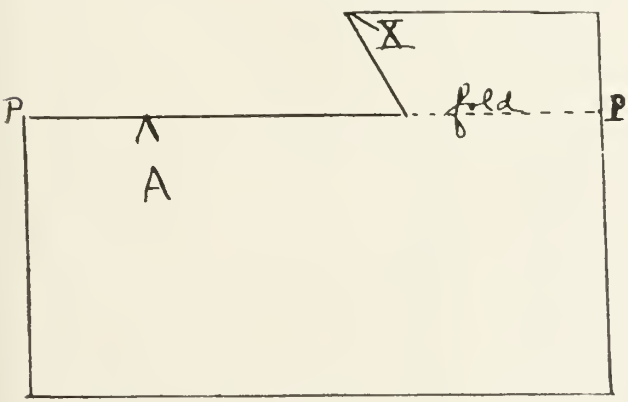

FIG. II.

We have, therefore, by constructing these triangles from the data obtained, definitely determined the relation of the foreign body to the known points and the plane containing them.

The following is a simple method of utilizing the knowledge obtained in locating foreign bodies in the eye: A piece of cardboard is cut (Fig II.) so that the point X has the same definite relation to the point, A on the base line, that it has in the drawing. If the card is now bent to a right angle along the base line, the relation of A and X will not be altered. If it is then applied to the patient's head, with the larger portion of the card occupying the position of the plane of the photographic plates, and the point, A resting at the known point on the patient's scalp, the point, X would rest on the foreign body, since the smaller portion of the card represents the plane perpendicular to the photographic plate in which the point X was found. This, however, would be impossible if the foreign body was within the eyeball. But, if the point, X, is placed upon the surface of the eyeball, the distance from A to the point on the skin will represent the depth necessary to cut to reach it.

These skiagraphs represent some of the instances of localization by these methods without the use of the apparatus. In these cases the plate was bound to the side of the patient's head and the head held firmly by a suitable rest with the patient in a sitting position. The tube was adjusted by angles suitable to the individual case traced upon cardboard, the apices of these angles esting on the plate at a point opposite the bony orbital margin, while the common side ran parallel to the plate.

The tube was placed successively at the extremity of the other sides, thus two sides and the included angle were known in all the triangles, while the foreign body was situated at the point where the third sides intersected and could be determined mathematically, or more readily by the graphic method.

THE ROENTGEN RAYS IN THE DIAGNOSIS OF PULMONARY TUBERCULOSIS.

At the congress on tuberculosis recently held at Paris, Bouchard and Claude (Paris) presented a long report on the application of the Roentgen rays to the diagnosis of pulmonary tuberculosis. In that disease at the outset the lesions consist of new formations (tubercles, isolated or agminated) constituting an obstacle to the penetration of air, and of congestion of greater or less intensity. At this time the fluorescent screen will show at one apex or both, sometimes at several places in the lungs, small spots, ill-defined at their circumference, or a slight mistiness veiling one apex; in other cases a kind of stippling of small shadows on a less dark ground. Confluent pulmonary infiltrations with a tendency to softening and ulceration give rise to almost complete opacities; these are darker in the case of lobar infiltrations, lighter in the case of lobular infiltrations. The intensity of the shadows is proportional to the defect in the penetration of air into the lung: if the lesion forms a compact, voluminous mass absolutely impenetrable by the air, the darkness shown on the screen is complete: if there is a number of little nodules separated by parts still permeable by the air, the general opacity is less intense and on the dark ground are to be seen deeper shadows corresponding to points completely caseated. The formation of cavities reveals itself on radioscopic examination as on the plate, sometimes by an absolute opacity, sometimes by zones of relative transparency surrounded by spots of variable opacity. Absolute opacity is met with only in the case of cavities full of pus, or when the cavity is deeply seated and surrounded by pulmonary tissue stuffed with tubercles, or when a covering of dense adhesions prevents the passage of the light rays. If, on the other hand, the cavity is superficial, empty, and has a thin wall, it shows as a clear zone when compared with the neighboring parts of the lung more deeply shaded; it is oval in shape, and sometimes the ribs in front of it are visible. When the cavity fills up, the clearness which marks its situation diminishes, and there is only a large shadow, rather less deep at one part than in the rest of its extent. Every degree of variation is possible, but the essential character in all forms of the radioscopic image of cavities is the presence of a very dark zone more or less annular in outline, encircling a region relatively clear or altogether transparent, whilst the rest of the lung in the neighborhood is in shadow. It is a sharp contrast between these two elements of the lesion—spots relatively clear showing on a ground frankly dark, a shadow fining off at the circumference and sharply cut round the central clear zone—that is characteristic of a cavity. The pneumonic confluent form of acute phthisis reveals itself on the fluorescent screen by complete opacity of the diseased parts: this is explained by the fact that at these points the lung is no longer permeable to air. Effusion at the base is shown by a thick shadow which hides the diaphragm, and below is lost in the obscurity of the abdominal mass, and above is limited by a zone of penumbra directed obliquely from above down, from the axillary region to the vertebral column, or in the shape of a curve concave at the upper border. Examinations at intervals of a few days will show the variations in the extent in the liquid effusion by variation in the extent and form of the shadow. An intense opacity of generally rounded outline occupying the middle part of a lung in which the upper and lower parts have almost re tained their normal clearness suggests an interlobar effusion. Here, again, the variability of the shadows at different times is a help to diagnosis. Dense and extensive adhesions of the pleura, on the other hand, manifest themselves by shadows less dark but constant in their form. In such a case it is often impossible to distinguish the condition of parenchymatous lesions by radioscopic examination alone. Pneumothorax is characterized by an abnormal transparency of one side of the chest, which allows the light to pass through without any interference, except over a small area on the affected side corresponding to the retracted lung. The heart and the vessels may be displaced: the curve of the diaphragm is lower than in health. In hydro-pneumothorax and pyo-pneumothorax the appearances vary according to the position of the patient; if he is lying down, the whole of the affected side is dark: if he is standing up, the upper side of the part is more transparent than in the normal state, and the lower is opaque. Even slight tuberculous changes in the pleura affect the mobility of the diaphragm. In general terms it may be said that in pulmonary tuberculosis there is a diminution in the movements of ascent and descent in the diaphragm; this change may be observed on one or both sides. Radioscopic examination can also give important information as to the condition of the mediastinal glands in tuberculous patients. In acute or subacute bronchitis the two sides of the chest show little or no departure from the normal state, and there is no change in the respiratory movements of the diaphragm—negative signs which may be of some importance. In pneumonia there is complete opacity at the part corresponding to the lesion. This opacity, however, varies in its limits and intensity from day to day. The movements of the diaphragm are diminished on the affected side. Non tuberculous broncho-pneumonic foci cause a slight opacity. but according to Maragliano this becomes less marked on deep inspiration. On the other hand, foci of pulmonary sclerosis, like patches of tuberculous infiltration. do not become clearer on deep inspiration. In simple emphysema the permeability of the lung to air is increased, and thus the transparency is exaggerated, and the ribs are less distinct. Moreover, the emphysematous lung is larger than natural, and extends into the pleural cul-de-sacs, so that the transparent surface corresponding to the organ extends more upwards towards the mediastinum and particularly more downwards towards the abdomen. When the subject is examined at the back there is seen below the diaphragm a transparent surface of much greater extent than in the normal state. The authors conclude that the use of the x-rays makes it possible in certain cases to discover commencing changes in the lungs at a period when other methods of clinical investigation give no indication. In other cases it defines the extent or reveals the importance of a lesion insufficiently disclosed by auscultation or percussion. Again, it enables the practitioner to reject the hypothesis of tuberculosis in cases where symptoms and clinical signs of doubtful import puzzle the clinician; while at the same time it often enables him to trace to their true cause general disturbances which clinical observation has failed to detect. Radioscopy is not merely a method of control, correcting or supplementing the ordinary methods, but it yields new indications. By making visible the working of the respiratory apparatus, it shows the functional value of one lung. It dis closes the pleural adhesions, the pareses or ankyloses of the diaphragm, which limit the movement of expansion. In a word, it makes the evolution of the disease visible to the eye.

A. Beclere (Paris), in a communication on the same subject, said that for the exact and complete determination of tuberculous lesions radioscopy and radiography should be employed simultaneously. He dealt successively with the results obtained by the x-rays in (1) latent, (2) suspected, and (3) declared tuberculosis. In latent tuberculosis the patient has every appearance of perfect health, and presents absolutely no physical sign or symptom of disease. The frequency of this state of things is shown by the large number of cases among soldiers who have died of various diseases in whom old unsuspected tuberculous foci have been found. Kelsch made radioscopic examinations on 124 men admitted to hospital in October and November, 1897, for various medical and surgical affections, all cases in which pulmonary tuberculosis could be recognized by the ordinary diagnostic methods being carefully excluded. The results were absolutely negative in seventy-three of the cases, but in the remaining fifty-one the fluorescent screen revealed abnormalities of various kinds —lessened transparency of the apices, enlargement of the bronchial glands, more or less marked opacity of the pleura, diminished movement of the diaphragm. These appearances were considered by Kelsch to be characteristic of tuberculosis. He adds that the screen, by allowing, as it were, a pathological examination of the lung to be made during life, confirms the conclusion to which he has been led by post mortem examinations, namely, that in young persons latent tuberculosis exists in at least two or three of every five cases. The use of the x-rays also serves for the identification of tuberculous lesions which disguise themselves under the mask of anaemia, chlorosis, dyspepsia, and neurasthenia. In cases of suspected tuberculosis, if the disease attacks the lung suddenly, radioscopic examination shows chiefly a diminution in the clearness of the image at the apex and in the pushing down of the diaphragm on the affected side. Tuberculosis may begin by an attack of diaphragmatic pleurisy, the symptoms of which are so slight that the only proof that the pleura is involved and that the case is not merely one of intercostal neuralgia is supplied by the Roentgen rays, which show thickening, diffusion, and immobility of the diaphragmatic shadow. If the case is one of dry pleurisy with "stitch" in the side, but without any decisive physical sign, radioscopic examination shows superficial opacities quite close to the thoracic wall. In cases of effusion the condition of the apex in regard to transparency on the affected side must be carefully investigated. Even a slight degree of opacity in the region of the apex is important in regard to prognosis. In declared tuberculosis the lesions are plainly shadowed on the screen. In such cases radioscopy is more valuable for prognosis than for diagnosis; it will show when both apices are attacked where clinical examination appears to warrant the conclusion that one is still intact, or when the lesions extend lower down than is disclosed by ordinary methods. The x-rays are particularly useful for the detection of central lesions, which on account of the depth at which they are situated are apt to be overlooked.—*British Medical Journal.*

BI-POLAR DISCHARGE. Wien. *Wied. Ann.*, No. 6, abstracted briefly in the Lond. *Elec.*, July 15.—He abolishes the distinction between anode and cathode rays, substituting the expressions "streams of positive and negative particles": that is, it is claimed, shows a victory of the English view. Both kinds of light contain admixture of particles of the opposite sign, which he shows by an arrangement in which the cathode is put into an out-of-the-way side tube. The anode emits positive particles from its front surface, and the cathode, negative particles; both, if perforated, also emit particles of an opposite sign, though to a lesser extent.

CATHODE RAYS. Jaumann. *Wien. Akad. Sitzber.*, 106, p. a number of articles. One on cathode rays by Wiedemann and Schmidt, from the *Wied. Ann.*, 62, p. 603; another on the relation between the positive light and the obscure cathode region by Wiedemann, from the *Wied. Ann.*, 63: p. 242: another on the mutual influence of the different regions of the same cathode, by Wiedemann, from the *Wied. Ann.*. 63, 246: another on the deflection of the cathode rays by Kauffmann and Ashkinass from the *Wied. Ann.*, 62, p. 588; and another on the magnetic deflection of cathode rays by Kauffmann from the *Wied. Ann*. 62, p. 596.

MUTUAL REPULSION OF CATHODE BEAMS. Wiedemann and Wehnelt. *Mitt. Phys. Inst. Erlangen*, March; abstracted briefly in Lond. *Elec.* Sept. 9. *Electrical World.* N. Y.—Crookes, in his earlier work, believed that two parallel cathode beams were bent aside by mutual repulsion; the present authors repeated an experiment made by Weber, which the latter claims confirms this repulsion, but they obtained the opposite result; under favorable circumstances the rays can be distinctly seen cutting each other in straight lines without a trace of mutual repulsion.

FLUORESCENCE AND ROENTGEN RAYS. Arnold. *Mitt. Phys. Inst. Erlangen*, March; abstracted briefly in the Lond. *Elec.*, Sept. 16. *Electrical World*, N. Y.—He investigated whether the fluorescence of the anti-cathode has a favorable or unfavorable influence on the production of these rays. The anti-cathode was made to consist of a fluorescent and non-fluorescent plate, and a pin-hole camera produced an image of the compound cathode on a sensitive plate. With none of the substances used could any difference produced by luminescence be observed? It appears, therefore, that there is no connection between Roentgen rays and luminescence.

THE TREATMENT OF DISEASE BY ELECTRIC CURRENTS.

A handbook of plain instructions for the general practitioner. By S. H. Monell, M. D., Brooklyn, N. Y. Published by William Beverly Harison, 3 and 5 West 18th Street, New York. 1088 pages.

Another extremely valuable work on electro-therapeutics has been launched by the same author as the recent publication, "Manual of Static Electricity in X-Ray and Therapeutic Uses," which has attracted world-wide reputation thus early for its clearness of description, and usefulness to the general practitioner.

It would be impossible for us to specialize the headings of the 70 chapters in this volume in the space allotted for this review, therefore it must suffice to state that every known modern employment for faradic, galvanic and static electricity and their therapeutic indications are detailed in this volume with conciseness of language and minute directness of application, so that the general practitioner may read and understand

Probably no book on electro-therapeutics, and we say it conservatively, has ever equaled this volume for value to those of the profession who would use electricity as a therapeutic agent, and he who does not use it at this age is certainly not up to the times in his profession.

We therefore heartily recommend this volume to our readers, believing that they will not be disappointed in adding it to their libraries.—*Medical Times and Register*, Phila., Pa., January 1898.

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FLUOROSCOPES versus UNCOVERED SCREENS.

Soon after Roentgen's publication of his discovery of x-rays, Salvioni, abandoning the method of covering the tube with black cloth, invented the cryptoscope with which an uncovered tube could be used, the light being prevented from reaching the eyes by means of a box enclosing the luminescent screen. Edison by substituting tungstate of calcium and modifying the cryptoscope gave us his fluoroscope which in America has become a standard instrument. In making medical examinations the use of a fluoroscope is fatiguing to the eyes, because they are exposed to a confined and warm atmosphere and are required constantly to adjust themselves to variations in the light caused by removing the fluoroscope at intervals and subjecting them to illumination of the room. In making graphic records of the movements of the diaphragm and heart, as should be done in all examinations of the chest, the use of a fluoroscope is exceedingly inconvenient. It is therefore best to go back to a modification of Roentgen's method of enclosing the tube in a black cloth. Without modification this method is objectionable because the cloth (in damp weather) carries part of the current around the tube, thus wasting it. I prefer to place the tube in a box, as has already been done by several operators, though I find it objectionable to enclose the entire tube, on account of leakage, as with the cloth. The form I recommend is shown in Figure 43. The supports for the end of the tube are of hard rubber. The connections with the terminals of the generator are held in hard rubber plugs easily removed when it is desirable to disconnect them. This tube holder is to be used in the diaphragm holder shown on page 400 of this JOURNAL for September, 1898, Figure 34.

All powerfully excited tubes give off in addition to the short vibrations producing Roentgen light longer vibrations causing ordinary light. Enough of this latter escapes through the uncovered ends of the tube, which project beyond the box, to faintly illuminate the room so that the physician can see to move about and yet the light is too feeble to interfere with the use of the uncovered luminescent screen, which should be of the nonphosphorescent type discovered by Mr. Kinraide, in size not less than 11 by 14 inches, and placed in a light wooden clamping frame serving also to hold the tracing cloth in firm position. The frame is then secured in contact with the patient and on the tracing cloth are marked certain fixed parts of the body for reference, after which the movements of the diaphragm and heart or dull areas in the lungs are sketched in. This method of examination originated and developed by Dr. Francis H. Williams has been found to be very simple and convenient. The charts properly labeled and card catalogued are filed away, becoming invaluable and easily accessible records for subsequent study and comparison. As the use of Roentgen light enables us to detect diseases of the lungs before they can be found in any other way, the time is not far distant when consumption will be a much less serious disease than it has been, because, when detected early the patients have been found to rapidly respond to treatment. What have been supposed to be the very earliest stages are now proved by Dr. Williams to have been well advanced. In this connection I have already written on the importance of regular examinations by Roentgen light and have advocated them from the beginning to my patients. When there is an inherited tendency to weakness of the heart or lungs the importance of these semi-annual examinations cannot be overestimated.

FIG. 43.

WILLIAM ROLLINS.

PROF. ROENTGEN TO GO TO LEIPSIC.—The *New Yorker Staats-Zeitung*, in a dispatch from Berlin announces that Professor W. C. Roentgen, the discoverer of the rays bearing his name, has been tendered the chair of philosophy in the University of Leipsic, with exceedingly flattering inducements. It is also stated that the Professor will accept the call. In connection with this report, it may be of interest to state, that not long ago, in recognition of his valuable labors, Prince Ludwig, of Bavaria, created Prof. Roentgen a Baron. Kaiser Wilhelm has decorated the great scientist with the Order of the Royal Crown.—*Electrical Engineer.*

X-RAY APPARATUS FOR MILITARY POSTS.—According to the *Press and Circular*, November 9, the British War Office, recognizing the advantages of the x-ray in military surgery, has issued a large number of outfits to the home and foreign stations under its charge.—*The Journal of the American Medical Association.*

SKIAGRAPHY AND THE CIRCULATION.

WILLIAM SMITH,

Licentiate of the Royal Colleges of Physicians and Surgeons, Edinburgh, and of the Faculty of Physicians and Surgeons, Glasgow. Licentiate in Midwifery. Member of the Medico-Chirurgical Society and Fellow of the Obstetrical Society, Edinburgh. Demonstrator of Anatomy in the American School of Osteopathy, Kirksville, Mo.

It is probable that every teacher of anatomy has, at some period or other, felt in his inmost being a desire to see how the structures of the body appeared before being subjected to the mutilation of the knife and the necessary alteration of relations. This desire was satisfied in a great measure so far as the skeletal apparatus was concerned by the advent of the Roentgen rays ; but the extreme permeability of the soft parts of the body rendered further observation of little value. In the case of the vascular apparatus an easy method appeared to be the injection of the arteries with some substance impervious to the rays, and, of course, the first agent thought of was mercury. Unfortunately the metal is very heavy and also has a tendency on injection to be erratic in its distribution; as a consequence the mere weight of the injected material breaks down the smaller vessels, or, in other cases we find serious hiatuses in the resultant radiograph.

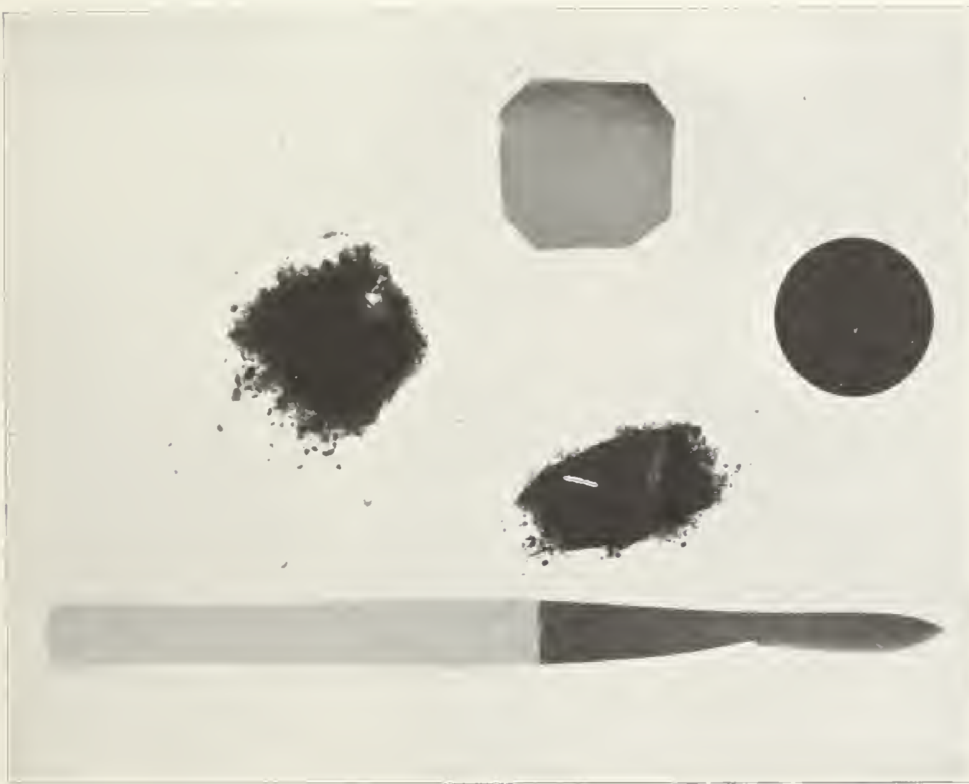

FIG. I.

The school with which I am connected as Demonstrator of Anatomy recently secured a ten-plate Van Houten and Ten Broeck static machine, together with a Dennis fluorometer and a series of large-sized Crookes' tubes, Monell type, and the idea entered my head to try and ascertain whether it was not possible to devise some system of arterial injection which should comply with the following requirements : First, be of such consistence as to be readily injected into the smallest vessels without solution of continuity; second, be almost, if not quite, as impervious to the rays as is bone: third, to be of such consistence, either on injection or immediately thereafter, as not to tend to gravitate to the more dependent parts of the body and so leave the higher vessels devoid of injection; fourth, be of such weight as not to rupture the smaller vessels. On these lines I made some experiments, and now present to THE AMERICAN X-RAY JOURNAL some account of my method and its results, prefacing what there is to be said by the remark that my work in this line is only in its infancy.

FIG. 2.

The first problem to be considered was as to what material would most efficiently interrupt the rays, and at the same time be readily introduced into the arteries. Metallic mercury for the reasons previously given I did not consider; solutions of salts I believed would be impractical as, in order to produce opacity, it would be necessary to wait for either precipitation or drying, and in either case the tendency to settlement in the more dependent parts was certain. I was therefore compelled to discover some agent which might be mixed with substances which would carry it into the body, hold it in suspension and then harden with it in position. I tested a few salts with the fluoroscope and found that vermillion (the bi-sulphuret of mercury, or red sulphide) was very opaque to the rays; the Chinese being rather more so than that produced in this country. In Fig. 1 I show the two specimens, (Chinese and the domestic article) as compared with such objects as a silver quarter-dollar and an ebony-handled dissecting scalpel. The little mass above the scalpel in the picture is the Chinese product. (And let it be noted that the vermillion is almost as opaque as metallic silver).

Having found my agent to be introduced, the matter of its method of introduction now arose; its settlement was easy. In my work as demonstrator I inject in all my subjects an arterial filling of tallow and spermaceti with coloring matter. It is more troublesome to produce than a plaster injection, but the result amply justifies the extra trouble. I made up a compound of tallow and yellow beeswax, selecting the latter instead of spermaceti as it hardens rather slower and also produces a mixture which is not quite as brittle as that made with spermaceti; the proportions being made simply by a process of "guess," adding more and

FIG. 3.

more beeswax until the consistency of the mixture when cold satisfied me. In the same manner I added my vermillion, taking a drop of the compound and examining it on the fluoroscope until the opacity of the mixture led me to believe that a body injected with it would have its arteries sufficiently clearly defined by masses of vermillion. It can thus be readily seen that the opacity of the material is marked, but that the particles of vermillion have been so far separated by the menstruum that the rays could readily pass between them and thus render the opacity very materially less than in the pure powder.

FIG. 4.

the rays to be capable of skiagraphic delineation. In Fig. 1 a small, regularly shaped object is seen at the top of the cut; that is a drop of the injected wax allowed to fall on a smooth surface, which after cooling was cut into that shape. The thickness is precisely that of the silver quarter, as also is that of the two

Having settled the preliminary points, all that remained was to inject some bodies with the mixture and then determine whether or not it was a success; first by fluoroscopic observation; second, by skiagraphy. The technique of the injection process is not difficult but disagreeable. I selected four bodies for the purpose, and from three of them illustrations accompany this article. Each body was first immersed completely in a bath of water heated to a temperature of 45 C. and the water was then kept at that temperature for two hours. During the latter part of this time the mixture for injection was heated to a point some- As an artificially heated body cools very rapidly (extremely rapidly as compared with postmortem cooling) this is an important point in any injection with material which is used hot, so also, to save time, it is well to expose the artery before immersing the body. The injection was made with a

FIG. 5.

what under the boiling point of water. Immediately upon the removal of the body the injection was made, the vessel selected for the purpose being the femoral for the reason that I judged, it being in a fairly central part of the body, the distribution of the liquid would be more rapid throughout the arterial system. metal syringe holding about thirty ounces, through specially made nozzles provided with stop cocks. The arteries were injected as fully as possible, save in one case shown where the injection was cut off from certain parts in order to exhibit the difference in appearance. The body was not moved after the injection was made until it was quite cold ; and then extreme care was taken to avoid flexion of any part which would, naturally, have broken the continuity of the hardened mass of coloring matter.

The accompanying illustrations were all made from three bodies, as already stated ; the first was the body of a male aged 35, slight build (No. 1); the second was a colored female, 22 years of age, medium build (No. 2); the third, an aged negro, spare but muscular (No. 3). In Fig. 2 No. 2 is shown on the fluorometer table. The position is that as the radiograph of the thorax was being taken. It will be noticed that the body is that of a fairly well-built woman, with a thorax by no means flattened.

FIG. 6.

The statement has been made that dead tissue is very much more impervious to the rays than living. Accordingly I made the exposure longer. But in Fig. 3 is seen a controversion of the statement. The two hands there shown are the right hand of No. 1, and the corresponding hand of a young woman who kindly placed her hand on the plate and allowed me to use it in comparison. Both hands were about the same thickness; the tube was so placed as to shed its radiance on a point precisely between the two; the exposure was three minutes. In the photograph both are *exactly* the same in clearness of definition. This fact was not, however, ascertained until I had made all of the other radiographs : hence the far longer exposure which is recorded in connection with each.

Fig. 4, hand of No. 1, shows very clearly the radial and ulnar arteries, as also the anterior and posterior interosseous, also the anterior carpal branches of the radial and ulnar, and the various digital branches. Length of exposure, 10 minutes.

Fig. 5 is placed next in order to show in contrast to the last an abnormal condition of the arteries. This is the hand of No. 3, and here we see a magnificent illustration of the tortuosity of the vessels in the aged, consequent upon the hardening of the vessels and their loss of elasticity leading to increase in their length. Note here that even in the small digital branches this is well demonstrated. Exposure, 10 minutes.

Fig. 6 is taken from No. 1, and here are seen the internal and external plantar arteries, with the plantar arch and digital branches. The exposure here was 12 minutes, but owing to the density of the tissues of the foot and the greater size of the bones the arteries are not seen as clearly as are those in the hand.

Two feet are seen in Fig. 7, these are from No. 2 ; in this case one foot and one hand were shut off from the injection by strong pressure on the arterial trunks. One foot is thus seen uninjected while the other shows plainly the track of the vessels. In Fig. 8 the hand in this case is shown, the radial and ulnar arteries are seen distended and distinct, their branches are invisible.

Fig. 9 is the elbow of the same case, here are seen the following vessels, the brachial bifurcating into the radial and ulnar; branches of the superior and inferior profunda and the anastomosing branches from the radial and ulnar. Note in this case the clearness of definition of the very small branches from the two profunda arteries.

In Fig. 10 is seen another pathological condition; No. 3 had at some time sustained an amputation through the junction of the middle and the lower third of the thigh. The femoral artery has here undergone consequent atrophy, (to a very great extent at least,) and in its lower part exists only as a very slender and rapidly diminishing trunk. In this case note that the injection has been broken subsequent to its introduction; also that, while the amputation had evidently been done long before, the bone is not rounded off. Exposure, 10 minutes.

Next follow three radiographs which I consider of special interest, none so ex-

FIG. 7.

tensive of injected subjects, so far as I am aware, having ever been attempted, and I am not a little pleased with my success on this first trial. Fig. 11 shows the thorax of No. 1. Here are well seen the base of the heart with the arch of the aorta and its branches. The axillary artery lying in close relation with the neck of the scapula, giving off the circumflex (which one, whether anterior or posterior, I am unable to say) and the subscapular. In the case of the latter it is interesting to note the curious twist; the artery requires the means for increasing and diminishing its length to accommodate to the movements of the shoulder. Nature has made provision. Compare this artery with the same in Fig. 12. Here also we see well the carotids in the neck, together with the vertebrals. In these last three illustrations special care was taken to have the Crookes' tube *exactly* over the center of the object to be depicted, and the anode level with the horizon. Hence we have, in each case, an almost absolutely symmetrical picture. Exposure, 60 min. Another thorax is shown in Fig. 12, that of No. 2; the same remarks as in the last case would apply in this, save that on one side it appears as though the axillary artery were double; this, however, may be only apparent, as in more than one case of employing hot injections I have found that the injected material has passed through the capillaries in a part and thus filled the veins. Here it seems too thorough, and in cases where colored wax passes through the capillaries it is always found of a distinctly lighter hue in the veins, much of the coloring matter having been filtered out

FIG. 8.

FIG. 10.

in the capillaries. Here both vessels appear equally opaque, I am thus inclined to believe that we have a double axillary artery. Time of exposure, 70 minutes.

The position of the tube in the cases of the two thoraces was precisely similar. It may be noted that the structures in the neck of No. 1 are much more distinct than in No. 2; the difference is due to the fact that in the female subject there existed a large goiter which, being so highly vascular, was distended with the injection and so tended in a marked degree to obscure the sublying vessels and bones.

Fig. 13 is a view of the pelvis of No. 2. This was somewhat disappointing to me as the pelvic vessels are not clearly defined. When one considers, however, the vascularity of the parts, and that all the vessels are filled with material somewhat opaque, it is not at all wonderful that even an exposure of 70 minutes should not show more clearly such large structures as the aorta and the iliac arteries. They all lie deeply, are covered by vascular structures, and these simply render the picture very cloudy. The superficial and deep femoral arteries are well seen, the internal and external circumflex branches of the

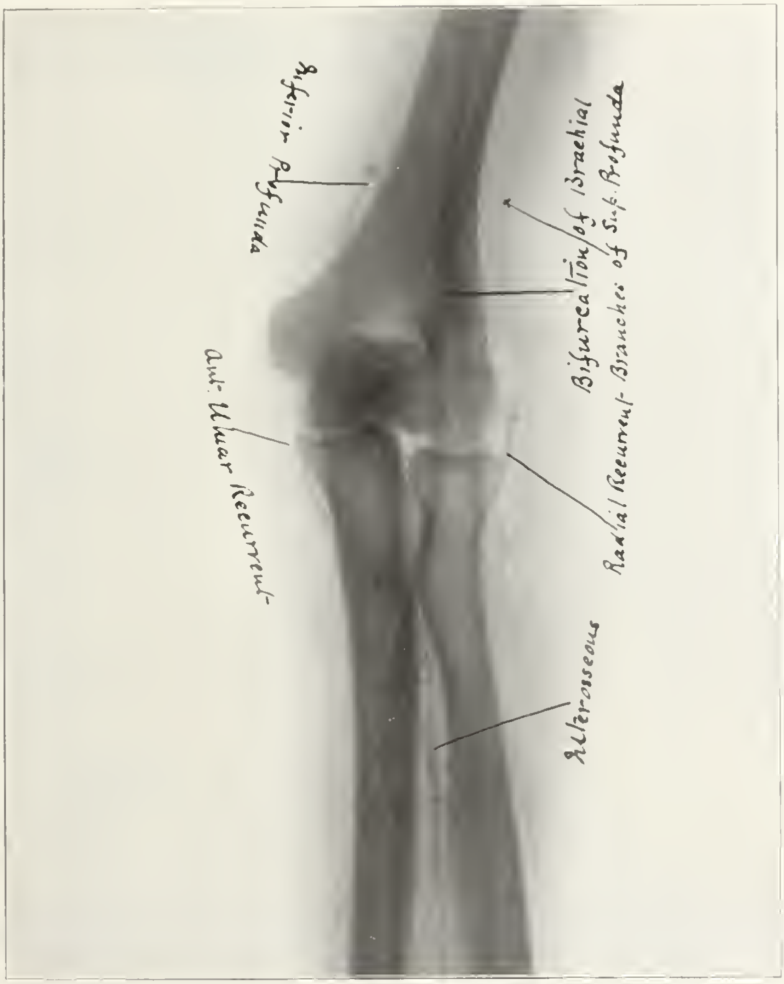

FIG. 9.

latter; the obturator lying in relation with the thyroid foramen and, very faintly, the sciatic and comes nervi ischiadici. The girl from whom this illustration was taken had the narrowest pelvis which I have yet noted; the distance between the anterior superior spines was only 17.5 cm, while she was a little above medium height and of normal build in every other particular.

As regards the height at which the tube was elevated above the plate; this varied from 30 cm. in the case of the hands, to 70 cm. in the case of the thorax and pelvis. The height in the latter cases was estimated with regard to the area to be covered.

While writing this paper I have before me reproductions of the photographs from which are made the illustrations which accompany it. These are larger and of course clearer than any half-tone can be; it may be, therefore, that my remarks do not apply with exactitude to the figures in the JOURNAL.

To Dr. David Littlejohn, who has charge of the X-ray Department in the school with which I am connected, and in which these experiments were carried out, I have to express my thanks for

FIG. II.

much valuable assistance; while Mr. Lee Hickman, a student, also merits acknowledgment for his very careful handling of the plates in development.

The Magnetic Deflection of Diffusely Reflected Cathode Rays.

BY ERNEST MERRITT

It is now known that x-rays are developed in a Crookes' tube at all places where the cathode rays encounter a solid obstacle. In the tubes now made the cathode rays are usually "focussed" on a piece of sheet platinum, and the x-rays proceed from this focus. But other rays are developed at this point as well as Roentgen rays, and are the cause of the brilliant fluorescence which usually covers about half the glass of such tubes. The rays are deflected by a magnet like cathode rays. In this they differ from x-rays, which are entirely unaffected by the most powerful magnetic field. Goldstein, who first observed these rays, believed them to be cathode rays that had been diffusely reflected from the platinum, just as light would be scattered by a roughened surface. S. P. Thompson believed that the rays were intermediate between cathode rays and x-rays, and

FIG. 12.

has proposed for them the name "para-cathodic rays."

The author has measured the deflection of the "para-cathodic rays" in a given magnetic field, and compared it with the magnetic deflection of the direct cathode rays in the same tube. No difference could be detected in the behavior of the two sets of rays. This fact must be looked upon as an argument in favor of Goldstein's view. According to the generally accepted theory, cathode rays consist of small negatively charged particles repelled at enormous speed from the cathode. It seems probable that when these particles strike an obstacle some are stopped, and by their impact produce the x-rays; a few of the particles may, however, rebound like elastic balls. The particles that rebound will then travel off with practically undiminished velocity and will form the "para-cathodic rays," possessing all the properties of the original cathode rays.

FIG. 13.

The author is therefore of the opinion that "para-cathodic rays" are really the same as cathode rays, and result from diffuse reflection.—*Electrical Engineer.*

LONDON ITEMS.

J. M. BARBOUR, M. B.,
Librarian Roentgen Society, London, Correspondent.

The Roentgen Rays in Italy.*

According to a review by Dr. Emile Boix in the current number of Duplay's *Archives*, one of the latest additions to the series of manuals which, to the number of over 600, have been issued by the well-known Milanese publisher Ulrico Hoepli with a view to the popularizing of science, art, and literature, consists of a volume by Italo Tonta on the nature, history, and practical application of the Roentgen rays. The author, who has studied his subject in several German schools, adds the experience of others to his own observations and advances certain hypotheses which he has formed regarding the nature of the rays and the effects which they produce. He also discusses their mode of action, chemical and luminous, and is able to find a great many points of analogy between them and lightning. Adopting Crookes' theory that all transmissible physical forces are due to vibrations through ether and matter differing from each other solely by reason of the relative rapidity of the vibrations, he likewise agrees with Roentgen, that whereas electricity corresponds to 33,359,730,750 oscillations per second the x-rays should be included in the category which corresponds to about 300,000,000,000 oscillations per second. But Signor Italo Tonta does not adhere exclusively to the dry bones of science, being evidently of opinion with Horace that *omne tulit punctum qui miscuit utile dulci*, for he quotes the following definition of electricity which was written by Galileo Ferrari in an album at the request of a young lady with scientific aspirations: "Ever since Maxwell showed that luminous vibrations may consist in periodic variations of the electro-magnetic forces and his theory was given an experimental basis by Hertz, who adduced facts to prove that electro-magnetic oscillations propagate themselves as light does, the idea has gone on growing ever firmer that the luminous ether and the medium where electro-magnetic forces have their seat are one and the same thing. Wherefore, O! maiden, so intelligent and so amiable, who dost ask What is electricity? am I able to reply to thine inquiry. Electricity is not only the titanic agent which tearing athwart the atmosphere terrifies by the crash of its thunderbolt, but also the vivifying agent which transmits from the sun to the earth by means of light and heat the magic color and the breath of life, which communicates to thy heart the pulsing of the external world and conveys to thy soul the enchantment of a look and of a smile."—*Lancet.*, 2, 22, 10, 1898.

*Italo Tonta: Raggi di Roentgen e loro pratiche applicazioni, 160 pp., 65 figs., and 14 plates. Milan: Hoepli, 1898.

IMPROVEMENT OF OVER-EXPOSED PLATES.—We know that plates when exposed too long in the camera are weak and uniformly gray when over-exposure is very great, only traces of an image are obtained. It suffices to dip a plate, even when much over-exposed, into a tartar emetic solution (2.5 grs. in 100 grs. of water) for about two minutes, let it dry and develop with hydroquinone, in order to obtain a strong image. Thus plates, otherwise useless, can be saved. It is indifferent whether the plate be treated before or after exposure. Salts of antimony or arsenic with organic oxide possesses the same property. It is the same with morphine and codeine salts; they give softer negatives than tartar emetic, with pyrogallic acid, and with hydroquinone. Amidol, metol, orthol, and pyro, when in very slight quantities (1 centigramme in 100 grs. of water), and previously oxidated by action of air, delay appearance of the entire image in case of under-exposure, and favor the appearance of the large blacks in case of over-exposure. They enable the obtaining of good negatives with strong contrasts when exposure has been excessively prolonged. Employed after exposure they delay appearance of the image and give it less intensity. These same non-oxidated developer-reducers, (particularly armidol) promote development when used with hydroquinone or pyrogallic acid. They increase the intensity of the blacks, and preserve great purity in the image. The various substances of which I have spoken act only when allowed to dry on the plate. It is useless to add them to the developer.—M. MERCIER (*comptes rendus*).—*The Photogram*, London.

X-RAY PRINTING is announced by Monsieur Georges Isambard, who describes himself as a "literary man," as a new money-saving printing process. He proposes to sensitize sheets of paper, to lay them over each other in thick pads, and to print by exposing to the x-rays, with a stencil-plate or type-screen "printed in ray proof ink." He proposes to have one set screen at the top and another at the bottom of the pile, in order that he may print both sides of the paper at once, and in order to prevent the rays from one side interfering with those from the other, he arranges his lines of type and his spaces to be of equal width, and so disposed that the line of type on one side of the page falls opposite the blank line on the other side. On his type screen he represents his lines by strips of lead which prevents the rays from passing through them. This is an exceedingly ingenious development of a suggestion which was made in quite the early days of radiography, but it suggests such obvious practical difficulties as to render it more like an interesting dream than a suggestion ever likely to be realized.—*The Photogram*, London.

Photographic Effects Produced by Bacteria.

The "rapid" dry photographic plate with its extremely sensitive film has become a most remarkable aid to knowledge. It has brought countless stars to view which had otherwise escaped observation even with powerful instruments and it has more recently demonstrated the existence of dark light, so to speak—i. e., of radiations which are not realized by the eye, having no apparent effect upon the optic nerve. Recent experiments have shown that almost all substances give off a dark radiation or, at any rate, something which affects the sensitive silver film. This has been attributed to the throwing off of vapor in minute quantity, but sufficiently to act upon the photographic plate in the same way as actinic rays. Dr. Percy Frankland has now shown that certain bacteria have the property of producing images. With some organisms the effect is obtained when the sensitized plate is placed at a distance of half an inch over the culture, whilst when in contact with the film definite pictures of the bacterial growths result. Since the interposition of a piece of glass prevents the action it is probable that the action is due to the evolution of volatile chemical substances. But with phosphorescent bacteria the phenomenon is evidently a different one, since the interposition of glass makes no difference, the organisms emitting a radiation which traverses the glass easily. It is suggested that it is quite possible that considerable differences as regards activity toward a photographic plate may be found to exist with different bacteria, in which case this property may become of importance in their diagnosis. If the method could be applied to the identification of typhoid fever and cholera bacilli in water its value in the service of public health would indeed be great.—*Lancet*, October, 22, 1898.

The Harbeian Oration on the Influence of Character and Right Judgment In Medicine.

BY SIR DYCE DUCKWORTH, M. D.,
Delivered before the Royal College of Physicians of London, on October 18th, 1898.

* * * * * * *

In a lengthy oration Dr. Duckworth touched upon Roentgen work as follows:

Amongst the secrets wrested from nature in recent times is the discovery of the Roentgen rays, which have already proved of great practical use to surgeons for the detection in certain parts of foreign bodies and the exact determination of injuries to the skeleton. To the physician these scrutinizing rays have as yet yielded little new information. Some varieties of renal calculi may sometimes be detected by them, but they afford no evidence of billiary concretions. We may, however, obtain indications of solid tumors and aneurysms, and enlargement of certain viscera. The therapeutic influence of these rays, if any exists, is as yet not determined. According to Rieder, of Munich, rays emitted from "hard," *i. e.*, high vacuum, tubes kill bacteria. Such rays have the highest penetrating power. With the assistance of my colleague, Dr. Lewis Jones, I have examined radioscopically the lungs of several patients with tuberculous disease in various stages. The physical signs were well marked and readily detectable by the ordinary methods of examination. The consolidated portions of the lungs gave no further evidence of their condition than a somewhat dark opacity, in mottled tracts, as compared with the luminous clearness of the unaffected parts. Pleural effusions and pneumothorax are detectable, also pneumodic consolidations, and even early and limited areas of tuberculous deposit. In a recent report on this subject MM. Bouchard and Claude, of Paris[27] declare that cavities can readily be discovered and even enlargements of bronchial lymph-glands.[28] The free movements of the diaphragm are well displayed and are well worthy of study, since it is found that this structure is lowered on the affected side in cses of consolidation of the apex of the lung and rendered dense and immovable in diaphragmatic pleurisy. The most startling revelation by means of the x-rays is that of M. Kelsch, who declares that he discovered the existence of pulmonary tuberculosis in 51 out of 124 military patients who presented none of the ordinary signs of the malady. With respect to these observations I will only say that I desire more detailed evidence and, with it, confirmation.

It may be affirmed that radioscopy and skiagraphs tell but little to the physician that could not be ascertained by other methods of physical examination, but they certainly afford additional means for accurate clinical determination. Thus, in a case of mitral valvular disease with great cardiac hypertrophy which I examined the melon-shaped outline of the heart could be seen to bulk more largely in the thorax than the physical signs alone led one to believe. With improved apparatus we may come to better results than any yet attained, and, indeed, there may be other secrets in the domain of electrical science awaiting diligent research, of which perchance some may serve to revolutionize our present methods of clinical investigation.—*Lancet.*

SPECULATIONS CONCERNING ROENTGEN RAYS. Woodward. *Elec. Eng.*, Oct. 13. *Electrical World*, N. Y.—A short article on the nature of these rays. Believing them to be vibrations of an inconceivably short period, he suggests that the rays may be very closely related to the solar spectrum, whose period of vibration is very short. He suggests that we might call electricity an "effect produced by a vibration capable of a minimum and maximum period, and, according to the length of the vibration period, are produced sound, heat, light, Roentgen rays, and electricity, in the sense we have understood it."—*Electrical World, N. Y.*

DEFLECTION OF CATHODE RAYS. Kaufmann. *Wied. Ann.* No. 6; abstracted briefly in the Lond. *Elec.*, July 15.—He superposes a magnetic upon an electrostatic deflection and from the resulting deflection he draws important conclusions. The deflection is inversely proportional to the square root of the difference of potential between the anode and the cathode. If along any given length of path a certain potential is maintained, the anode ceases to exert any influence and the deflection is inversely proportional to the square root of the difference of potential between the length in question and the cathode. The deflection obeys the law indicated by the emission theory.

ROENTGEN RAYS IN MEDICAL WORK.—A complete Roentgen ray equipment has been presented to the North-Eastern Hospital for Children, Hackney Road, Shoreditch, England, by the Duke of Newcastle. The apparatus throws an 18-inch spark, and is one of the largest and most efficient in existence.

THE attractive, unique and expressive Calendar of the Antikamnia Chemical Co., is out for 1899. Six lively pictures are shown of the bones of the face without the aid of the x-rays—the old, old way.

THE TREATMENT OF DISEASE BY ELECTRIC CURRENTS.

A handbook of plain instructions for the general practitioner. By S. H. Monell, M. D., Brooklyn, N. Y. Published by William Beverly Harison, 3 and 5 West 18th Street, New York. 1088 pages.

Another extremely valuable work on electro-therapeutics has been launched by the same author as the recent publication, "Manual of Static Electricity in X-Ray and Therapeutic Uses," which has attracted world-wide reputation thus early for its clearness of description, and usefulness to the general practitioner

It would be impossible for us to specialize the headings of the 70 chapters in this volume in the space allotted for this review, therefore it must suffice to state that every known modern employment for faradic, galvanic and static electricity and their therapeutic indications are detailed in this volume with conciseness of language and minute directness of application, so that the general practitioner may read and understand.

Probably no book on electro-therapeutics, and we say it conservatively, has ever equaled this volume for value to those of the profession who would use electricity as a therapeutic agent, and he who does not use it at this age is certainly not up to the times in his profession.

We therefore heartily recommend this volume to our readers, believing that they will not be disappointed in adding it to their libraries.—*Medical Times and Register*, Phila., Pa., January 1898.

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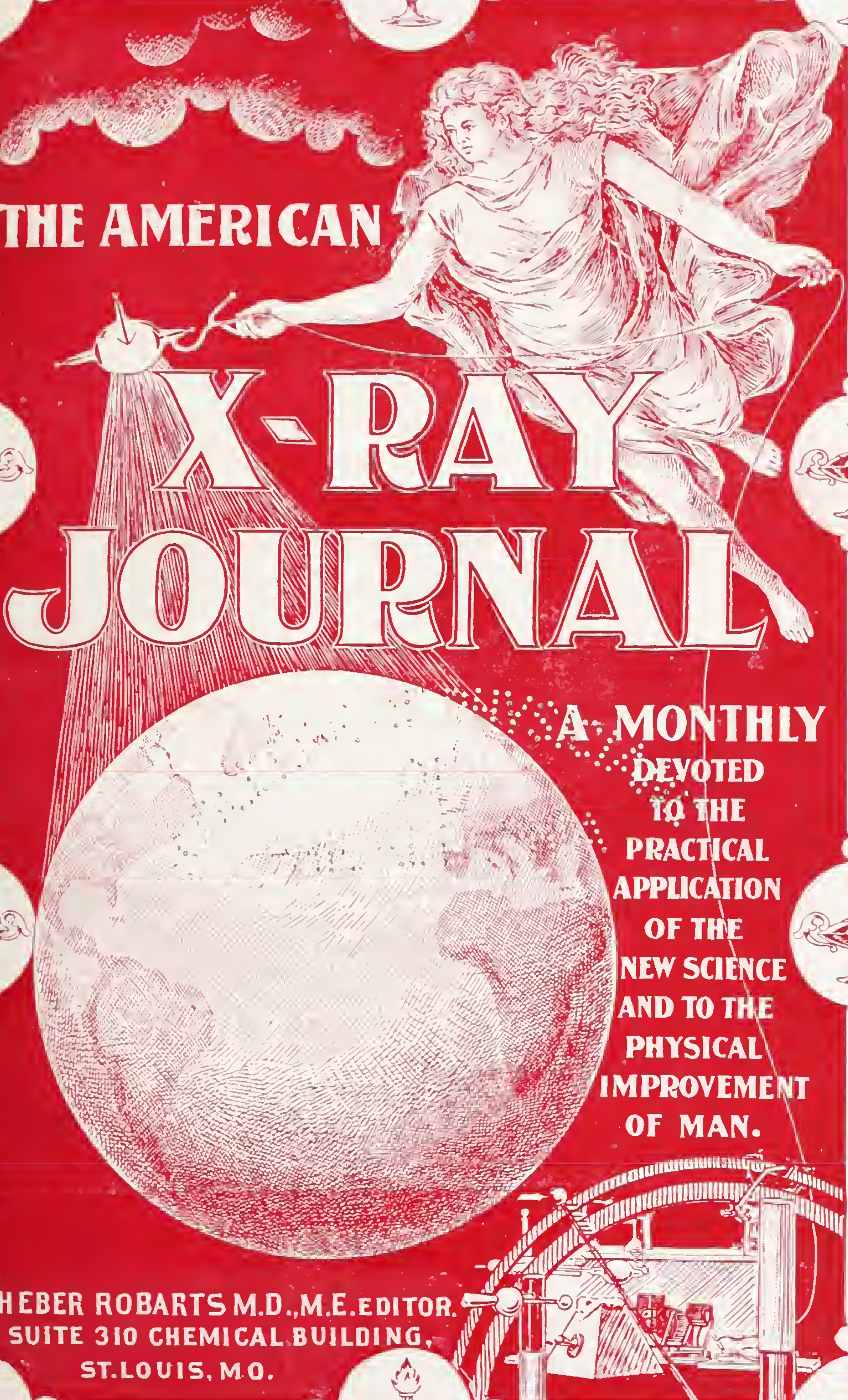

THE AMERICAN X-RAY JOURNAL

A MONTHLY DEVOTED TO THE PRACTICAL APPLICATION OF THE NEW SCIENCE AND TO THE PHYSICAL IMPROVEMENT OF MAN.

HEBER ROBARTS M.D., M.E. EDITOR.
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ROENTGEN LIGHT.

Accepting from the beginning the statement made by Crookes many years ago that the cathode stream was composed of material particles it seemed probable when Roentgen's discovery was announced that the wave length of this new form of radiation would depend upon the temperature to which the particles of the cathode stream were raised by their impact upon the target. To test this a tube was constructed in 1896 in which the metal target was hollow and could be cooled to any desired temperature. With tubes of this kind many experiments have been made, a few of the results which seemed likely to be of interest being published from time to time as a series of short notes in the *Electrical Review* during 1897-8.

As they are scatttered over a considerable period owing to the infrequent intervals available for preparing them, this summary of a few of the observations is now made.

The cause of Roentgen light is a high temperature of the originating particles.

The wave length of the radiation depends upon the temperature of these particles.

Their temperature is due to several conditions.

First—On the velocity with which they strike the target; the higher the velocity the greater their temperature.

Second—On the angle at which they strike; the greater the angle the higher their temperature: a glancing blow not stopping the particles as suddenly, their temperature never reaches a maximum.

Third—On the nature of the target; the denser the target the higher their temperature, because the denser metals stop them most suddenly.

Fourth—On the temperature of the target; the colder the target the lower their temperature—a target cooled below zero yields less light than when the temperature is several hundred degrees higher. On the other hand many observations indicate that a temperature sufficient to materially soften the surface of the target diminishes the efficiency of the tube.

The velocity with which the particles strike the target depends upon several conditions.

First—On the electromotive force; the higher this is the greater their velocity.

Second—On the distance of the target; the greater the distance the less violent the impact.

Third—On obstructions on the way. These arise from various causes—the degree of the vacuum; the form of the tube; the amount of harmony between the vibrations of the exciting current and the tube. One can get a good idea of what is going on in a tube when harmony is absent by looking out of a rear window of his town house during a wild snow storm and watching in the narrow alley with its irregular sides the tempestuous rush of the snow as it is driven by the constantly changing reflections of the wind.

Fourth—On the weight of the particles; a higher electromotive force is required to deliver mercury particles at the target with a given velocity than those of aluminum and oxygen.

The amount of light depends upon the quantity of energy utilized at the target; with a given velocity of impact the greater the amperage the more the light.

Definition depends on several conditions—

First—On the size of the radiant area on the target; the smaller this is the better the definition, therefore the target should not be at the theoretical but at the real focus of the cathode discharge, the distance of which from the cathode depends upon the degree of repulsion between the particles forming the discharge and is a result of the intensity of their charges. For the degree of exhaustion generally employed the focus is twice the length of the radius of the cathode curvature or double the theoretical distance.

Second—On the steadiness of the radiant area: due to harmony and right proportion between the size of the cathode and the surges.

Third—On eliminating other light sources, such as the second impact or that of rebound; the anode rush; the secondary source.

Fourth—On the proper form of the tube.

Fifth—On the use of the diaphragm.

Sixth—On shielding the object to be photographed from aerial reflections in the room by using opaque metal plates closed as far as possible so that no Roentgen radiation can reach the object except in straight lines from the target.

Seventh—On maintaining a considerable distance between the tube and the object, thus producing shadows of nearly normal size, a matter of importance in medical diagnosis.

Ninth—On the quality of light: it is unwise to flood the tissues with light of any wave length expecting thereby to bring out more detail. One of the reasons why a photograph often shows more detail than the fluoroscope is the smaller amount of light needed to affect the plate than to give clear images on the screen.

The Form of Tubes.—A tube should be of sufficient length to admit of the use of a high electromotive force. The cathode should be in proportion to the surges; largest for large condensers, smaller for Tesla coils, where the amperage of each surge may be less on account of the rapidity with which they come. There should be a simple method of lowering the vacuum to enable a large amperage to be sent through the tube for a long time without need of re-pumping.

The Residual Gases.—The atomic

weights of the cathode and the residual gases should be near each other.

The Target.—This should be so constructed as to enable a large amperage to be used without injury and so arranged that its temperature may be varied according to the kind of radiation desired, for it should be remembered that in the same tube, by changing the temperature of the target and the velocity of impact, we can make light of any wave length from the shortest Roentgen down to, including and below that of ordinary light.

Distance of the Cathode.—This should be less for small than for large generators. The cathode being a rapid firing gun should be placed in the most efficient position for regular and rapid loading, being shielded from the anode rush. The walls of the tube should be of such curvature as to prevent the return stream from causing collisions with the normal cathode discharge as well as to ensure a regular circulation. The target should be in a line between the cathode and anode or the cathode discharge will not strike with efficiency. When the anode is behind the cathode the concave surface of the cathode gives off so little force that the target is no longer an available source of Roentgen radiation with ordinary generators, while a diffuse stream of particles rises from the convex side and by their impact upon the glass walls give rise to a broad area of Roentgen light. The cathode discharge is therefore not independent of the position of the anode.

Generators.—There are no efficient ones outside the laboratories of the great electricians like Tesla and Thomson. Large static machines while very satisfactory for experimental work because they can be run for days without attention, yielding a constant amount of current, have so little amperage that they require the patient to be placed within a few feet of the tube. Ordinary induction coils are irregular in action while if made to give high electromotive force the discharges are slow and the amount of force delivered at the target is too small.

High frequency coils though condemned by eminent foreign authority on account of the imperfect definition from tubes excited by them, are our main hope for the future. This form of generator whose development we owe to Tesla can deliver a large amount of force at the target, while by keeping this from melting as well as by throwing the second light source out of the field, an astonishing amount of light can be obtained with good definition. No one, however, seems able to make them work with regularity, the interrupter being a constant cause of trouble. Until Tesla is willing to leave other work in order to furnish the profession with a suitable break we shall have but imperfect ideas of the value of Roentgen's discovery for medical diagnosis. WILLIAM ROLLINS.

WITHIN the past few years there has been a remarkable increase in the use of the static machine, and one of the foremost in advocating and popularizing its use in the profession has been Dr. S. H. Monell. He has also forced the recognition of the static machine as a preferable means for producing the x-ray, and that against determined opposition. A visit to his office gives no indication of ostentation or exaggeration, but convinces one that he is moderate in his claims, and has accomplished what he has by hard work and unremitting attention.—*Cleveland Medical Gazette.*

A GERMAN army surgeon states that in a large number of "sprains" of the ankle joints the Roentgen ray showed that in the majority of cases there was actually either fracture or dislocation of some one or more of the small bones. The treatment should be fixation, in order to prevent false joints, exostoses, etc., leaving permanent impairment of functions. —*Medical Times*, N. Y.

ROENTGEN RAY DERMATITIS.

BY ELIHU THOMSON.

I notice that in the November number of THE X-RAY JOURNAL immediately following my article on X-Ray Burns, there is a paper by Dr. Chas. Lester Leonard practically on the same subject.

He endeavors to show that electrostatic charges or effects are the true cause of the dermatitis and not Roentgen rays. In doing this, however, he misinterprets very ordinary electrical phenomena and conditions. Had he interpreted correctly the results he alludes to, his conclusions must have been the opposite of those which he takes so much pains to maintain.

He says: "It is a physical fact that high potential currents produce static fields of electricity around their paths." Also—"High potential currents have a more marked effect on tissue than any other form of electricity and are capable of doing more injury."

Both of these statements are based on a misconception. All electric currents in the same conductor are alike if of the same frequency and wave form. Properly speaking there are no high potential currents at all. Static fields of electricity are produced not by current, but by electric pressures excited upon insulating media. A current attends equalization or neutralization through conductors. Injury by electric current acting upon tissue is due, not to the potential, but to the current flowing. If a living organism can not stand more than a certain number of milli-amperes without being destroyed or devitalized, then it matters not if the source of such current be of high or low potential. It is the current which alone kills. It so happens that most tissues have so high a resistance as to require a considerable potential to force the current to flow, but if, for example, 1,000 volts exist in one case and 10,000 in another, and the conditions also exist in each case for the passage of only that amount of current which would destroy vitality, the difference of potentials in each instance will not affect the result. A person may indeed be killed by a very low voltage such as 100 volts if an excellent contact with the skin be made, as by the use of large surfaced electrodes of liquid; such as brine.

Abundant experience proves that, regardless of potential, currents of high frequency are almost without physiological action.

I have frequently passed such currents through my body without apparent effect, and in amounts thousands of times in excess of any possible currents due to static fields in the neighborhood of vacuum tubes.

This is significant taken in connection with the fact that just such harmless high frequency currents are often used in exciting Roentgen ray tubes of the double focus type.

Are such double focus tubes as excited by harmless high frequency currents, incapable of producing Roentgen ray dermatitis? Certainly not.

In referring to the discussion of the therapeutic effects by Edward Schiff and Leopold Freund, of Vienna, Dr. Leonard says:

"They found that the most energetic action was exerted by a tube of moderately low vacuum energized by a spark of high electromotive force and amperage, 3½ amp. and 12¾ volts at a distance of about four and one half inches and with a long exposure."

I confess I am at a loss to understand the "3½ amp. and 12¾ volts" as referring to the current and pressure used in working a vacuum tube. The current is absurdly high and the volts more absurdly low. But it is possible that the figures refer to the current and volts of the primary coil of a Ruhmkorff used in the experiments. The statement and that which follows "$11\frac{1}{2}$ volts and 2 amperes" is certainly obscure as it stands.

I make the quotation in which these figures are contained, not so much on account of the irrelevancy of the figures, but because it is stated that the "most energetic action was exerted by a tube of moderately low vacuum". This accords with my experience. Dermatitis *is* more easily produced by the low vacuum tube because a very large proportion of the rays emitted by such a tube are readily absorbed by the skin and flesh, and so do harm.

"What," says Dr. Leonard, "is the reason for the excessive action which they found in a tube of low vacuum," &c.

He answers his own question thus: "It is the higher amperage current which the lower resistance of such a vacuum permits to pass through the secondary circuit, produces a more intense static field around the tube, &c."

Nothing could be farther from the truth. This would be equivalent to saying that if the tube had no resistance the static field around it would be a maximum, which is the reverse of true. As electricians well know it is impossible to establish static fields between bodies joined by a conductor of no resistance or a perfect conductor. Is it possible that Dr. Leonard is getting "magnetic field," which is stronger the stronger the current, mixed up with "static field"?

He says again: "If it is the Roentgen ray *per se* that exerts this therapeutic and destructive action, why is it that they find a high vacuum tube, which we know produces the most intense fluorescent effects and has the greatest penetration or Roentgen value, has the least therapeutic value?'

And in his answer he is equally at fault. He says: "The resistance of the high vacuum tube is too great to permit the flow of a high amperage current through the secondary and it thus prevents the formation of an intense static induction field about the tube." Does not Dr. Leonard realize that an induction coil gives a maximum static field when its terminals are insulated or separated by a very high resistance; and does he not know that connecting the terminals of the coil by a copper wire, in which case the higher amperage exists, is just the way to prevent static field? His misinterpretation is as complete as it could well be.

The true explanation of the action of the high vacuum tube is very simple, namely, it gives off a less proportion of rays of easy absorbability by the skin and tissues and so does less harm.

Schiff and Freund were then quite right in their interpretation of their results as due to certain kinds of Roentgen rays.

I have already in my former article, shown why a screen of aluminum is a protection by its absorbing the harmful rays of easy absorbability, permitting the highly penetrating and harmless rays to pass. Electrically a wire mesh or netting would be about as effective a screen for static field as an unperforated plate, but I venture to predict that the hardy experimenter who uses a perforated screen with a low vacuum tube and long exposure will not escape, although the static effects will have been effectually shielded in such case.

The fact that complete plates used as screens afford protection is certainly, as Dr. Leonard says, "strong evidence that the agent that is at work and is eliminated by their use * * * is the cause of the dermatitis and the source of therapeutic action."

But in inserting with this quoted sentence the words *i. e.* "the static electric current" he spoils the statement as to its truth. In the first place, what, it may be asked, is a "static electric current."? That I am not acquainted with such a thing I must confess.

There are other statements equally curious to an electrician, equally meaningless, and quite fallacious if a meaning be assumed. Dr. Leonard says, "on the other hand when it (the screen) was omitted the static charge collected in the patient, and a deep necrosis was the result of the devitalization of the tissues."

Does not the doctor know that for a static charge to *collect in a patient* the latter must be pretty well insulated? Does he not know that the surest way to prevent its collection in the patient is to connect the patient to ground? Why not recommend that procedure as a preventative? He is, however, evidently unaware that a collected charge in a patient will reside only on the surface, not alone of the skin but of the clothing where it covers the skin; that it will diffuse itself and be most intense on the projections or extremities. Why then should such a collected charge, if it be assumed to collect, act only where the Roentgen rays are being absorbed? Why should it act *deeply* in any case? Why would it not produce a dermatitis on the ends of the fingers, on the nose and on the feet of the patient, where the static charge, assuming the patient insulated, can most readily collect?

Was there ever a case of such severe dermatitis produced simply by electrifying a person when mounted upon an insulating stool even with the highest static charges? Indeed I have myself while insulated been repeatedly charged for many minutes at a time to potentials such as would be able to cause sparks to leap over ten inches between body and ground, without ever having experienced the least ill effects.

Persons have been known to work day after day in proximity to electrified belts without trouble. The peculiar deep necrosis of the Roentgen ray burn was, I believe, unknown in the absence of the excited Crookes' tube and still always requires for its production such a piece of apparatus.

It is about time that occult and impossible properties of static fields should cease to be invoked to account for account for actions that have been plainly recognized and traced to their origin by suitable crucial experiments.

Let the persistent exponents of the static field mystery try the experiment of using a low or "soft" tube, energized so as to give abundant rays of easy absorbability by the skin, with a very long exposure and with a screen having say a hole of one-half inch diameter in it. Let the screen be grounded, if they please and under the opening let the back of the hand be placed on a finger and kept so that the rays through the opening continually enter the same spot of skin surface during the long exposure. The screen may be made of copper or brass heavy enough to take care of all eletrostatic induction. This it will certainly do in spite of the hole assumed to be made in it and through which the rays, purged of static field effects, may freely pass. It would be interesting to have a report of the conditiou of the spot of skin surface say two weeks after a conscientious trial of this kind was made.

I have tried just such an experiment, as I have before stated in THE AMERICAN X-RAY JOURNAL, but the opening in the screen was oblong and I have now a scar to show where the exposure was made. More than that, two thicknesses of aluminum foil were used over a portion of the spot during exposure and were not sufficient to prevent the dermatitis. Could anything be more convincing as to the fact that static field has nothing to do with the case? What more proof is needed that electricity or electric currents are not involved? On the other hand the *proof is positive that Roentgen rays of such character as to be easily absorbed by the tissues are the true agency in causing the dermatitis.* I was convinced of that by my experiments made over two years ago. I am pleased to find that Dr. Philip Mills Jones, of the University of California has written several papers putting forward views in substantial accord with my own and I am sure that any competent investigator attacking this question must be drawn to the adoption of these views.

FIG. 1.

FIG. 2.

SKIAGRAPHY IN GUNSHOT WOUNDS.

BY DR. GEORGE F. SHEARS

The following case is presented as illustrating the value of the x-ray in locating foreign bodies imbedded in the tissues.

Case. Mrs. S., æt. thirty-two ; three

years ago was shot in the neck. The bullet entered the left side about the level of the fourth cerebral vertebra, and on a line dropped perpendicularly from the lobe of the ear.

The line of direction through the tissue, according to the patient as received from the statement of her physicians, was upward and slightly forward. The bullet was probed for but could not be located, and after careful search had been made all attempts to find it were abandoned. It was believed that the bullet was in the deep structures near some of the great arterial trunks. The patient made a good recovery from the injury. Some six months after this she began to complain of neuralgic pains extending up the spine from a point midway between the shoulders to the base of the cranium ; accompanying this were symptoms of nervous irritability in other parts of the body. Her eyes troubled her, being the seat of pain, and often it was difficult for her to focus them upon near objects. She applied to several prominent surgeons, who advised her to let the bullet alone as in all probability it was located near the carotid artery, and would not only be difficult to find, but there was considerable risk in making the operation.

She applied to me and was advised to have a skiagraph made of her neck and the bullet accurately located. To this she consented, and the accompanying skiagraphs (Figs. 1 and 2) were made showing the bullet located to the left of the median line on the posterior side of the spine, and lying on the transverse process of the fifth cervical vertebra. An incision was made seven-eights of an inch to the left of the median line on the posterior surface of the neck over the fifth cervical vertebra and continued through the muscular tissue until the bullet was reached, when it was easily extracted.

Two points may be of interest to consider in addition to the locating of the bullet by the x-ray. First, the presence of the nervous symptoms ; and second, the course of the bullet. Were the nervous symptoms due to imagination, or did they follow from some injury done by the bullet? So far as can be determined by the location of the bullet they could not be due to its presence. It was imbedded in muscular tissue and could not impinge upon any nerve trunk of importance.

Still its removal, so the patient claims, relieved all except the eye symptoms. In regard to the second point it may be noted by looking at the skiagraph that the bullet is located with the point downward and is below its point of entrance. The bullet itself, you may observe, is slightly flattened upon one side. It is quite possible, therefore, that the bullet may have passed upward, as was believed by the examining surgeons, come in contact with one of the cervical vertebra and been deflected downward. And it may be that to some injury done in its passage, rather than to its pressure, are due the nervous symptoms suffered by the patient.—*The Clinique.*

Pressure in the Interior of Vacuum Tubes. Seguy. *L'Eclairage Elec.*, Sept. 17, and *L'Ind. Elec.*, Sept., 25. *Electrical World*, N. Y.—A reprint of an Academy note, in which he enunciates the following law : The internal pressure in an exhausted vessel is neither uniform nor constant in all the parts of the vessel when it is traversed by an electric current. To prove this he experimented with a tube 4 meters long and exhausted to a millionth of an atmosphere ; when a current was passed he found that for about half the length of the tube from the cathode end of the vacuum was about the same, but near the anode the pressure had been raised to about a thousandth of an atmosphere.

THE X-RAY IN FORENSIC MEDICINE.*

BY FRANK WARD ROSS, A. M., M. D., PH. D.,
Acting Assistant Surgeon, U. S. A.

My personal experience and observation, from which I have evolved the subject matter of this brief paper, convinces me that the x-ray in forensic medicine is not necessarily a bed of roses. There are many pitfalls and unpleasant experiences, which must be considered and met.

If I can make the way clearer to avoid these dangers, and add to the safeguards and methods to be employed, by those of this distinguished body who may use the x-ray in cases when required to appear in court, and assist them in any way to make their efforts competent, and their evidence safe, I shall have accomplished my mission.

Knowing that it had come to my lot to have a little personal experience in a number of forensic cases, your distinguished Chairman, the Hon. Clark Bell, requested this paper.

I shall be brief and practical. I shall begin by giving hints regarding x-ray photographs in cases where these are to be exhibited in court and used as evidence.

The greatest care is required to make the skiagraph competent evidence, and the absolute necessity of using the healthy side of comparison, taking the same exposure from every standpoint, as to time exposed, light and position, must be rigidly adhered to.

Means for identification of the photographs, and care in producing positive assurance of the court that they are *the* exact pictures, and have in no way been changed, are absolute requisites.

Supplementary evidence, in the shape of examination by the fluoroscope as well, as the pictures must be presented and defended on cross examination. Extreme caution is necessary in eliminating sources of error, in the shape of natural or acquired deformities. Caution as to having absolutely *no motion* of the subject on the plate is best obtained by strapping the patient down, or fastening the part to the plate, so that no exaggerated or distorted photograph can result.

Caution is advisable as to allowing the photographer to exhibit or allow the plate, proof, or picture in question to go into any other hands, either from curiosity or from design; also as to reversing the picture or not, by various methods, depending on whether the picture is taken on a plate and printed, or on a paper which is developed as a picture.

Surround the picture with every safeguard to make it competent evidence, not alone to your own mind, but to the court, as courts and judges are sometimes skeptical.

We have never been permitted to place a picture in evidence in this city in a criminal trial, the presiding judge, on one occasion, excluding it on the ground that the picture was not an exact representation, and can not be verified; also that the methods used are not sufficiently established, and the legal status yet under dispute; although I have been allowed to testify in one case as to my examination by the fluoroscope, as additional and supplementary evidence, to a physical examination by me. I especially caution those using the x-ray to take unusual care in giving an opinion of a case without the consent and knowledge of the attending physician, particularly where a suit for malpractice is likely to ensue, or is in the possibilities.

The same precautions should be observed in taking pictures to be used in cases in which suits for damages have been brought against a corporation; or in the so-called "negligence cases," which we so frequently meet; and I al-

*Read before the Medico-Legal Society, June session. 1898, at New York.

Read before the American Association of Physicians and Surgeons, June. 1898, at Chicago.

ways insist on having the consent, and if possible, the actual presence of the attending surgeon, at the time the picture is taken.

If the question of age, or non-union of bone presents, the following points should be considered:

It is well known that adult bones can be readily distinguished from those of children, or where the bones are not fully ossified. Do not mistake an incompletely ossified bone for a fracture, or vice versa.

A picture which I have seen, taken from a mummy in which there was a doubt as to whether the hand was adult and human or not, and was supposed to have been an Egytian prince, (all mummies are), the hand was clearly that of a child, showing the bones not fully ossified.

A case in France was decided against a corporation, on the evidence of a skiagraph, which showed the bones had not been united, although there had been no other evidence than the picture.

This was incorrect, as we know that bony union in fractures takes, in some cases, months or years to unite,—some never completely ossify. This must always be considered. Here the decision was in error, as there were no physical signs of fracture existing. Hence we should never accept, as an assured fact, that we have an ununited fracture or deformity, when other evidences are wanting or are even negative; especially if the patient's subjective symptoms are liable to be biased with the prospect of indemnity. In estimating the amount of damage done, not only must we always compare the injured with the sound side, but remember that some deformities, like those of the wrist-joints, may be quite extensive, and yet perfect co-adaptation of the bony parts have been made,—with perfect union of bone, —yet deformity exists, (particularly true in Colles fracture).

Again, our failure to see the cause of the deformity, in the x-ray, is not evidence that it does not exist, if other symptoms point to its being present. (The contrary line of reasoning in the French case cited).

The reason for this is obvious; the traumata of the soft tissues are often, (particularly in the fractures at the wrists), of greater importance than fractures of the bones.

The x-ray has caused us to look at bones and joints from a very different standpoint than formerly. We must, as competent witnesses, be well versed in the conditions existing, the surgical anatomy of the part, and land marks, aside from, and independent of the additional evidence given by the x-ray.

Fractures and deformities may exist which, from the position, line of fracture, effusion of blood, or character of deformity, will not furnish evidence in a skiagraph or fluoroscope.

Again, failure to get an x-ray, or to get a fluoroscopic view, will, in some cases, occur from faulty manipulations: machinery being out of order, insufficient power, or adverse atmospheric conditions.

Hence failure may occur at one time and success at another.

In one instance where I examined a case for a police surgeon, of gun shot wound, of a prisoner who was supposed to have been shot in the forearm, by an officer of a neighboring city, who escaped the authorities. The man claimed that he was intoxicated at the time of the shooting, and set up also as a defense that the ball was still in his arm.

I was able to demonstrate, clearly and conclusively, before our local and foreign officers, that *no* bullet was in his arm, as the entire arm and forearm were perfectly transparent to the fluoroscope. The ball had been removed, but for reasons best known to the prisoner he refused to reveal when and where, even when told that we were about to operate and find the ball, supposing that he would weaken in case it was attempted and the ball had already been removed.

Our evidence may, therefore, be of either "to find or not to find" foreign bodies, etc., positive or negative in character, (particularly true in accident insurance cases.)

Counter tests with metals, readily showing in the above, the absolute non-existence of the ball. In this case, it was ascertained subsequently, that it had been removed by a surgeon.

We may be materially assisted in our search for the exact location of foreign bodies, or injuries, by the Dennis fluorometer, which ingenious device gives the exact location for present or future reference.

It is essential in all cases where tissues, other than the arms and legs, are to be examined, particularly in the trunk and the head for bullets, that photographic and fluoroscopic observations should be taken from two or more points of view, at right angles to each other. This is materially aided by the little device mentioned.

While the use of the x-ray is of inestimable value to us in making diagnoses, it is not an unmixed personal good, as we well know from actual experience.

If it increases our diagnostic ability, it also increases our responsibilities, and we are more exposed to suits for malpractice in fractures, particularly if deformity exists, and we have not used it as a means of diagnosis, also in dressing and examination after reduction. I use it in all cases of fracture after splints and bandages are adjusted. Negligence will be claimed for failure to use it in all cases where bad results follow. If we have used this means we are strongly fortified.

Again, the so-called x-ray burn is no small factor, not only in the minds of the laity, but also of the court, and is an actual source of danger, and must always be considered, guarded against, and avoided by proper precautions, by suitable apparatus, not too long exposure, with perfect insulation of the patient, and if necessary, an aluminum or celluloid screen.

I have never seen an x-ray burn where a static machine was used, and believe its dangers to be overestimated; yet it is a factor which we must not ignore. I have made on my own person and others perhaps 2000 exposures, and have not seen a burn of my own making, time being from two minutes to three hours exposure.

Neither can we ignore the possible harm which might result in using it in cases of open wounds or injuries to the brain.

In a case in which I used this method, (the resulting skiagraph was taken after the man's death; three weeks later), the use of the x-ray was used as a defense, on the ground that it seriously jeopardized the man's chances, and that with the use of ether anasthesia, to keep him quiet, was not only seriously condemned by the defense, but the danger was so portrayed, that with the rulings of the court and other circumstances attending the case, the prisoner was acquitted on the charge of a deliberate murder, and our use of the x-ray was a great factor in bringing about this verdict. (I shall have a detailed account of this case at the next meeting of the American Electro-Therapeutical Association, to be held in Buffalo in September next.)

My greatest consolation, in this case, was that the same argument would have been used had I failed to use the x-ray to locate the bullet. Had the case died, then the omission would have been claimed as neglect.

As it was, it was argued that it was a

source of extreme danger to the patient, jeopardizing his chances and leaving a "reasonable doubt" in the minds of the jury, as to whether he might not have recovered had the x-ray not been used. In spite of positive demonstration that no harm resulted from the x-ray or ether,—the man living three weeks after the exposure, and dying of meningitis, which existed at the time the examination made and was due to the presence of a bullet in the brain.

We must, however, not be hampered by prejudice or fear of evil to ourselves, still we must exercise caution, and precaution under all circumstances, particularly in murder trials, criminal and negligence cases of all classes.

What we consider our duty to the case in hand, should be done fearlessly, or there can be no progress in our art; time and science will vindicate us in the end.

Courts and juries deal with tangible. things, and evidences which may sway juries may be due to ignorance, bias, or prejudice. We are thus made partly or wholly responsible, allowing the innocent to be punished or the guilty to escape !

Evidences which to our trained surgical senses or deductive logic may be sufficient for us to use as a guide for treatment which holds a human life, may count for naught in a court of law, and our efforts to save life ; and best intentions are often looked upon with suspicion by the court and jury. Especially is this true in regard to new discoveries, which are viewed rather in the light of experiments.

Those things which are the best of evidence for us as surgeons, may be the poorest in the world in a legal aspect.

Of this fact we must never lose sight for a moment, and so shape our examinations in this line as to make them conform to the rules of legal evidence in all its technicalities, or our work may not only be productive of no good, but may be an actual source of menace to us personally and professionally.

Careful attention to the points mentioned as to surrounding the case with safeguards will insure you good results in your own cases and make your testimony in courts competent and material evidence.

While the points made in the above will not cover perhaps all conditions which may arise in every case, I am satisfied that the salient factors have been stated.

Elmira, N. Y.

STATIC CURRENTS IN CHRONIC INJURIES. Translated by Frank Ring, A. M., M. D., for the AMERICAN X-RAY JOURNAL.—At the French Society of Electro-therapy, on Oct. 21st, M. C. Sudink, of Buenos Ayres, made a report upon an ingenious application of the currents of high frequency, in a case of luxation of the shoulder.

The injury was caused by a fall. The usual procedures for reduction having failed, the author made several applications of currents of high frequency (one plate upon the deltoid and the other upon the wrist). During one of these applications the head of the humerus was reduced, thanks to the sedative effect, as well as muscular resolution, thus obtained.

This leads the author to formulate the following conclusions : 1st. Currents of high frequency have an indisputable anaesthetic action ; 2d. Currents of high frequency have an action upon contractures of traumatic origin.—*Gazette Medicale*, Paris.

RADIOGRAPHY OF FETAL LUNGS.—Atelectasis is readily distinguished in a radiograph of a fetal lung, and can thus be demonstrated in court in doubtful cases. —*Gazz. d. Osp.*, September 4.

LONDON ITEMS.

J. M. BARBOUR, M. B.,
Librarian Roentgen Society, London, Correspondent.

NOTES ON BOOKS.

On the study of the Hand for Indications of Local and General Disease, by Edward Blake, M. D., London. H. J. Glaisher, 1898. (p. p. 45, with illustrations. 2-6.) Dr. Blake has collected within a small compass all that can well be said on the human hand. In terse phraseology he conveys much that the all-round physician would do well to study—and salient points apt to be overlooked by the radiographer. We commend it to those in constant touch with "Hands."—Its value is enhanced by a most complete index and a bibliography.

Radiation, by H. H. F. Hyndman, London. Swan, Sonnenschien & Co., Limited.

This is a successful effort to bring together the results of the more important recent investigations on "radiations" whether of Sound, Light, Heat or Electricity. About 100 pages are devoted to an excellent analysis of the theories of the best workers on Roentgen rays.

Radiations are discussed under different heads and more particularly where the border lands of each branch of physics march together. It is rather a summary of work done up till date, than a practical guide. Prof. Silvanus Thompson in a preface sums up its value thus: —"To the real student of physics who pursues the sucject for its own sake it will be found most useful. It is much too good to be of use to one whose highest aims is to pass examinat ions."

Under the presidency of Dr. Mansell Moullin, the Roentgen Society gave a most successful Conversazione on 21st inst. While there was an absence of any pronounced discovery, a very general improvement was noted in the manufacture and application of the x-ray technique. Among the more prominent exhibitors Dr. Silvanus Thompson showed experiments with the Tesla oscillator, whereby vacuum tubes (destitute of electrodes) gave luminous phenomena within the electrically charged field. Prof. Gladstone showed an apparatus for testing grade of rays, and a h ost of members contributed in many ways to demonstrate to visitors the mysteries of the rays. In side rooms opportunities for purely medical demonstrations were given, and throughout the evening an excellent band contributed to the enjoyment of the guests.

Faivre (Jour de Clin et de Therap Infant,) quotes a case of a child, two and a half years of age, who was supposed to have swallowed a pin. Emetics and purgatives were freely given, but failed to dislodge it. Five weeks after, when the child came under notice, the head was vividly flexed on the left shoulder, and any attempt to move it produced intense pain. Under chloroform anaesthesia a radiograph was taken and the pin was located behind the posterior faucial pillar, from which it was readily removed.

Seiz, (Therapeut, Monakhefts No. 8. 1898) draws attention to errors likely to occur in interpreting injuries to young children. Even in the case of a girl, aged nineteen, who had sustained an outward dislocation of both bones of the forearm,—the radiogram, taken twelve days after reduction—showed the position of the joint to be normal, but with an apparent separation of the tip of the olecranon. However, there was no other clinical sign of this lesion and the *apparent* separation was probably due to the fact that the epiphysis of the olecranon was still joined to the shaft by cartilage. Had the diagnosis been based *absolutely* on the radiogram a fracture of the olecranon was doubtless been diagnosed.

The foregoing calls to mind the most prominent skiagraphic publication of the year:— Dr. Poland's Tramnatic Separation of the Epiphyses, a work, which, is the most complete of its kind in any language.

Seiz gives a further illustration in which a boy, aged nine, sustained a fracture of the shaft of the femur. It united with an inch of shortening, though the skiagram showed an apparent shortening of three inches! He emphasizes the necessity of recording, in each case, the distance from and the relation to the illumination of the part radiographed.

It is stated that Prof. Roentgen has been offered the Chair of Physics at Leipsic.

THE EDISON PORTABLE CABINET X-RAY OUTFIT.

At the beginning of the Santiago campaign, the necessity of equipping the hospital ships with efficient and powerful x-ray apparatus was immediately perceived by the Surgeon General of the United States Navy, who realized the importance of installing apparatus which should be the most powerful of its kind, and also which should be so simple in construction and operation that it could be properly handled by any ordinary mechanic. An order was, therefore, placed with the Edison Manufacturing Company for one of their latest Portable Cabinet X-Ray Outfits, to be placed on board the U. S. Naval Hospital Ship "Solace" and the entire apparatus was placed in position ready for use forty-eight (48) hours after the placing of the order. A brief description of this apparatus, which is illustrated below, may be of interest to our readers.

The Cabinet which is made of polished quartered oak, of massive construction, occupies a floor space 2 ft. 8 in. by 1 ft. 8 in. and is furnished with four wrought iron Ls screwed on to the base of same, by which it can be rigidly fastened to the deck. This is most necessary, as, in case of heavy weather, the apparatus might be damaged by the ship rolling if it were not firmly attached in this way.

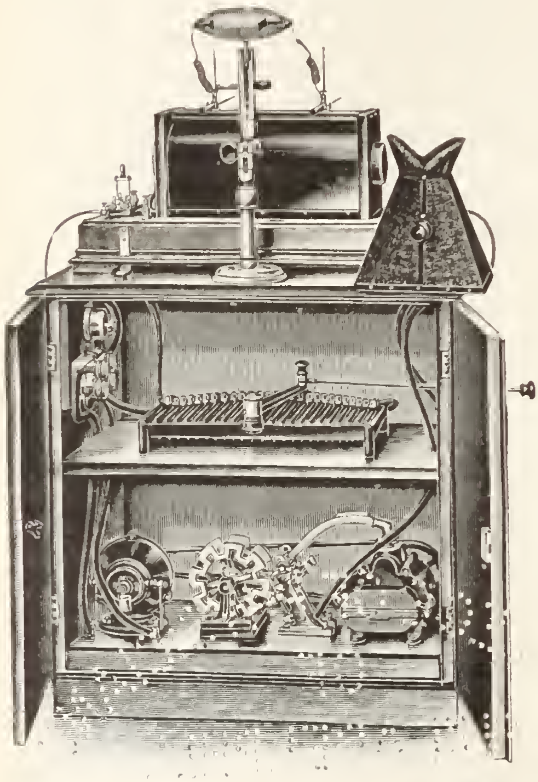
The Edison coil, which is mounted on top of the cabinet is also furnished with brass Ls and strips to hold it firmly in position, and the base of the adjustable focus tube stand is similarly screwed to the top of the cabinet. The upright part of the focus tube stand has a wooden screw at the end of same, by which it is attached to the base, and when the focus tube stand is not required to be used, it is only necessary to unscrew the upright from the base, which can be done in a moment.

The distinctive feature of the Edison electric light x-ray outfits is that there is no vibrator on the induction coil, its place being taken by the instantaneous air-break-wheel device shown in the bottom part of the cabinet.

This device consists of two tooth-wheels mounted on the same shaft. The projections or teeth make contact with two flat brushes, which bear on the outer peripheries, and by which the current is brought in and led out again. These wheels are rotated at a very high speed, by a small direct current motor, which also runs a pressure blower. The air blast from this blower enters a bifurcated tube and is connected to two flat nozzles immediately over the contact brushes.

When the device is set in operation, by starting the motor and connecting the primary of the Edison x-ray coil in series with the binding posts (attached to the break-wheel) provided for this purpose; the spark formed at the contact brushes, when the coil is energized, is instantaneously blown out by the air blast at the moment of formation. This greatly increases the rapidity of change in the magnetic circuit, and consequently vastly augments the electromotive force in the secondary coil.

The controlling rheostat shown on the upper shelf of the cabinet is used to vary the current in the primary of the Edison coil, and the lever arm of the rheostat is connected to the extension rod passing through the side of the cabinet so that the doors of the cabinet may be closed and the rheostat actuated by means of this extension rod, which is

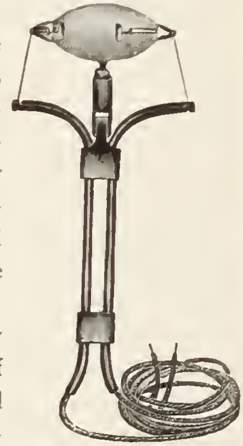


EDISON PORTABLE CABINET X-RAY OUTFIT.

shown on the right hand side of the cut. The main switch is shown on the left hand side of the cabinet, near the top, and the cut-outs directly underneath same. The advantage of this arrangement is seen at a glance, as the keys of the cabinet are always in the possession of the Chief Surgeon on board ship, and it is impossible for any one to use the apparatus without his permission.

The coil is protected by a polished oak cover (not shown in the cut), which fits over the top of cabinet, and in which, room is left for the fluoroscope to fit into, so that the apparatus is entirely protected when not in use. The operation of the apparatus is exceedingly simple. The focus tube is clamped in the jaws of the focus tube stand and connected to the secondary binding posts of the Edison coil by two highly insulated thin wires.

The doors of the cabinet are now opened and the main switch is turned, which starts the motor and the pressure blower in opreation. The doors of the cabinet are now shut, in order to economize space, and the reversing switch shown on the left of the coil is closed, so that the secondary current from the coil excites the focus tube, and the energy of the coil is increased by gradually drawing out the extension rod attached to the lever of the controlling rheostat.



The patient is now placed in front of the focus tube and the fluoroscope placed behind the limb or that portion of the trunk that it is desired to examine. In cases where the patient is so seriously wounded that it is necessary for him to maintain a reclining position, the focus tube is attached to the portable focus tube holder, as shown in cut No. 2. and the focus tube stand is dispensed with. The end of the portable tube holder wires, which are very highly insulated, are now attached to the secondary binding posts of the coil. These heavily insulated connecting wires are several feet in length and the portable focus tube holder is made of hard rubber so that it can be handled easily, without fear of shock to the operator.

The portable focus tube holder with

focus tube, is now placed underneath the cot or operating table, and the surgeon makes his examination by looking through the patient from above.

The entire apparatus is substantially and strongly made, and is also of handsome design, and the work that has already been done with it has shown the great value of such an apparatus in warfare, and the necessity of equipping all naval, marine and military hospitals with a device of this kind.

One great advantage possessed by this apparatus is that it can be moved from place to place without delay, as the cabinet is mounted on heavy casters, and it is only necessary to disconnect the attachment plug and cord attached to the main switch, from the receptacle into which it may be screwed, and the cabinet may then be moved to any part of the ship or hospital and attached to another receptacle by screwing in the attachment plug, which will not occupy any time whatever.

We understand that the Edison Manufacturing Company have one of these cabinets in operation at their show rooms, St. James Building, Broadway and 26th Street, New York.

Vague and Indefinite Pains Due to Latent Rheumatic Conditions.

The physician is frequently called upon to treat patients, who though not ill enough to be in bed are not at all well. Their appetite is capricious, they sleep indifferently or even if they sleep soundly, they are not refreshed and in the morning they are more fatigued and ill at ease than was the case on retiring. Upon awakening there is frequently an aching sensation in the loins, sometimes in the lower limbs, which is noticed upon getting out of bed or in dressing, and particularly in putting on their hose or lacing their shoes. As the day progresses this soreness may partially wear off, but there is at all times a vague, undefined, uneasy, painful feeling.

A competent examination of the urine in these cases will in almost every instance be found to disclose a notable absence of the soluble urates. On the contrary it may be loaded with the phosphates and very frequently bile will be present as also uric acid. If the condition remains neglected, the probable results will be sooner or later a pronounced attack of rheumatism in one or another of its forms. All that is needed to induce such a condition is a sudden change in the weather or the exposure on the part of the patient to cold or wet or a combination of the two. This is due to a latent rheumatic diathesis, to which every adult is liable.

In such cases the physician will find Tongaline in any one of its forms as indicated, given at short intervals with copious draughts of hot water, a remedy which goes directly to the source of the trouble. Tongaline seeks out the retained excretions or perverted secretions, which it either neutralizes or renders amenable to the physiological action of the emunctories, and then it brings to bear its strong eliminative powers, correcting the complaint promptly and thoroughly.

The Phonendoscope.

This little book, covering about 75 pages, is made up of descriptive matter concerning the practical application of this most useful instrument.

There are 37 beautiful illustrations printed upon half-tone paper, used for the purpose of exemplifying more clearly the work on phonendoscopy. One section of the book contains an article which should be read and studied by every practitioner of medicine. This is chapter 4 on the Relation Between Outlines of the Internal Organs of the Body as Determined by the X-Rays and by the Phonendsocope. Laws Governing the Two Methods. The same article was published in THE AMERICAN X-RAY JOURNAL, Vol. 2, No. 4. This is a most useful publication. It is not only interesting to read, but very instructive, and will aid the practitioner in a wider range for easy diagnosing. The book is well bound and well printed. Chapters 1, 2 and 3 of this book are of the English translation of lectures by Professor Aurelio Bianchi, translated by A. George Baker, A. M., M. D. The book may be procured in Europe from Martin Wallach, Nachfolger, Gassel, Germany; also from George P. Pilling & Son, Philadelphia. Price 50 cents.

The American X-Ray Journal.

Devoted to Practical X-Ray Work and Allied Arts and Sciences.

VOL. 4. ST. LOUIS, FEBRUARY, 1899. NO. 2.

NE FRONTI CREDE!

BY J. RUDIS JICINSKY, A. M., M. D.

There seems to be a plethora of new institutions which go before the public under the "scientific cloak" and which seek to uphold their interests in this way. Months ago there was in our town a quack, who advertised himself with a complete x-ray apparatus, pretending with the help of his second-hand machine to diagnose and certainly heal all acute and chronic diseases. What a shame!

The cause of real science is not a selfish one. It extends the hand of welcome to all new comers, who can and dare to point to a clean bill of truth and proof of the claim that they make. It, however, *can not tolerate any exaggeration, which have plans wholly at variance with common sense and legitimate effort.* This the public should know especially in regard to the unique discovery of Prof. Roentgen, which to the world of science gave new problems and new means of diagnosis to our profession. Admitting the fallacies of x-ray pictures, made in the undeveloped stage of this branch, it is the most attractive field for investigation. These investigations are going on and must bring some more and good results in a very near future. Labor omnia vincit!

Now as to the fallacies of x-ray pictures. These can be sometimes easily avoided, if we keep in our mind, the source of the x-ray and all the steps necessary in the photography of the invisible. One of the earliest experiments made in this country demonstrating a point of origin for the x-ray was made by Dr. Morton. (Vide: *The Electrical Engineer*, March 25, 1896). But the question still remains open, however, as to whether the x-ray actually springs into being at platinum or other anti-cathode placed independently within the tube. We know, that the x-rays are projected in all directions from that side of the reflector opposite to the cathode. Now in this beautiful green field of x-ray activity, we have to work, using our fluoroscope as often as we can and determining the shadows of an object opaque to the x-ray. We must not forget that our flat disk of platinum in the tube is at an angle of 45 deg. Such being the case, we observe either photographically or fluoroscopically that our object directly under the point of greatest intensity of the x-ray gives hardly a shadow. There is no question about it, that the shadows which are seen most beautifully, correspond exactly with the radiation from the disk of platinum in the tube.* This having in mind, we must always know the power of our x-ray, the distance of the tube from our object, the distance from

*The X-Ray, by Wm. J. Morton, M. D., New York, N. Y.

the plate, the duration of exposure and the angle at which the picture is taken. If we have to make correct diagnosis and produce an accurate picture, we must never be satisfied with one radiograph of the case, but make it also our duty to compare the picture of the injured part with the normal one. Therefore, to read correctly the lesson of an x-ray picture, *keep the obliqueness of x-rays always in mind, make it as nearly life size as possible to get sharply defined outlines, remembering that we are dealing with shadows only and use a proper dividing screen* (Dennison's etc.) for measurements and exactness of your pictures. While it is self-evident that different radiographs of the same case may show very differently, yet I would not say, that they should be inaccurate, when accompanied by a description of the relative positions from which they were taken and when all the rules given above were observed. Such a description could accompany each picture and being perhaps necessary in courts of law, would fortify us in every case against x-ray pictures which might prejudice a jury. I say might!

In the corner of each picture—make it a rule—we may note the power of the spark used, say "spark 8 inches": the distance of the tube from our object: "Tube 4 inches"; the distance from the sensitive plate: "Plate 12 inches", duration of exposure: "Exposure 10 seconds", at the angle, at which the picture is taken "36 deg." or simply:

S 8, T 4, P 12,
E 10 seconds, 36 deg.

And if we mark also the right and left side of the object taken, there hardly could be a possibility for a great deviation and bringing such radiographs before the jury, we could show nearly always the same result on our plate and the same condition of the case either with the fluoroscope or screen direct or photographically right in the court room. We could produce before the jury the same kind of apparatus and knowing that a slight deviation in the angle of the object to the plate makes a difference, knowing the distances and duration of exposure in such a given case, we may have a good opportunity to show that the x-ray opens out a new and feasible method of proof and substantial evidence, especially in cases of irregularities or deformities of the bones.

To one, who has already had experience with the revelations of the x-ray in showing conditions of the bones far different from those assumed to exist by ordinary means of diagnosis, seems the alarm about the damage the x-ray may do the surgeon, altogether unnecessary, when we consider the strong advantages it has for him and in the near future will develop perhaps still greater accuracy. We know, that the x-ray detects and diagnosticates fractures and dislocations very good, it shows in given case, whether it is a fracture or a dislocation, or both together. We may then stop the growths of the calus and discover other deformities of the bones (tuberculosis, cancer, etc.), see the marrow cavity and look upon the progress of the union of the bone, after it has been set in splints, or even the correctness of the setting of the fragments may be determined and rectified. In anchylosis the x-ray is useful also and has inestimable value in detection of foreign objects in the body, same in diagnosis of phthisis pulmonalis,* intestinal obstruction, location of organs, study of anatomy, development of the bones, any enlargement, etc.

In fact, in the treatment throughout the broad field of surgery, the factor of prime importance is the diagnosis, which with the application of the x-ray, seems to be much easier and more correct. Just allow me to cite two eminent men:

*Proceedings Nebraska Med. Society: X-Ray in Diagnosis of Tuberculosis, by the author, June, 1898. Dr. Beclere, Dr. Blande and Dr. Teissier, Paris. etc.

Dr. Cole, before the fourth Annual Meeting of the American Academy of Railway Surgeons: "I believe that the present generation will see the x-rays and the fluorescent screen in practical every day use to such an extent that the surgeon will with the aid of these adjuncts, together with the use of progressive aseptic and antiseptic methods, obviate many terrors formerly attaching to the practice of bone surgery."† Prof. Senn in his "Recent Experiences in Military Surgery After the Battle of Santiago," on board the hospital ship "Relief," says: "If, as is often the case, the whereabouts of the bullet is not known, its presence and exact location can be determined without any pain or any additional risks to the patient by the use of the x-ray. All of the bullets removed on board the hospital ship Relief were located in this manner. (Dr. Gray)." ‡

It must be stated that a great deal of refinement in operating the x-ray and its pictures is necessary, as well as a good deal of experience to "read the shadows" properly and identify them, but in suits for damage, I think we could accept radiographs made by a disinterested operator, especially those with proper description, as stated above and then demonstrate according to such given description the whole case to the jury in the court room if possible. But *never trust to appearances, find out yourself!*

Not long ago, I received a radiograph of radius*, showing fracture in upper third, case examined by me too. There was no doubt, from ordinary physical examination, as to the existence of fracture, and yet it took nearly an hour with the fluoroscope to find it. After I received a description of the relative positions from which the picture was taken and used my operating table and the screen accordingly, I made in a few seconds and without any trouble an authenticated radiograph of that case, exactly same as the one shown to me. It is a picture very convincing and will sure

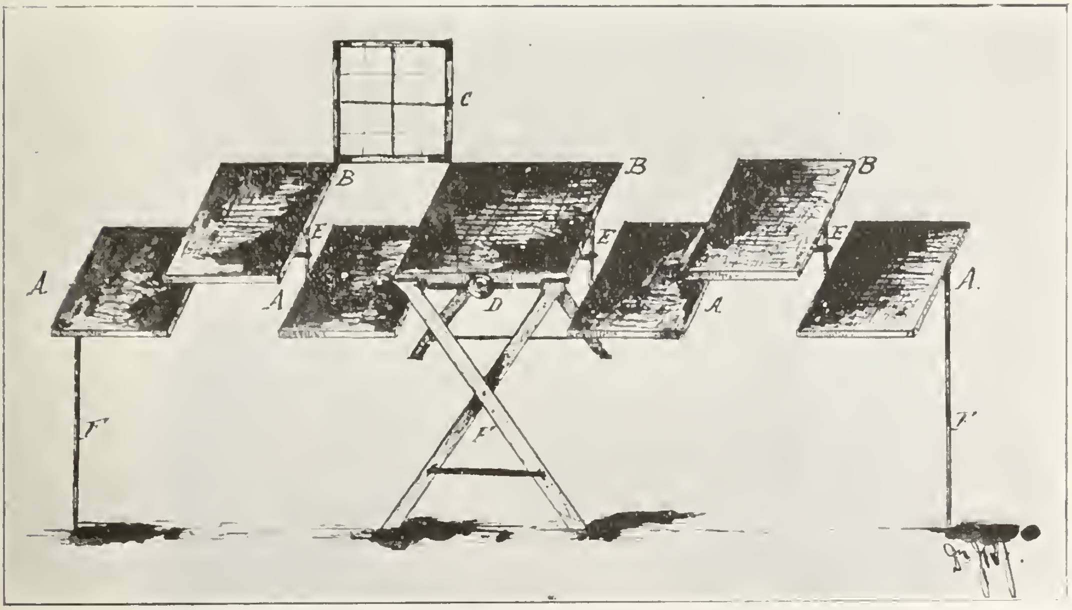


FIG. 1 —A lower parts of the table; B, upper; C, dividing screen; D, screw; E, mechanism for moving the parts; F, the stand.

†The Journal A. M. A., May 28, 1898.

‡The Journal A. M. A., Nov. 12, 1898.

* The original x-ray negative is now a court record.

have great weight with the jury. For such work I have constructed a simple but practical table, (Fig. 1). It consists of a stand (F), with a screw (D) to move the separate parts of the table (A B) and a dividing screen (C).

The parts of the table are marked in inches and show plainly how far we are from the tube with our object and the plate, giving also the angle at which the picture is taken. Such measures in connection with our dividing screen, should give us good results. Our dividing screen is marked with metallic R on one and L on the other side of the frame. Both letters must appear in our picture—no mistake about that—and our radiograph is then more complete. The operating table is so constructed to be tipped in any desired position on the Yale chair plan. The sensitive Carbut's plate finds its place on the under part of the table (A) and you will see that the nearer you bring the Crookes' tube to your subject, the stronger will be the effect of your x-rays, which easily can be followed and observed with the fluoroscope in your hand. Having such a table in our laboratory, we can measure all the distances necessary and verify those measurements very easily with our dividing screen.

CEDAR RAPIDS, IOWA.

This instructive article from the pen of Dr. Jicinsky should be read by all physicians interested in their own success in diagnosing. But there is one fact which should not be lost sight of in all x-ray work, viz.: The proof of the picture. All x-ray shadows are distorted. I say all. There is a normal divergence of the x-rays. This divergence is perpetual, constant and never varies. It is the same from all tubes under all conditions. The distortion is therefore always present. There is also distortion due to position. This may sometimes, possibly, be avoided—but rarely unless impervious right angle devices are used to correct it. In both instances the distortion can be corrected. It should always be corrected before the picture is taken. Unless this distortion, due to divergence of the x-rays and to position, is corrected the radiograph is not true and therefore dangerous evidence to the operator and also in the court of law. The Dennis fluorometer will correct these distortions with mathematical accuracy. No operator can conscientiously do surgery without this evidence and the time is not far distant when his knowledge in medico-legal cases will be put to the severest test.—ED.

PROFITABLE RADIOGRAPHY.

This radiograph was taken by Prof. W. O. Horner, the eminent radiographer, of Cleveland, Tenn. The picture is of a boy of the age of three years, who

W. O. HORNER.

accidentally falling while playing, sustained a fracture of the right femur. The father of the young lad had presence of mind enough and good common sense to send for Prof. Horner at the same time that he summoned the aid of a surgeon. The Prof. immediately responded, and took his x-ray apparatus to the residence. An examination with the fluoroscope revealed the true condition of the injury. The surgeon being satisfied with the diagnosis, immediately set the fracture. After the work of the surgeon was done, a second examination was made to determine if the bones were in proper apposition; and then in order to retain a likeness of the same. Prof. Horner made a two-minutes exposure, the tube 20 inches distant. The radiograph and examination with the fluoroscope revealed a satisfactory condition. Four days after this injury had occurred, suspicion arose as to the possibility of an injury about the pelvis. The Prof. again made an exposure, including the pelvis and the fracture, and found that the suspicion of pelvic injury was not founded, but that there was considerable overlapping to the extent of about one inch of the fragments. This condition, which is so beautifully demonstated, was all that was necessary for the surgeon to employ means to overcome what would undoubtedly have been a permanent deformity.

The child has since recovered, and is now in perfect health, walking as though no injury had ever occurred. This is an able argument in favor of the universal use of the x-ray in fractures. Certainly no surgeon can be safe in setting fractures or dislocations without the aid of the human eye looking directly upon the site of injury.

Prof. Horner is recognized as one of the most competent experts in radiography, and the good people of his state, appreciating this, call him "far and wide" for assistance. He is called upon by the railroad surgeons for nearly every railroad line that crosses the State of Tennessee, and by the better surgeons throughout the state.

Cases Illustrating the Value of the X-Ray in the Treatment of Fractures of Long Bones With Displacement.*

BY A. R. SHANDS, M. D., WASHINGTON, D. C.

In reporting these cases of fractures of long bones in which the use of the x-ray has been of inestimable value in diagnosing the exact position of the broken bones, surely a few remarks on the modern treatment of such cases will not be out of place, although I fear some may accuse me of being a little dogmatic in my enthusiasm on this subject. If there be such, I trust they may think me somewhat justified in the remarks which are to follow by the results that have been obtained in these cases.

No subject in the wide range of surgery has received more attention than that of fractures of bones. From time immemorial surgeons the world over have given the subjet great study; innumerable devices have been used by different surgeons, all with the same object in view—that of bringing about the best results. Many of these have long since been abandoned for the adoption of newer methods which in turn have likewise been dropped and others taken up. All of this goes to prove we have not yet found the method that will bring about perfect results in all cases. This has not been, however, to the detriment of the unfortunate individuals that have been the victims of such accidents, for after all the best method is the one that the surgeon knows best how to use. The number of deformities and cases of non-union that one sees as result of the treatment employed, as well as the great number of appliances that have been used, show how imperfectly the methods have answered the purpose. All surgeons, however skillful, have met with cases that have taxed their ability to the utmost, and, even after faithfully and conscientiously exercising all the skill at their command, have left living monuments to the glory of their failures.

The first and most important point in these cases is a correct knowledge as to the position of the fragments of the broken bones, before attempting reduction. Thanks to modern science, we have in the x-ray the most valuable aid in diagnosing the true condition of affairs in these cases that has ever been discovered, and its aid should be invoked in every case where there is the least doubt as to the true position of the fragments of the broken bone.

Every hospital that proposes to do this kind of surgery should be equipped with this machine. It would be an excellent routine practice to have photographs of every fracture taken after reduction and application of the splints, to be sure that the fragments are in the best possible position for union. These x-ray photographs can be perfectly well taken for this purpose through the dressings.

Cases II. and III. [Plates III.-VIII.] here reported were photographed through a plaster-of-Paris case, after an attempt at reduction had been made and it was thought that a proper approximation of the fragments had been accomplished, when the condition of affairs as represented by the photographs was found to exist.

After a correct diagnosis as to the position of the broken bones has been made, the first and most important step in the treatment is to bring about the best possible approximation of the broken ends. Many conditions militate against this perfect approximation so

*Read before the Medical Society of the District of Columbia, November 16, 1898.

much desired, such as a great separation of the ends; muscular action, which often makes it almost impossible to bring them together by manipulation and at the same time makes it impossible to hold the ends together, especially if the line of fracture is oblique. Interposition of soft tissues is another obstacle often encountered. All of this is more strongly emphasized by the numerous cases of non-union and union with deformity that we meet with than can be done by the words of any writer. Nothing can be more mortifying to a surgeon than a failure to get union, nor proclaim more loudly his lack of skill than to get union with deformity.

In these days of antiseptic surgery and almost perfect modern surgical technique, when the abdominal surgeon often enters the peritoneal cavity with impunity simply for the sake of explanation, why should one hesitate for a moment to cut down on fractured bones to satisfy himself with absolute certainty as to the relative positions of the broken fragments? In other words, all simple fractures with displacements that can not be easily reduced so as to obtain a perfect approximation should be converted into compound fractures by means of the knife, under the best possible antiseptic precautions. In doing this nothing is added to the severity of the case, and often just the opposite is the result, for, by so doing, blood clot and effusion can be removed which will put the surrounding tissues in a better condition to bring about repair to the injured parts. When the surgeon does this he has a perfectly clear field before him, he is then enabled to put the bones in the best possible position and fix them there by any means he may prefer, closing the wound for primary union. If this were done in all cases of fractures, both simple and compound, there would be fewer cases of non-union, and cases of union with deformity would be things of the past

The writer does not mean to say that all cases of simple fracture should be so treated, for there are many fractures without displacement and many with slight displacement that can be easily reduced and held in apposition by simple means that will not require such radical procedure, but it is asserted that all cases that are difficult to reduce and those that have interposing tissues should be treated by open operation, and after approximating the broken ends they should be secured by some extraneous means, such as silver wire or kangaroo-tendon suture; better still, by leaving the drill in the bones. Later the drill can be easily removed after union has become sufficiently firm to prevent a recurrence of the displacement. When the line of fracture is oblique, the drill left in the bones projecting through the soft tissues is by far the most perfect means of fixing the bones in apposition. When the fracture is located near a joint, especially the elbow joint, which is beautifully illustrated by Case III. it is impossible to keep the small pieces of bone in apposition with the longer bone without cutting down on the seat of fracture and securing it there.

Case I. [Plates I. and II.] Age 13 years. Fell from a horse February 14, 1898, producing fracture at junction of upper with middle third of right femur. Position of fragments better shown by skiagraph No. 1 than can be done by any description. This case was referred to me by Dr. W. A. Gordon, of Orange county, Virginia, May 11th, about three months after the accident. The photograph of the case was taken at the Lionel Laboratory, Emergency Hospital, the day that I first saw the case. No definite history of the treatment that the patient had received was obtained beyond the fact that several attempts at reduction had been made by the family physician and that he had been treated on an inclined plane at first, and later the limb had been put up in plaster-of-Paris.

of three months' confinement in bed. There was marked atrophy of right limb which rotated outward to 45 deg.

PLATE I. CASE I. Fracture of femur at junction of upper and middle thirds

Upon examination I found the general condition of the patient bad, the result

Voluntary motion *nil:* passive motion was resisted by marked muscular spasm and produced great pain. The limb was two inches shorter than its fellow.

Operated May 12, 1898. A la al incision about five inches long was made over the seat of the fracture. Fragments of the bone were found to be united by firm fibrous union in the over lapped position shown in the photograph. Bones were separated: a transverse section of the ends was made. It

PLATE II. CASE I. Six weeks after operation.

required considerable force to extend the leg to obtain an approximation of the fragments, the result of muscular contraction of three months' standing. Silver wire was used to hold bones in position. Wound closed with cat-gut sutures; no drainage. Antiseptic dressing applied and limb put up in a plaster-of-Paris spica extending from foot to the nipples. Temperature reached the highest point, 100½ deg., afternoon after the operation: it dropped to normal on third day, where it remained. Patient had considerable pain during first two days caused by the stretching of the muscles; it was relieved by moderate doses of morphine. Plaster-of-paris removed at end of six weeks; primary

PLATE III. CASE II. Fracture of right tibia and fibula. Antero-posterior view.

union perfect; bone firmly united. The following day the patient was allowed up and around on crutches, which were used for about four weeks, when one patient revealed the fact that limb was less than 2-8 of an inch short. At present the patient is walking to school one-half mile from his home.

PLATE IV. CASE II One-half anterior and external view.

crutch only was used for two weeks. Twelve weeks after day of operation patient was able to walk with almost perfect gait, without support. Final measurements made the last time I saw the

CASE II. [Plates III. VI.] Age 22 years. Sustained fracture of both bones of right leg, February 2, 1898. Came under my care April 28. Operation on April 28, 1898. Anterior incision about five inches long made parallel to crest of tibia and about 1/2 inch to outer side. Space between ends of bones filled with dense fibrous tissue. Transverse section of ends of tibia made and when approximated were held by a drill left in projecting through the dressing. The fracture of the fibula being an oblique one, the edges were freshened, and held together by a kangaroo-tendon suture. Wound was closed without drainage; antiseptic dressings applied and plaster-of-Paris case put on extending from the toes to middle of the thigh. At end of three weeks the drill was removed and wound inspected, when primary union was found to be perfect. Six weeks after the operation the plaster-of-Paris

PLATE V. CASE II Six weeks after operation.

case was removed, and another extending from just below the knee to the ankle was put on and patient allowed up on crutches. Solid bony union was delayed in this case, it being about four walks well unaided, leg about three-eighths of an inch short.

In both these cases it should be noted that the plaster-of-Paris was extended well beyond the joints, above and below

Plate VI. Case II. Six months after operation.

months after the operation before the crutches could be discarded. This was due to the patient's general condition being very poor. October 28, 1898, photograph [Plate VI.] was taken which shows good, solid, bony union. Patient

the seat of the fracture, which produced complete immobilization of the entire limb. This is an excellent safeguard to prevent any danger of the fragments of bone becoming displaced, and at the same time adds very much to the comfort of the patient, by putting at perfect rest the muscles of the injured limb, and thereby preventing painful spasm of the muscles.

PLATE VII. CASE III. Fracture of right humerus one inch above elbow. Thirteen days after the fracture. Skiograph taken through the plaster-of-Paris dressing

CASE III. [Plates VII. and VIII.] Age 9 years. Fracture of right humerus one inch above elbow, March 4, 1898. On day of the accident forcible manipulation at reduction of the fracture was made and arm put in a plaster-of-Paris splint. On the thirteenth day after injury x-ray photograph taken through the plaster-of-Paris dressing, showing that no reduction of the fragments had been accomplished.

March 25th, three weeks after the accident, Dr. W. T. Bull, of New York, operated on the case, and to him I am indebted for the privilege of reporting the case and also for the following notes regarding the technique of the operation.

Through an open incision on posterior There were very dense adhesions which glued everything together, although there was motion between the ends of the fragments which were pried apart and traction made upon the elbow to reduce the deformity, but with no success

PLATE VIII CASE III. Side and front views. two months after operation.

aspect of the elbow, the position of fragments as shown in plate VII. was found to exist. The lower fragment was tilted inward and upward and so situated as to prevent normal flexion of forearm on arm: fragments were sharp pointed. The ragged and pointed edges were cut square and holes drilled through. After the fragments were approximated they were held in position with kangaroo-tendon sutures. Wound closed except at lower end, where a piece of drainage gauze was left in. After the application of an aseptic dressing, arm was put in a plaster-of-Paris case with forearm slightly flexed. Very little reaction followed: gauze removed on third day and repacked for forty-eight hours longer; this was gradually removed. With exception of a small, discharging sinus for a few weeks the recovery was uneventful.

The second photograph [Plate VIII.] of this case taken two months after the operation give side and front views of the elbow and show the articulating surface to be in perfect position.

This case has recently been examined by the writer, that is to say seven months after the operation. The motions of the elbow are practically perfect. Extension may possibly be limited by three or four degrees. In closing this report I wish to thank my friends, Dr. T. Ritchie Stone and Mr. W. H. Merrill, for the excellent x-ray photographs illustrating this article, which were taken at the Lionel Laboratory, Emergency Hospital, Washington, D. C.

1328 New York Avenue, N. W.

—*Medical Register*, Dec. 15, 1898.

Through the courtesy of E. C. Levy, M. D., Editor of the *Medical Register*, we were enabled to procure these electros.

RECOVERY OF ROENTGEN RAY TUBES. Machado. *Comptes Rendus*, 126. p. 1341; noticed briefly in *Science Abstracts*, Sept. *Electrical World*, N. Y.—He wraps the tubes surrounding the stem of the cathode with a flexible metallic sheet of tin, lead or platinum, or surrounds it with an insulated coil of copper wires. With this arrangement it is claimed that exhausted tubes recover in a few seconds. No further description is given in the abstract.

The usefulness of the Dennis Fluorometer has been recognized in Europe and several complete outfits have recently been purchased for x-ray operators on the continent.

LONDON ITEMS.

J. M. BARBOUR, M. B.,
Librarian Roentgen Society, London, Correspondent.

"Traite Pratique de Radiographie et de Radioscopie A-Londe," Paris.—This is a practical work without any introduction of electrical methods. To English and American readers the work presents some errors and occasional omissions. The only allusion to workers other than French, is in regard to Prof. Silvanus Thompson, to whom they erroneously ascribe the inception of the focus tube. The employment of tungstate of calcium for screens is omitted, and further it is surely inaccurate to affirm that *the size* of the anti-cathode governs the definition of the tube. The chief merits of the book are its medical chapters.

"Of Traumatic Injuries, Especially Those Depending Largely on X-Ray Application for Their Elucidation."—Dr. Poland's treatise may well be regarded as the leading publication of the year, if not the foremost work of its kind. Some idea of the magnitude of the work involved may be gathered from a collection of over 700 cases wherein each is carefully recorded, classified, deductions drawn, and where possible, illustrated by skiagrams. The work is arranged in four parts—the first treating on traumatic separations in general. The second and third on those pertaining to upper and lower limbs respectively, and finally those of the vertebrae and ribs are dealt with. Under each heading, the age, sex, varieties, complications, and treatment are fully given, together with drawings of special appliances where helpful. Nineteen skiagrams of the hand at ages varying from 1 to 17 years are given, serving to illustrate the relations of the epiphyses at their respective ages. This is well embraced here, though also published in a separate volume, as "The Skiagraphic Atlas" of the bones of the hand and wrist. The entire volume is extremely well got up and is a mine of information on a subject, the literature of which has hitherto been most scattered.

"Clegg's International Directory of Booksellers." Rochdale. 6.—The edition for 1899 is a wonderfully cheap compendium of all that is necessary for the average bibliophile. The foreign section and the list of dealers in every variety of book hobby is remarkably complete.

A discussion on "Dermatitis in Relation to Roentgen Work", was held at the Roentgen Society on the 6th inst. Mr. Ernest Payne and Dr. Walsh read each a paper dealing with some of the accepted theories and some recorded cases. The exact factor in determining the destruction on tissues remains an unsettled one. X-rays, other rays, brush discharges, abnormal conditions of the skin, individual susceptibilities, had each their advocates. The employment of metal and other "masks" around the exposed parts occupied some discussion, but the modus operandi by which these exercised protection was not agreed upon. It is to be regretted that only some half dozen replies were received in response to a largely distributed "form" requesting tabulated information from those who had experience of x-ray burns. This limited testimony, however, was quite in accordance with the general experience of workers, viz.: That small coils with long exposures, and "soft" (low vacuum) tubes, were the usual conditions under which the damage occurred. However, under improved technique, long exposures are no longer necessary, and in future such "burns" may be regarded as almost outside the pale of possibility.

In a recent lecture before the Royal Photographic Society, Dr. Russell discussed the manner in which certain bodies act in the dark on a photographic plate. The principal substances dealt with were printer's ink, in contact with or at a distance from a photographic plate, oils, copal varnish, turpentine, wood and metals. Dr. Russell is of opinion that peroxide of hydrogen is the cause of many of the singular photographic phenomena thereby produced.

A still further singular employment of the x-rays has been suggested. In the process of winding silk from the cocoon it is necessary to place it in hot water whereby the grub is killed. A rough guess in weight is the only way of determining between the male and female. As the latter contains—on account of its eggs—much more mineral matter than the male, x-rays may be employed to distinguish the sexes so that the females, valuable for their eggs, may be saved.

In Germany the use of the Roentgen rays has led to very satisfactory diagnosis being arrived at in cases of swollen feet, a complaint very frequently met with among infantry soldiers, more particularly after days of weary and protracted marching. This swelling is frequently unaccompanied by any outward and visible wound. An examination made with the help of the Roentgen rays not infrequently shows the trouble to be caused by a fracture of the middle metatarsal bones. Among the soldiers of the mounted branches of the army bone fractures are not infrequent. To enumerate: damaged shoulders, elbows, hips and ankles. Again in cases of malingering, or alleged malingering, the rays have been equally successful. The following case shows to what curious devices men will sometimes resort with the object of thus freeing themselves from military service. A cavalry soldier reported himself in hospital as suffering from inflation of the skin of the third and fourth fingers, which had—he affirmed—been caused by the bite of a horse a week previously. After undergoing an examination at the hands of the regimental surgeon, who was much puzzled by some of the symptoms, the part was x-rayed. The result showed five needle-shaped foreign substances embedded in the flesh of the hand. The man then admitted having himself inserted the two smaller ones during a period of arrest that he had recently undergone. Of the three larger ones he emphatically denied all knowledge. He himself afterwards secretly withdrew the two smaller needles. The other three had to be removed by an operation. These substances proved to be strong pins which had had their heads broken off before being inserted. One of these was found to be embedded in the interosseous muscles.

In another recorded case, the muzzle of a revolver was discharged opposite the apex of the heart. The surgeons had every reason to suppose that the heart itself was injured. On a radiogram being taken it was seen that the bullet had become fixed in the lower part of the pericardium.

Dr. Hoffman records an interesting case of a shoemaker aged 38 who was shot on December 14, 1895. The shot was fired at a distance of thirty centimetres and struck the unfortunate man in the throat just over his shirt collar. After a short interval of consciousness, he fell down senseless and so remained for four hours. On regaining his senses he became conscious of a feeling of extreme cold and a great rigidity of the whole body. His head remained quite clear. At the same time he felt extreme pain in the throat. For a long time he remained bed-ridden and semi-unconscious. With the exception of the head and neck, nearly all the muscles seemed paralyzed—he being only able to move his toes and fingers. For the first fortnight evacuation only took place after the use of an enema, and micturition after using a catheter. The use of his limbs gradually returned—the right more quickly than the left. His left arm also recovered very slowly and still remains weak and stiff. A curious symptom was recorded; any part of the body (with the exception of the throat and face) that was touched with anything cold experienced a curious prickly sensation resembling the application of a mild electric current. At no period was a loss of feeling present. Evacuation and micturition became normal. The man recovered entirely with the exception of a slight lameness of the left leg, and a slight stiffness of the left arm.

An examination made with the help of the Roentgen rays clearly showed the bullet lodged in the vertebral canal at the height of the fourth cervical vertebrae. This shows that a bullet may pass through the throat from front to back, into the vertebral column, and even through and into the vertebral canal without injuring any vital organs. The result of such an accident being nothing more serious than the partial and temporary paralysis of the limbs.

At a recent meeting of the Royal Society, Mr. C. J. R. Wilson, read a paper showing the results of his experiments in the comparison of x-rays with the rays from uranium, with ultra violet rays, sunlight, metals in contact with the gas under examination, and further with the modifications brought about by electricity. The net results of Mr. Wilson's work, which lay in the effect upon the condensation of aqueous vapor into fog or visible drops of these various radiations, conclusively showed that these radiations were all distinct and different and not to be confounded with one another, there having been at one time, a strong tendency to show a similarity of constitution through similarity of effect.

In the annual report of the Paris Observatory for 1897, we learn that a special study of the cathode rays has recently been made. These investigations were inspired by the theory, in accordance with the conception of M. Deslandres, which assimilates the rays of the solar corona to the cathode rays.

Firstly, it was a question of if the the reciprocal actions of the cathode rays and of the conductors could explain the curved rays of the corona. The ollowing are the initial results obtained: A cathode ray is deflected by means of a metallic wire situated in the interior of the vacuum tube and connected with a conductor on the outside. It becomes devided into unequally deflected rays, in the same manner as the prism deflects rays of lights by reuniting these deflections the "Cathodic Spectrum" is obtained. Who knows if the phenomenon of the crepuscular lights (twilight), such as has been authenticated, will not be explained in this manner?

A simple cathodic ray corresponds to a simple electric oscillation (vibration). At a very low pressure, widely deflected simple rays alone exist in the cathode spectrum and furnish the greater part of the x-rays. At that moment, the corresponding electric oscillations are those of the vacuum tube itself, which vibrates in its own period.

Mons. Deslanders and Millochan have succeeded, basing their opinions on these results, in giving a very clear explanation of the tail of a comet.

Radiograms taken at different stages of Coxalgia show the following lesions: atrophy of the femur and of the pelvis on the side corresponding to the coxalgia; light color of the whole femur indicating lesions of the full length of the bone; deep color indicating fungi or the presence of cold abscess; spongy bone with small anfructuous cavities; disease of the neck of the femur; lesions of the cotyloid cavity; dislocation, or partial dislocation of the head of the femur.

By following these deductions, an exact diagnosis of the affection and its peculiarity may be made, coxalgia may be distinguished from osteo-myelitis, periarticular lesions, and the different varieties of arthritis.

Fluorescent Screens For X-Ray Work.

A contributor to the *British and Colonial Druggist* says, from personal experience, that effective fluorescent screens may be made by the amateur, and that a material reduction in cost is thereby effected. Calcium tunsgate he regards as a very fair material, and a salt of uranium he thinks very good (the particular salt not being mentioned). The method of making the screen is as follows: Take a plate of glass, say, $8\frac{1}{2}$ by $6\frac{1}{2}$ inches, make a mask of stout paper, with an opening 7 by 5; wet this mask with glycerine or muçilage of gum arabic and place it over the plate; cover the plate with collodion or varnish, or mucilage (with a little glycerine added), and sift the powdered salt quickly and evenly all over the surface. If vellum, parchment, cardboard, or ebonite be used as the support, one may put a coating on both sides, and thus even up any inequalities of deposit; but with a glass support the same advantage will not accrue. Having got a good thick coating of powder, the mask is removed, but this does not matter very much; it has served its purpose to give a clear edge to the coating. The coated side, which must face the tube, if glass is used, is covered with a piece of thin black celluloid, or ebonite, or opaque paper. With vellum, parchment, or paper, there should still be a black shield between the tube and the fluorescent salt; but the latter should be left uncovered, and facing the eye. The platinocyanides may be used in the same way, though they do not powder or sift so finely; or they may be mixed with varnish, and spread over a glass or vellum surface. The trouble is to get a really even coating, but with anything but glass one can apply a roller pressure, and thus smooth down any unevenness. The easiest way to get an even coating, according to the author, is to use a vehicle of paraffin and petrolatum. Equal parts of each are melted together, stirred until cool, and the powdered salt (about 2 drachms for a 7 by 5 screen) rubbed on a slab with just enough of the wax mixture to make a workable mass, which is spread by means of a long, straight spatula. An undesirable feature is the liability of the mixture to "run" in a heated atmosphere, but at normal temperature no trouble whatever is encountered. The author, whose article is abstracted in *Scientific American*, mentions that in addition to its value as a means of direct observation, the fluorescent screen reduces the time of exposure in making a skiagraph, being placed beneath the plate when exposed. In conclusion, the author remarks:—"Of course, it must be understood that even the best and most costly screen will not fluoresce to any extent if the rays are being delivered poorly and intermittently; it will not compensate for a poor and weak electrical discharge and a faulty tube. As a gauge by which to estimate exposures, I consider a good screen very valuable. With practice one becomes as intimate with the capabilities of his 'tubes' as a photographer with the capacity, as regards covering power and rapidity, of his lens."—*Electrical Review*, London.

Conservative surgery is the pride of the modern Esculapian on the field of battle. The stacks of amputated limbs that constituted such a gruesome and constant sight after every great battle during the Civil War, will never be seen again on the field of battle where modern surgery is practiced. Aseptic surgery has driven out of our military hospitals the four greatest enemies of the wounded soldier: hospital gangrene, secondary hemorrhage, pyemia and erysipelas. The probe, an instrument of torture, danger and fallacy, has been abandoned for the x-ray in locating bullets lodged in the body.

Extract from "Esculapius on the Field of Battle," delivered at the banquet of the Inter-State National Guard Association, Dec. 14, 1898, by Dr. Nicolas Senn.

The Value of the X-Ray in Military Practice.

The use of the probe as a diagnostic instrument in locating bullets in modern military service has been almost entirely superseded by dissection and the employment of the x-ray. If from the nature of the injury and the symptoms presented the bullet is located in a part of the body readily and safely accessible to the knife and it is deemed advisable and expedient to remove it, this can often be done more expeditiously and with a greater degree of certainty by enlarging the track made by the bullet than by relying on the probe in finding and on the forceps in extracting the bullet. If, as is often the case, the whereabouts of the bullet is not known, its presence and exact location can be determined without any pain or any additional risks to the patient by the use of the x-ray. All of the bullets removed on board the hospital ship Relief were located in this manner. Dr. Gray, an expert in skiagraphy, who has charge of the scientific work of the floating hospital, has been of the greatest service to the surgeons in enabling them to locate bullets and in guiding them as to the advisability of undertaking an operation for their removal.

His large collection of skiagraph pictures will also furnish a flood of new light on the effects of the small caliber bullet on the different bones of the body. Dr. Gray's work will constitute an essential and enduring corner-stone of a much-needed modern work on military surgery. The skiagraph has enabled us to diagnosticate the existence or absence of fracture in a number of doubtful cases in which we had to depend exclusively on this diagnostic resource. In fractures in close proximity to large joints the x-ray has been of the greatest value in ascertaining whether or not the fracture extended into the joint. In one case of gunshot wound at the base of the thigh in which the bullet passed in the direction of the trochanteric portion of the femur, opinions were at variance concerning the extent of injury to the bone. Some of the surgeons made a diagnosis of fracture while others contended that there was no fracture but believed that the bullet had made a deep groove in the anterior portion of the bone and had possibly opened the capsule of the joint at the same time. The x-ray picture clearly demonstrated the absence of fracture and the existence of a deep furrow with numerous fragments on each side. The x-ray apparatus also proved of the greatest practical utility in showing the displacement of fragments in gunshot fractures of the long bones, which enabled the surgeons to resort to timely measures to prevent vicious union. The fluoroscope has greatly added to the practical value of skiagraphy. In the light of our recent experience the x-ray has become an indispensable diagnostic resource to the military surgeon in active service, and the suggestion that every chief surgeon of every army corps should be supplied with a portable apparatus and an expert to use it, must be considered a timely and urgent one.—*Journal of the American Medical Association,* Nov.

The Rational Treatment of Grippe.

The necessity of a powerful eliminant in every prescription for grippe is self-evident. While antipyretics and antiperiodics may somewhat stimulate the excretions and relieve congestion, thereby controlling certain features of the disease, a complete cure can not be expected until the grippe poison is thoroughly eliminated and the diseased organs enabled to resume normal functions.

The successful treatment of grippe depends upon the thoroughness of the remedy employed, hence we ask why temporize with antipyretics and antiperiodics when Tongaline always secures prompt and efficient as well as permanent results.

The internal use of Tongaline Liquid taken at short intervals in hot water, washed down with copious draughts of hot water, may be supplemented by its local application to the inner parts of the thighs and to the abdominal surfaces. Or as grippe invariably renders the stomach irritable and the nerves sensitive, the disturbing effects of internal medication can be entirely avoided by the external use of Tongaline Liquid alone.

In fact when the system is thoroughly under the influence of Tongaline, the progress of the grippe is arrested and as a result there is immediate recuperation, followed shortly by a perfect cure.

Upbraiding the Doctor.

Dr. Samuel Wolf, Physician to the Philadelphia Hospital, and Neurologist to the Samaritan Hospital of Philadelphia, presents among others, a case which is of special value at this time. He says:—"The entire experience of the writer with antikamnia is not confined to the series of cases on which this paper is based, although its previous use had been limited to a few prescriptions, and those in cases where it was given after the usual routine had been exhausted. It is, however, to a striking result in one of these instances, that the incentive to investigate more fully, is to be largely attributed. A man of 42, in the course of an attack of LaGrippe, was enduring extreme torture from the pain of a trigeminal neuralgia. The second ten grain dose of antikamnia gave such complete and permanent relief, that my patient, a druggist of large experience, upbraidingly asked me, 'Why didn't you prescribe this remedy before?'"

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Dr. WILLIAM KONRAD ROENTGEN.

[From a photograph of Haufstaengel, Frankfort-on-the-Main.]

The American X-Ray Journal.

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VOL. 4. *ST. LOUIS. MARCH. 1899.* *NO. 3.*

THE ROENTGEN RAY IN THE ORME MURDER TRIAL.

BY JOHN T. PITKIN, M. D. BUFFALO, N. Y.

The Tragedy.—It was in an old house known as "the barracks," in the little village of Horseheads, Chemung County, N. Y., on the eighth day of July eighteen hundred and ninety-seven, when an elderly man with a long gray beard and intelligent features upon returning rather unexpectedly to his residence found to his great surprise his conjugal partner in the fond embrace of an Italian boarder named James Punzo. In the general melee which ensued Mrs. Orme is said to have assaulted her husband with a large tin dipper striking him several times on the head, cutting a deep gash with each blow from which the blood gushed most profusely, covering his head and face and blinding his eyes. Whereupon Orme drew a revolver and discharged two of its chambers, both shots took effect upon his antagonists. One struck Mrs. Orme in the mouth and removed a portion of her tongue, the other went crashing through the skull and into the brain of James Punzo, her paramour.

The Sequel.—Mrs. Orme recovered sustaining only the loss of a small portion of her lingual organ, but Punzo did not fare so lightly, the thirty-two caliber bullet penetrated his skull at a point in the back of his head, one and one half inches to the left of the median line as indicated by the external occipital protuberance, and about one and one half inches above the superior curved line, entering the posterior portion of the left hemisphere of the cerebrum to the depth of about two inches, in which position the bullet remained until its exact position was revealed by postmortem examination.

At The Hospital.—On the day of the shooting Punzo was taken to the Arnot-Ogden Hospital, in the city of Elmira where the patient was subjected to a process of probing which failed to locate the position of the foreign body. From the eighth day of July (the day of the shooting,) to the fourteenth of the same month the patient remained in a somewhat dazed condition with more or less elevation of temperature. On the sixteenth of July the patient began to manifest signs of improvement so that between that date and the thirty-first, a period of fifteen days, his temperature, respiration and pulsation indicated a nearly normal condition and it was subsequently proven by the sworn testimony of six professional nurses that the patient so far recovered that he was able during this time to leave his bed nearly every day, to walk about the hospital wards, including the rooms set apart for the convalescing, that he was allowed to converse freely with all who were interested in his case and wellbeing, during the greater portion of this period he was perfectly rational but had short spells of incoherency. Examination of the patient July thirty-first showed that the scalp wound had healed perfectly over the aperture in the skull, but on that day an unsuccessful attempt was made to locate the bullet in Punzo's brain with the Roentgen Rays.

The Exposure.—In order that your humble scribe may render a true and impartial report of the remainder of this extremely interesting case we will refer to the court records of the Orme trial, from which we glean the following:

First. Substantially an extract taken from the testimony of the prosecution's own witness as to the modus operandi employed in the x-ray examination. The patient was placed under the influence of ether and maintained unconscious for the space of fifty minutes. A sort of head rest was employed which had an aperture through it to admit the back of Punzo's head. A Crookes' tube was then placed in a stationary position directly under, and opposite to the bullet opening in the skull at a distance of *one and one half inches* from the head, this tube was attached to and received its excitation from what is known as a Holtz Static Generator with a capacity of producing a half million volts. Its use was continued for a space of *thirty-five minutes* without removal from its position. The weather and other conditions were favorable for the working of the apparatus; nevertheless no picture of the bullet was obtained, nothing but a dark outline of the skull appeared upon the sensative photographic plate.

Exit Punzo.—The clinical record of the hospital indicated that within a few hours after this x-ray exposure the patient's temperature rose from normal to 100.4 (two degrees,) and from that day until the day of his death, August twelfth, his temperature fluctuated from one to two points above to a little below normal, the patient remaining in a dazed or semi-comatosed condition which gradually increased up to the time of his demise.

Second. The following is a sworn statement certified to by the leading physician who was duly appointed by the Coronor of Chemung County, to make a post-mortem examination of the body of James Punzo.

"On the twelfth day of August, 1897, at the hospital morgue, Elmira, N. Y., I assisted in the autopsy of the body of James Punzo. The body was in some degree emaciated and showed but little rigormortis. We found no external wound but could feel through the scalp a circular opening in the occipital bone. The scalp was incised transversely and turned off from the skull and on uncovering the opening in the bone a flattened bullet fell out. The skull was then sawed through, the brain uncovered and removed for examination.

Report of Medical Examiner to Coronor on the Autopsy's Revelations.—The wound in the brain extending from the opening in the skull was laid open by incision. The ball had passed through the skull a little above the transverse ridge and half an inch to the left of the external occipital protuberance aud entered the brain, its direction then being forwards and outwards toward the left. At its termination there was a depression in the brain of the size and shape of the ball where it had laid imbedded. I measured the extent of this wound and found it to be one inch and one half in length, and the ball must have been lying there when we commenced the autopsy, and by the concussion and jerking of the head in removing the scalp it became dislodged from its bed and dropped into the opening in the skull. There was no abscess or accumulation of puss in or about the wound. Numerous deep incisions were then made into the brain, anterior to the track of the ball, but we found no wound or injury to indicate that the ball had penetrated the brain any further than one and a half inches. The scalp had perfectly closed over the aperture in the bone, and a little plastic lymph had been effused about the bed where the ball had lain to protect the brain from its rough and angular surface, and would appear to be in a favorable process of repair. It would appear then It is idle to say we do not know that they penetrate the brain or do harm, because we do not know what they are. We know no less what the x-rays are than we know what light, heat and electricity are. All we know of any of them is by their effects. And we know that instances are now being published from all parts of the country of most disastrous and destructive effects of the x-rays in unskillful and imprudent hands."

In my opinion James Punzo came to

that the bullet wound was only a contributing cause and by no means the only or sole cause of his death. It has been stated here in the account of the treatment given him that on two occasions anaesthetics were administered and the x-rays used to locate the ball in his head. The administration of the anaesthetic at any time after adhesive inflammation had supervened jeopardized his safety, and the application of the x-rays to his head was hazardous to his life. his death from injuries to the brain caused by a gunshot wound, anaesthetics and the x-rays.

(Signed) E. H. DAVIS, M. D.

Third. The following is taken from a report of Attorney Wilmont E. Knapp.*

The Trial.—George A. C. Orme was placed on trial charged with murder in the first degree on the thirteenth day of

*Wilmont E. Knapp, of the law firm of Messrs. Knapp and O'Connell, attorneys for the defense whose indefatigable efforts in their client's behalf resulted in his acquittal.

December at a term of the Superior Court, held in the city of Elmira. The case lasted until the twenty-third of December (some ten days) the defence maintained that the cause of death was not the bullet alone, but that there were other contributing causes. First, and chiefly the exposure of the deceased to the influence of the Roentgen Rays. Second, repeated and improper administration of ether. Third improper probing for the bullet on the day of the shooting, being claimed that the probe went outside of the wound and into the substance of the brain proper. The last subject, however, was very lightly touched upon and played little or no prominence in the case, owing to lack of proof, but the question of the x-rays figured as the principal element as to the cause of death.

The jury sustained the position taken by the defense and acquitted the defendant. The penal code section 181 prescribes that the prosecution must establish beyond a reasonable doubt that the bullet was the only and direct cause of death.

The Scribe Swears.—To sustain the contention of the defense the writer was produced and duly sworn. In reply to the hypothetical question based upon the conceded facts as to the manner in which the x-rays were employed the following answer was given: "I regard the use of this small apparatus (that is the one employed upon Punzo) for x-ray purposes extremely dangerous to the subject exposed. See illustration. I should say that such an examination of a brain already irritated as his was supposed to have been would in my opinion, have not only retarded the healing process but cause a distinctive irritation, resulting in a breaking down and softening of the brain tissue and thus cause the death of the sufferer." In the exposure of Punzo to the Roentgen Rays it was proven that no preventative means were employed to obviate their dangerous and destructive effects. The parts were too close to the excited tube. No plate of aluminum connected with a ground wire was interposed between the Crookes' tube and the patient's head to absorb the electrical streamers. No attempt was made to insulate the patient from the electrical conductors of the apartment. In other words the irritated brain of the patient was placed directly in the danger zone without protection from electrical bombardment, and in all probability what was a healthy reparative constructive process was arrested and converted into a condition of destructive or retrograde metamorphosis.

NON-METALLIC DIAPHRAGM FOR RADIOGRAPHIC WORK.

BY W. [illegible] ANDREWS

I feel much indebted to Dr. Wm Smith for the information given by him in the December number of THE AMERICAN X-RAY JOURNAL, concerning the use of vermillion for screening x-rays.

The employment of metallic diaphragms in radiographic work is objectionable on account of their conducting properties, and their liability to draw the high tension discharge away from the tube. Diaphragms of very thick glass have been used, but they are expensive to make and heavy and cumbersome to handle.

Dr. Smith's remarks on the opacity of vermillion to x-rays suggested the idea of making a diaphragm of heavy bristol board thickly coated with vermillion paint. As stated by Dr. Smith, Chinese vermillion should be used, but if this is not procurable, the best grade of English vermillion will answer. It can be mixed with a solution of shellac in grain alcohol employing only sufficient shellac to make the vermillion hard and solid when dry, but not enough to impart any glaze to the dry surface. The mixture may be mixed to about the consistency of ordinary paint and applied to the bristol board with a brush in successive coats to the desired thickness.

I have made a diaphragm as above with two pieces of bristol board, each 10½x8 inches, and about .065 inches thick, with a circular hole 2½ inches, diameter cut in the center of each piece. These cards were coated with vermillion to a thickness of about .025 inches, on both sides. They were then stuck togther while the paint on two surfaces was soft, and dried slowly under pressure for two or three days. It was then covered with ordinary writing paper, the edges were rounded and smoothed off, and a few coats of fine varnish completed the finish.

The combined thickness of the four coats of vermillion is about .1 inch, and I find this to be sufficiently opaque to x-rays for ordinary radiographic work. I use a high frequency apparatus that produces a strong 6 inch stream of sparks, and the discharge shows no tendency to leak across or through this diaphragm. It is cheap and easy to make, very light and handy to use, and nearly as strong as a metal screen.

Schenectady, N. Y. Jan. 31 1890

AN IMPORTANT STEP IN THE ADVANCEMENT OF X-RAY RESEARCH. THE WEHNELT INTERRUPTER.

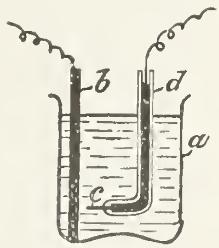
BY FREDERICK STRANGE KOLLE, M. D.

Since the discovery of the focus tube and perhaps an advancement in a better knowledge of the cause of x-ray injuries, little has been accomplished toward simplifying radiography. The addition of the Wehnelt electrolytic current interrupter promises, however, to prove one of the important discoveries, in this direction, which will within a few months revolutionize the building of vibrators now provided with the usual induction apparatus.

The interrupter has, up to the present time, as a rule, proved more or less unsatisfactory and the instrument of Dr. Wehnelt seems to have come to us as a blessing in the hour of need.

The discovery is the outcome of the electric forge devised by Hoho and Lagrange, and is a modification of their device, utilizing the phenomena produced by the immersion of two unequal sized electrodes in an electrolyte.

The light perceived in such an experiment or in the use of the forge will be found to be of a rapidly intermittent character, accompanied by the usual vibratory buzz or hum of the spring rheotome. Dr. Wehnelt of Berlin, conceived the idea of introducing this



principle, which seemed to answer every function of the vibrator, into the primary circuit of an induction coil and found the results to be far better than those given with even the most modern instrument especially made for that purpose.

Before going into the details of the results obtained by him, it may be of interest to describe the interrupter used.

The latter consisted simply of a beaker of glass, (a) containing an electrolyte, (e) on which were placed a plate electrode of lead or cathode, (b) and a second electrode made by fusing a platinum wire into a curved glass tube, (d) containing liquid mercury to convey the current. The exposed point of platinum (c), is allowed to project beyond the closed end of the tube. The electrolyte employed was a solution of dilute sulphuric acid of 20 degrees

Baume.) The point of platinum of the anode was placed opposite to the cathode plate with an appreciable distance between the two, to permit of a spark gap.

In the first experiment a battery of 60 accumulators was employed to furnish current for the primary of a small induction coil. As the pressure or voltage of the current in the primary was increased from a low E. M. F., a moderate spark discharge was noted at the secondary at the moment the light phenomenon between the interrupter electrodes was perceived. This sparking occurred even when very low potentials were used in the primary.

A sharp whistling noise accompanied the light phenomenon when about 80 volts and 3 amperes were employed.

With a 12-volt pressure and 6 amperes in the primary circuit of a 12-inch spark coil, the number of vibrations as judged by the tone were found to be about 1,000 per second, and even more than that of the Deprez interrupter, while a profuse spark discharge of as high as 18¼ inches was obtained.

It was found that the condenser was not necessary in this case, as self-induction was found to greatly favor the production of the light phenomenon and an increased sharpness in the breaks: in fact a higher potential was required to give the same results when the condenser was introduced into the circuit.

It will be found upon experiment that the number of interruptions or the rapidity of the break increases with the increase of the E. M. F.

I find a copper or amalgamated zinc plate electrode as the cathode seems to be an improvement on the lead electrode; but hardly think any doubt if any improvement can be made in the anode, as platinum seems to be especially advantageous because of its high infusibility.

The current strength increases with the size of the anode, corresponding to a current of an approximate density of 0.41 amperes per millimeter of its area.

With the increase of the current strength there is a definite decrease in the number of breaks because of the thus increased resistance of the induction coil.

The fact that the interrupter can be readily used on the direct lighting circuit of 110 volts, its striking simplicity of construction, indestructibility and its high rate, regularity and uniformity of breaks, makes it an instrument of inestimable value for induction coils used for x-ray work. In making a comparison with the expense of the improved make and break attachments of today, this instrument displaces all in its cheapness, even the oldest and cheapest spring vibrator.

The following increase in spark discharge was noted with the given sized spark coils where this interrupter was employed:

11¾ inches increased to 22½ inches
19¾ inches increased to 36⅝ inches

With a coil giving a 7-8 inch spark discharge, tubes intended for 6-inch spark coils, can be used with the Wehnelt instrument giving the same ray efficiency. With a 6-inch spark coil, using this interrupter, will permit of the making of a clear radiograph of the pelvis in about two minutes exposure.

I would advise, however, to use tubes intended for much larger apparatus when using this break arrangement, the platinum discs in all future tubes intended to be used therewith should be made much heavier to prevent the rapid fusion otherwise certain to follow.

A second's time I find is sufficient to pierce the platinum plate used in the ordinary focus tube. I propose to make the anti-cathode in the form of a square pyramid slightly flattened and in that way believe to overcome this difficulty.

Another noticeable fact is that the

flickering observed with apparatus furnished with poor interrupters is, by the use of this instrument, entirely overcome, and therefore the diagnostic value of the rays to the physician has been increased beyond description—the diagnosis of pulmonary disease are especially included herein.

A simple instrument may be constructed using either a copper or zinc cathode, while the platinum of the anode may be, partly, replaced by ordinary bare copper wire or a strand of wires as obtained in flexible cord, soldered to the platinum or projecting tip, just above the point where it has been fused into the glass. Liquid mercury surrounds the wire within the glass tube.

Brooklyn N. Y., Feb. 21, '99.

OSTEOPLASTIC EXCISION OF THE WRIST-JOINT.

Transactions of the New York Surgical Society, Stated Meeting, October 29, 1898.

Dr. Frederick Lange presented a man, thirty-nine years old, who, until the onset of his present trouble, had always enjoyed good health. On the 29th of May, 1893, he was admitted for a large swelling of the lower end of the left radius; this was operated on, and he was discharged, four months later, with a discharging sinus. In October, 1893, and in February of the following year, he was again operated on for recurrence of the growth.

In May, 1894, when the patient first came under Dr. Lange's care, he presented a fungoid growth, surrounded by scar-tissue, evidently taking its origin from the lower third of the radius, which was thickened and partially destroyed. After an extensive excision of the bone, almost four inches in extent, the patient made a rapid recovery, and two months later he was able to resume his work. In January, 1897, he again presented himself with a recurrence of the growth, which now involved almost the entire carpus, with the exception of the os pisiform and os unciform. The hand was useless for work, and a number of the axillary glands were distinctly swollen.

On February 11, 1897, the carpus was excised, together with the bases of the second, third, and fourth metacarpal bones, and a number of enlarged glands were removed from the axilla. In order to secure for the ulna a broad attachment to the hand the following plastic operation was done: About one inch above the styloid process the ulna was sawed across within its periosteum; the proximal end of the bone was then displaced out of the periosteal cylinder anteriorly, pushed down to the sawed ends of the second and third metacarpal bones, and united to them by silkworm sutures; the empty periosteum connected the two ends of the severed ulnar bone. The extensor tendons, now mu[illegible] too long, were suspended in several loose catgut loops, drawn through the integument, and tied outside, thus preventing the tendons from lying in close approximation to the bone and becoming adherent to it. Cicatrization was completed in about three weeks. The tendons, aided by proper exercise and electricity, gradually resumed their function, and within three months after the operation the hand was again fairly useful. The man is a locksmith and machinist, and is now able to perform all the work belonging to his calling. The hand is slightly adducted, but he has good control over it; there is no wabbling and the metacarpal bones are closely approximated to the carpus.

In connection with this case, Dr Lange showed two Roentgen ray photographs, taken, respectively, four months and twenty months after the operation. One of these photographs shows the formation of a broad and firm bony bridge between the two parts of the ulna, which now forms the ulna-metacarpal joint: in the first photograph, which was taken about four months after the operation, it appeared as only a slight shadow. A broken point of the drill is seen in the distal end of the ulna in both photographs. The relation between the second and third metacarpal bones and the ulna has somewhat changed,

Fig. I.—Osteoplastic resection of the carpus three months after operation. a, radius; b, proximal end of ulna, displaced and united to second and third metacarpus; c, distal end of ulna; d, periosteum in beginning ossification; between c and d, the point of a broken drill; e, probably point of needle.

the latter being in closer approximation to the base of the third metacarpus. (See figures.)

The radiographs Fig. I. and II., were kindly furnished for reproduction in THE AMERICAN X-RAY JOURNAL by Lewis Stephens Pilcher, M. D., editor of *Annals of Surgery.* The February issue of the *Annals of Surgery* published the transactions of the October meeting of the New York Surgical Society and also the instructive illustrations.

FIG. II.—Osteoplastic resection of carpus twenty months after operation, broad firm long bridge between the two ends of the ulna; the proximal end of the latter now more opposite to the third metacarpal bone.

The Importance of Radiography, For the Diagnosis and Treatment of Deviations of the Vertebral Column.*

BY M. M. F. REDAN, AND LORAN.

Translated from the French by FRANK RING, A. M., M. D. For THE AMERICAN X-RAY JOURNAL.

Our Radiographic investigations demonstrate that we can obtain, with a great precision of detail, the image of the configuration and the position of rachitic vertebrae.

We insist, more particularly, upon the service rendered by radiography, in the diagnosis and treatment of Pott's disease and of Scoliosis.

I. *Pott's Disease.* Several of our radiographic proofs of the dorsal and lateral planes, display clearly vertebral tuberculosis foci at different periods. The initial tuberculous lesions are revealed by radiography of the vertebrae. We have been able to affirm in several cases, the real existence of Pott's disease, and to exhibit therapeutic measures, when the objective and subjective symptoms were obscure.

Radiography teaches us, besides, the number, of vertebrae affected, the extent and depth of the tuberculous lesions, as well as the alterations in the neighboring tissues and organs. At an advanced period of Pott's disease, the radiograph indicates the extent of the lesions, the importance of loss of substance, the existence of sequestrations and of tuberculous caverns, the degree and causes of rachitic curvatures.

In several cases, cold abscesses, particularly those treated by iodoform and oil, have been manifest upon the picture, under the form of a shadow, more or less prominent. Radiographs taken at different periods of treatment indicate the progress or decline of the tuberculous process.

In a number of radiographs it is noted that the rachitis is consolidated in good position. They demonstrate the union of one or several vertebrae by a peripheral or interfragmentary callous.

The radiograph is in concordance with the proof furnished by the study of anatomical specimens, in demonstrating that, in a great number of cases of Pott's disease, above all in recent cases, that consolidation in good position, by junction of the vertebrae is frequently obtained.

II. *Scoliosis.* In scoliosis we can obtain information which is, usually, only learnt post-mortem.

One can see, very clearly, upon the radiograph, the dorsal and lateral aspects, the various deformities of the body, pedicle and arch of the vertebrae.

Upon a number of plates may be noticed the bony union of several vertebrae, the existence of osseous products at the periphery, which teach us the cause and degree of rachitic rigidity, and consequently fix the prognosis and curability of some old cases of scoliosis. The degree of rachitic lateral curvature, the diminution of the space of the concave side and the increase of convex side are displayed upon our radiographic proofs. Several radiographs, taken at diflerent periods of treatment, indicate the therapeutic results obtained.

It is demonstrated that the osseous tissue of the concave side is more dense, the medullary spaces more close than the convex.

Further, contrary to the usual opinion of former times, the osseous tissue of the concave side, far from being atrophied, is the seat of a hypernutrition, and of an osteo-genesis much more marked than upon the convex side.

*Read before the Congress of Surgeons, at Paris, France.

SUMMARY OF RADIOGRAPHY IN FRANCE FOR 1898.

Reone Internationale d' Electrotherapie et de Radiotherapie, of Paris, gives an interesting summary of radiographic work, for the year 1898.

Some of the items are here transcribed. Gunshot Wound of the Left Kidney. Immediate Laparotomy. Secondary Radiography and Extraction of the Ball. Secondary Infection. Peri-Renal Drainage. Preservation of the Organ. Recovery. (*Lyon Med*).

Displacement of the Pyramidal and Pysiform Bone. (*Rayons X*, Paris).

Treatment of Lupus by Concentrated Rays, after the method of Prof. Finser. (*Rayons X*, Paris).

X-Rays and the Diagnosis of Tuberculosis. (*Rayons X*, Paris).

Injury to the Elbow in Infants. Utility of the Radiography. (*Jour. de Med. de Paris*).

Diagnosis of Stomach and Bowel Complaints, by Means of X-Rays. (*Deutsch Med. Wochenscher*).

Endoscopy by X-Rays. (*Rayons X*, Paris).

Causes of Error in the Application of X-Rays to the Diagnosis of Tuberculosis. (*Rayons X*, Paris).

Application of X-Rays in Stomatology. (*Progres Med.*, Paris).

Upon the Determination in a Single Radiographic Operation of the Position of a Ball in the Organism. (*Rayons X*, Paris).

X-Rays in Ocular Surgery. (*Soc. de Med.*, Rouen).

Amputation in Ukro of the Right Fore-Arm. (*Rayons X*, Paris).

Report Upon the Application of Roentgen Rays to the Diagnosis of Pulmonary Tuberculosis. (*Arch. d' Electr. Med.*)

Localization of Foreign Bodies in the Eye, and in the Orbit by X-Rays. (*Ann. d' Ocul.*, Paris).

An Old Pleurisy. Consecutive Deformation of the Thorax. (*Rayons X*, Paris).

Examination of Calculus and Other Concretions by the Aid of X-Rays. (*These de Doct. Bourdeau*, 1898.

Localization of a Fragment of Babbit-Metal in the Eye-Ball, by Means of Repeated and Differently Placed Exposures to the Roentgen Rays. (*Phila. M. J.*)

A Piece of Money in the Esophagus of an Infant, Revealed by the X-Rays. External Esophagtomy. Extraction. Recovery. (*Gaz. de Hop.*, Paris.)

Acne Treated by Electrolysis and the X-Rays. (*Reveue Internat. d' Electroth*, Paris.)

Foreign Body (piece of 5 centimes) in the Thoracic Esophagus ot an Infant. Radioscopy. External Esophagotomy. Death from Broncho-Pneumonia. (*Bull. et Mem. Soc de Chir. de Paris.*)

New Communications Upon the Application of Roentgen Rays in Rhinology and Laryngology. (*Arch. de Laryngol*, Paris.)

Multiple Deformities of the Metatarso-Phalangeal Articulations of the Left Foot. Radiography. Resection of the Metatarso-Phalangeal Articulation and of the Head of the Second Metatarsal Bone. Recovery. (*Rev. d' Orthop.*, Paris.)

Note Upon a Case of Elephantiasis, with Nervous Troubles. Cured After Application of Roentgèn Rays. (*Normandie Med.*, Rouen.)

Urinary Calculi and the X-Rays. (*Ann. d' Electrobol.*)

Method of Measuring the Cardiac Area by Radiography. (*Radiographie*, Paris.)

Right Hemoplegia. Troubles of the Memory and of Speech, Occasioned by the Presence of a Ball in the Left Cerebral Hemisphere. Raidography of the Ball by the Process of A. M. Contremonlin. (*France Med.*, Paris.)

REFLECTION OF CATHODE RAYS. Starke. *Elek. Zeit.*, Nov. 17; abstracted from a German physical paper.—Description of experiments with the reflection of cathode rays. Platinum was found to reflect 36 per cent., brass 30 per cent., aluminum 21 per cent., and lampblack 17 per cent. of the incident cathode rays;these figures are not changed much when the voltage is increased from 6,000 to 9,000.

The Use of Roentgen Rays in Cuba.

In an editorial which appeared in our issue of July 6, we described at some length the excellent results obtained by means ot the Roentgen ray in an Indian campaign as described by Surgeon-Major Beever, of the English army, in a lecture before the Royal United Service Institution. At that time the Roentgen ray apparatus had not been given a fair trial in Cuba in locating bullet wounds, and there were many who still advocated the use of the probe, looking upon the x-ray apparatus as altogether too complicated for practical use in field hospitals. That the Roentgen ray apparatus may be used speedily and effectively is now clearly proven by Dr. William M. Gray, the microscopist of the Medical Museum in Washington, who was detailed to the hospital ship Relief by that institution for surgical work, with special reference to the diagnosis of gunshot wounds by the Roentgen rays. In an interview with Dr. Gray, which was reported in a recent issue of the New York *Sun*, he is credited with the following statement: "One thing this war has taught is that the *probe in all its forms has gone out of use*. No more searching blindly in a man's body for the bullet; no more danger of blood poisoning from the introduction into the wound of instruments of search. The fluoroscope tells us instantly where the projectile has imbedded itself, and we have only to cut it out as if it were there before our eyes. The ingenious electric probe and all similar devices have seen their day. In all future battles experts in skiagraphy will be attached of necessity to the medical corps, and the work of the surgeons will be materially assisted by their precise indications We took out bullets by the pint on board the Relief, and almost without exception they were located by the x-rays."

As to the time consumed in photographing the patients and in developing the x-ray plates, Dr. Gray stated that the whole operation consumed but a few minutes. It took ordinarily not over five seconds for a wound in the hand, thirty seconds for one in the foot. He further mentioned a case where a man was wounded in the right shoulder by a Mauser bullet which plowed its way on around the chest walls under the deep muscles and finally lodged in the arm, shattering the humerus. He said: "Here was an odd condition, a wound in the right shoulder but no bullet: the bone of the left arm broken but no wound. How long do you suppose it would have taken to find that bullet by probing? It did not take us one minute to find it with the x-rays."

That the Roentgen ray apparatus can be advantageously made use of to alleviate suffering during a campaign is not to be doubted notwithstanding arguments to the contrary. This fact would seem to be clearly proven by the statement of Surgeon-Major Beever, of the English army regarding the use of the x-ray in India and by Dr. Gray's experience in Cuba, who says: "In many cases we save hours of vain searching, and not infrequently we save the soldier's life."—*Electricity*, Sept. 7.

CURRENTS GENERATED BY ROENTGEN RAYS. Winkelmann. *Wied. Ann.* No. 9: abstracted briefly in Lond. *Elec.*, Oct. 28, and *Am. Jour. of Sc.*, Nov. *Electrical World*, N. Y.—He studied the property discovered by Perrin, that differences of potential are produced between two different metals when exposed to x-rays; a small constant current was observed.

INFLUENCE OF INDUCTION COIL CONDENSERS ON X-RAY DEFINITION.

BY ALFRED G. DELL

In making experiments to determine the effects on x-rays by varying the capacity of an adjustable condenser connected across the breaks of the interrupters of induction coils, I was impressed with the possibility that the varying penetrability of the light obtained by various experimenters in the fluoroscopes used was, if not entirely, at least to a considerable extent to be attributed to the different capacities of the condensers used.

The different penetrabilities of the rays have been ascribed to the vacuum of the tubes. While the vacuum of particular tubes may have some little to do with the penetrability of the x-rays produced, I think the capacity of the condenser plays a more important part than is generally supposed.

I find the light obtained in a fluoroscope, when the capacity of the condenser is between certain limits, is clearer, and objects are more distinct. The light is not such as would be obtained by increasing the electromotive force in the primary of the coil with capacities outside of the limits. The light obtained, no matter what the electromotive force used, when the capacity of the condenser is outside of the favorable limits, is more cloudy or duller in color, than when within the favorable limits.

The same proper capacity for the same coil seems to suit a rather wide range of electromotive forces in the primary of the coil, from which I would conclude that the proper capacity for any particular coil could be fixed in value, but, of course, an adjustable condenser is better.

I also find there is a limit to the electromotive force to be used with any particular coil, beyond which it is not well to go, when a good definition in the fluoroscope is required. One can obtain more light with excessive electromotive force, but poorer definition of the object.

I believe the cause of the better light between certain capacities of the condenser is that the impulses are made with greater suddenness, and the cathode discharges falling on the anode with greater vigor produce a clearer light. Each impulse is produced in less time with the proper capacity than when the capacity of the condenser is not right.

When the capacity is too small or too great, the impulses are more prolonged in their discharge, and the cathode discharges striking the anode plate fall on it more in a stream, as it were, and produce the cloudy light, and not the extreme bright light obtained with a proper condenser capacity. I really do not see why the fluoroscope could not take the place of the photographic plate, if attention is paid to small, but important, details in construction and use of the apparatus in cases where a record is not absolutely required.—*Electrical Engineer, N. Y.*

THE LIGHT OF GLOW-WORMS.—Experiments have recently been made to determine the character of the glow-worms, and the result seems to be that it must be identified with the x-rays. Experiments, says the *Revue des Sciences*, have been made with about 300 of these insects by enclosing them in a dark room sheltered from all foreign light and placing them before photographic plates screened by several thicknesses of black paper besides plates of brass, copper, and aluminum; also a piece of cardboard with a hole in it was interposed between the plates and photographic plates. When the plates were developed they were blackened except at the part opposite the hole in the cardboard. The rays of the worm penetrated the metal and excited luminosity in the cardboard. When there was nothing between the sensitized plate and the worm, the rays acted as do those of ordinary light.—*Electricity*, London.

Influence of X-Rays on Luminosity of Gases.

When a tube containing gas, at low pressure, is exposed to electrical oscillations, it becomes luminous when the pressure is reduced sufficiently, but if exposed also to the influence of x-rays the pressure at which luminosity occurs is increased. This effect of the rays was recently examined quantitatively, and the sub-joined table gives the pressure at which the gas becomes luminous—(I.) by the oscillations alone; (II.) by the simultaneons action of x-rays; (III.) gives the precentage increase:—

	Molecular Weight.	I.	II	III
Hydrogen	2	71 mm	94 mm	32 4
Oxygen.........	32	51 "	68 "	33.3
Methylic alcohol.	32	17 5 "	27 5 "	57 1
Ethylic alcohol..	46	16 5 "	26	57 5
Ethylic ether....	74	14 "	24	64.3
Chloroform......	119	10 "	18 "	80 0

The influence of the x-rays increases with the molecular weight and molecular complexity of the gas. Alexander de Hemptinne, writing in the *Zeitschrift fur Physikalische Chemie*, 1898, 26, p. 165, says that he does not consider the effect to be due to decomposition into atoms, or ions, and advances, with reserve, the hypothesis that a certain mobility is imparted to the ether by the rays, and this causes acceleration of the intramolecular oscillations, and hence, under the influence of the electrical oscillations, causes dissociation of some molecules, and brings about a multitude of minute discharges from molecule to molecule. As the luminous gas in a vacuum tube has conducting properties, the author considers it possible that it also, like metals, would absorb the x-rays, but experiments show that this was not the case, the luminous tube being as transparent in this respect as a non-luminous tube.—*Electrical Review*, London.

VACUUM TUBES VS. COHERERS. Righi. *Nuovo Cimento*, July; abstracted in the Lond. *Elec.*, Oct. 28. *Electrical World*, N. Y.—He describes a vacuum tube which he invented and which seriously rivals the coherer for detecting waves. The details are not given, as they are said to be too complicated; the tube shows a continuous streak of light, which breaks up under the influence of electric waves into positive strata, dark spaces, and cathode light; the cathode is a wire and the anode a disc; the conditions are resumed after the radiations cease; the effect is also produced when the radiation impinges on some portion of the circuit not too far away from the tube. Besides the optical phenomenon there is also a change of resistance, the current often increasing three times when the tube lights up. It has the advantage not to require a special mechanism for restoring the original resistance.

ROENTGEN RAYS IN 1898.—In the course of its "Review of Science in 1898," the *Times* remarks that the year witnessed great improvements in the technique of radiography or Roentgen photography, especially in the direction of making it stereoscopic. The opening of the Thomson-Yates laboratories at University College, Liverpool, was an event of much interest to physiologists, inasmuch as their completion and equipment is an indication that private generosity will often carry out what communities and Goverments fail to support. The laboratories under Prof. Sherrington's care are probably the finest in this country, and regarded from the standpoint of convenience of mechanical appliances, electricity, etc., are equal to the most renowned on the Continent.—*Electrical Review* London.

LONDON ITEMS.

J. M. BARBOUR, M. B., EUROPEAN EDITOR.
Business and Editorial Office, Earl's Court S. W. London.

CLINICAL CASES AND THE X-RAY.

Manton records a case in a boy aged 17, in whom the right canine had been extracted four years ago and from other dental idiosyncrasies the question arose whether the patient's permanent canine had been extracted or was still latent. This was determined by first taking models of the mouth; then a vulcanite splint was made for the maxilla, covering the palate and the masticating surfaces of the bicuspids and molars, but not encroaching on the labial aspect of the teeth. The case was also well cut away behind the incisors. This splint served to retain the sensitized plate in the mouth during the pose. After several failures it was found that an exposure of three minutes at a distance of forty centimetres (60 volts, 8 amperes) gave the best results. In using the sensitized films, it is urged that they need not be bent over accurately to the curve of the palate from the tendency of the gelatine to crack, and the trifling error otherwise arising is of so little moment. Further in view of the heat of the mouth damaging the film it is suggested that a hollow metal splint might be used with metal tubes attached through which a stream of cold water might be passed.

"Study of the Motar Function of the Stomach by Roentgen Rays." Roux and Balthazer have recently experimented in this respect on frogs, dogs, and men. In dogs and men liquids passed from the stomach in two or three minutes; solids not until usually about three hours after. Pure water at the end of five to ten minutes, but when 50cc. of water to 10 grains of peptone were added, an abundant secretion was determined which persisted for 1 to 1½ hours until the mass was wholly liquefied when it passed out.

Interesting phenomena have recently been observed by Kienbock in the examination of patients suffering from tuberculous pyopneumothorax. This condition was present on both right and left sides with large empyemata showing signs of free movement. The screen showed respiratory and pulsatory phenomena. The pulsation of the empyema was less marked in the case of pyopneumothorax of the right than of the left side as might be expected. This paradoxical respiratory movement of the surface is to be explained on the assumption that this half of the diaphragm was paralized, and therefore the inspiratory descent of the sound half raises the other one, carrying with it the fluid by the intermediary of the contents of the abdomen.

"On the connection between the Chemical Composition of a gas and the Ionization produced in it by Roentgen Rays." by Prof. J. J. Thomson.

This paper contains an account of experiments made to determine the ionization in a number of different gases when Roentgen rays pass through them. It is well known that the current of electricity passing through Roentgenized gas does not increase proportionately to the electromotive force, the current approaches a finite limit beyond which it does not increase however large the electromotive force may be. This maximum current which we shall call the saturation current is determined by the condition that the number of ions used up by the current in one second is equal to the number of ions produced in that time by the rays. Thus the value of the saturation current is proportional to the number of ions produced by the rays in one second, so that to compare the ionization in two gases we have only to compare their saturation currents when exposed to rays of the same intensity

The results of the experiments are given in the following table, the numbers give the saturation current through the various gases, the saturation current through air being unity :

H_2 = .33	NO = 1.08	SO_2 = 6.4
N_2 = .89	N_2O = 1.47	HCl = 8.9
O_2 = 1.1	C_2N_2 = 1.05	Cl_2 = 17.4
CO_2 = 1.4	C_2H_2 = 1.	NH_3 = 1.7
CO = .86	H_2S = 6.	

"Soft" tubes were chiefly used, as those given out penetrating rays were found to be too variable for these experiments. (Proc. Camb. Phil. Soc., Vol. 10.)

Mr. J. Dennis in the *American Journal of Electro. Therapeut*, gives some excellent hints in common causes of failure in x-ray work. Notably with regard to a fault in the coil he says that it had better be returned to the practical electrician, at the same time common errors in the connections and at the binding posts should not escape attention : the latter should always be bright and clean. As to the tube, if its vacuum be either too high or too low, imperfect results can only be obtained. Again if the terminals in the tubes are too close or too wide apart the penetration will be interfered with. Repaired tubes, he thinks are only false economy.

On the vexed question of x-ray dermatitis, Dr. Foveaux de Courmelle of Paris thinks that the cathodal rays only are injurious, and that if the vacuum tube be wrapped in black cloth this accident cannot occur, or at most a trifling desquamation only, and then only from a very prolonged exposure.

THE ROENTGEN RAYS AND HYSTERIA.—Dr. Holland, reporting in the *Liverpool Med. Chirurg, Jour.*, the examination of thirty-two cases for foreign bodies in the hand or wrist, found them in all but six cases. Regarding these latter he says : "Nearly all are women, and they are generally hysterical ; they complain of pain, and are certain that at some date a pin or needle had run into the hand and had stayed there. To be able to take a radiograph and demonstrate to these people the absence of any such thing is to cure them of their ailment. On the other hand, many patients complaining of pain in this manner have been considered as manifesting hysteria, and to be able to demonstrate the presence of a foreign body is most important.

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SIR WILLIAM CROOKES, F. R. S.

The American X-Ray Journal.

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X-RAY ESSENTIALS--THE VALUE OF THE X-RAY FROM A DIAGNOSTIC AND THERAPEUTIC STANDPOINT.

Read before the Erie Railway Surgeons' meeting held in Chicago at the Grand Pacific Hotel on October 19, 1898 by Prof. H P. Pratt. M. D. of Chicago

It was the latter part of January of 1896 that Prof. Roentgen announced to the scientific world that he had succeeded in photographing the bones of the living skeleton. There has not been a discovery of such vast importance to the medical profession since the discovery of the circulation of the blood by Harvey. Before the telegraph wires were fairly cold, giving to the world this intelligence, every scientist having an available, or able to secure an available apparatus, commenced to experiment independently, endeavoring to prove or disprove said statement. After they had satisfied themselves as to its correctness, they then undertook to advance a theory which would be acceptable to the scientific world.

The Century Dictionary gives the following definition of the x-ray or Roentgen ray, as it is sometimes termed :

The x-ray, or Roentgen ray, is a form of radiation having characteristic and distinctive properties discovered by Prof. Wilhelm Konrad Roentgen, of Wurtzberg, as announced by him in December, 1895. He said that the discharge of a Ruhmkorff coil through a vacuum tube produced a form of radiation external to the latter, which has the property of causing various substances to fluoresce, affecting the ordinary photographic plate, like light (although itself invisible) and of penetrating opaque bodies in various degrees, according to their density and relative thickness; platinum, lead and silver being quite opaque, while aluminum, wood and paper are quite transparent.

This is a statement that came from Prof. Roentgen direct; in the above definition he is dealing with the effects "only," and does not even suggest the cause or first principle.

Numerous hypothesis were advanced from time to time by such men as Edison, Tesla, Prof. J. J Thompson, Elihu Thompson, Sir Wm. Thompson, Dr. Lodge and others, and yet no two of them agree.

In January, 1894, Prof. Phillip Leonard is credited with being the first to discover the phenomenon that we now term the X or Roentgen ray. He was experimenting with a similar apparatus to that in use at the present time, for the production of the shadowgraph, endeavoring to determine whether the cathode ray could be transmitted to the outside of a vacuum tube. This suggestion was made to him first by Prof. Hertz. "His interest, therefore, in this discovery was so great that his researches extended to the minutest details." From all that can be learned, Phillip Leonard is entitled to all of the credit for the discovery of the X or Roentgen ray, because first, he not only used the same kind of apparatus for producing it, but he actually photographed coins in boxes, etc. These first experiments were published in "Wiedermann's Annalen," in January, 1894, and October, 1895. Had he placed his hand on a photograph plate for a few minutes, and then had the plate developed, Prof. Roentgen's name would never have been known. Since the announcement made in 1894 and '95, by Prof. Leonard, there has not been a change in apparatus or an improvement, as far as principle goes, down to the present date. The only improvements made, were purely mechanical, perfecting the old apparatus.

I will refrain from entering into any further discussion, in regard to the history of the x-ray, etc., but confine myself to the essentials for their production. The first apparatus for the production of the x-ray, was designed as I said before, and worked by Prof. Leonard (Fig. 2), which consists of a Ruhmkorff coil (*R*,) a battery (*b*,) and a vacuum tube (*t*.) The Ruhmkorff coil consists of a primary (*x*,) and a secondary wire (*y*,) of different lengths and sizes surrounding a core of soft iron wire (*z*.) Into the primary circuit of the coil, a battery or an electric generator (*b*,) and a vibrator or interrupter (*d*,) are introduced.

The two terminal wires of the secondary being attached to a vacuum tube (*t*.) There are several forms of vacuum tubes made, the difference being only in shape and degree of vacuum. They are named after the one that suggested the form, such as the Plucker, the Hittorf, the Geissler, the Leonard, the Crookes tubes, etc. The Geissler tube having a low vacuum, while the Crookes tubes are carried to a high degree.

In the Geissler tube the vacuum is estimated to be about one thousandth of an atmosphere, while that of the Crookes tubes, the vacuum is carried to an extreme degree, about one millionth of an atmosphere.

There are several different kinds of apparatus that can be used for the production of the x-ray, such as Static machines, Magneto-machines in connection with condensors, etc.

Now if you will follow me very closely, I think I will be able to satisfy you as to the nature of the x-ray. I think it is very simple. Before we can appreciate what it is, let us take up and discuss the following questions:

First: What is electricity?
What is an electrical circuit?
What is an electrical current?
What is induction?
What is resistance?
What is magnetism?
What are lines of Magnetic force?
What is electrolysis?
What is polarity?

The first question is, what is electricity? This is a question that has been discussed by the scientific world for years, and yet they have not arrived at a proper definition. I do not care what electricity is; but we do know of a phenomenon to which we give the name of electricity. If we take an ordinary bar magnet, properly magnetized, capable of attracting iron, nickel, cobalt etc., and analyze it very closely, we are bound to arrive at a definite conclusion.

For instance, if we take the north pole of this bar magnet and approach it to the north pole of a compass needle, we find that the two north poles repel. If we present the opposite poles, we find they also, repel; but if we present the north pole of one, to the south pole of the other, immediately there is an attraction.

Now let us take this bar magnet and divide and subdivide it into particles so small that it requires a magnifying glass to see them. Every particle of the magnet will exhibit the phenomenon on the one hand of attraction, and on the other hand, of repulsion when presented to like particles.

We are bound to arrive at this conclusion, that all particles, that is, every particle of this magnet, is a magnet in itself, and the large magnet is nothing more or less than an accumulation of small magnets.

This takes us back to the original hypothesis which was suggested so many years ago, especially by Faraday, that each molecule in the universe is an independent center of force, and that each molecule has, and retains a definite and constant amount of electrical force or energy, and that which is known as chemism, or chemical affinity, is nothing more than this electrical force, and that this force is what holds matter together.

If we should sprinkle iron filings on a glass plate and place a horse shoe magnet below the plate, we would find that all of the particles will be arranged in series and in parallel with the molecules of the horse shoe magnet, having all the north poles of the particles or molecules point in one direction, and all of the south poles in the opposite direction. Now if we substitute for this horse-shoe magnet, a temporary magnet of soft iron, with coils arranged in circuit, attached to a battery with a reversing switch, and change the direction of the current several times, we will find that the iron filings will turn in the opposite direction with every alternation of the current; they will have the appearance of turning within their own plane. My definition of *electricity* is a persistent force which is a part of the atomic structure of matter, and it exhibits the phenomena of attraction and repulsion.

What is an electrical circuit? (Fig. 1)

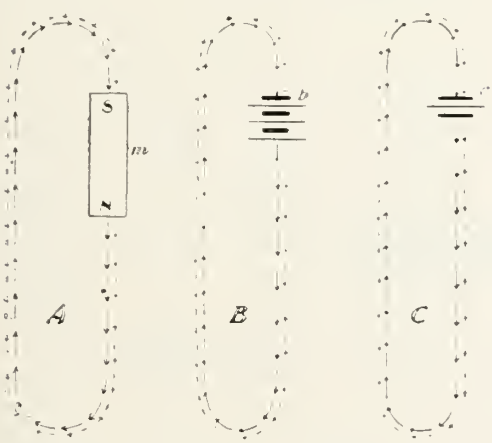
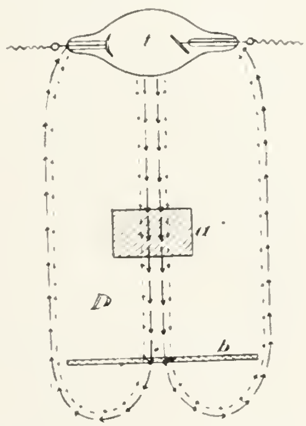


Fig. 1.



An electrical circuit is a series of molecules arranged in parallel, each molecule being a magnet or an equivalent of one. When so arranged, all of the north poles of the molecules point in one direction, and all of the South poles point in the opposite direction. If the north poles of a portion of the molecules pointed in one direction, and the north poles of the remainder pointed in the opposite direction, we would have two repelling forces coming together, and it would be impossible to establish a circuit.

What is an electrical current?

An electrical current is an accumulation of polarized molecules in a circuit;

the greater the number of molecules arranged in parallel, the stronger the current and vice versa. "The use of the word current has its advantages, and helps to convey ideas which are in accordance with observed effects; but the actual passage of a fluid in either direction is a matter of doubt, and in the opinion of Faraday, does not take place; he believing than the resulting phenomena are caused by a polarization of the molecules of the medium."

What is induction?

Induction is the result of a physical force which is brought to bear upon the molecular structure of matter, changing the relation between the molecules, causing them to be arranged in series in juxtaposition, and in parallel with the molecules of said initial force.

What is resistance?

Resistance is the condition or property of matter which opposes the rearrangement of the molecules.

What is magnetism?

Magnetism is the polarized condition of matter.

What are lines of magnetic force?

An endless chain of molecules arranged in series, each molecule representing an individual line of force: the greater the number of molecules added to the chain, the longer the line of force.

Electrolysis is the disassociation of the elements of a compound by the aid of electrical energy. (Fig. 3.)

Polarity: The having two opposite poles.

What is meant by potential?

Electrical pressure or force.

What is the unit of potential or electro-motive force called?

The unit of potential or electro-motive force is called a volt. The Daniell cell being taken as a standard, representing 1 079 volts.

What is the unit of resistance called?

The unit of resistance is called the Ohm. In 1827, Dr. George F. Ohm formulated his famous law, that the electro-motive force divided by the resistance is equal to the strength of the current.

Legal Ohm: The resistance of a column of mercury one square millimetre in cross section and 106 centimetres in length, at the temperature of 32 degrees F. This value of the Ohm was adopted by the International Electric Congress in 1884, as a value that should be accepted internationally as the true value of the Ohm.

What is the unit of current called?

The unit of current is called the ampere.

A milli-ampere is one-thousandth of an ampere.

THE ELECTRO-CHEMICAL SERIES.

Berzelius's final series stands thus:

Electro-Negative.

Oxygen	Boron	Mercury	Thorium
Sulphur	Carbon	Silver	Zinconium
Selenium.	Antimony.	Copper.	Aluminum.
Nitrogen	Tellurium	Bismuth.	Didymium
Fluorine	Tantalum.	Tin	Lanthanum
Chlorine	Titanium	Lead	Yttrium
Bromine	Silicon.	Cadmium.	Glucinum
Iodine	Hydrogen.	Cobalt.	Magnesium
Phosphorus.	Gold	Nickel.	Calcium
Arsenic	Osmium.	Iron	Strontium
Chromium	Indium.	Zinc.	Barium
Vanadium.	Platinum	Manganese.	Lithium
Molybdenum	Rhodium.	Uranium	Sodium
Tungsten.	Palladium	Cerium	Potassium

Electro-Positive.

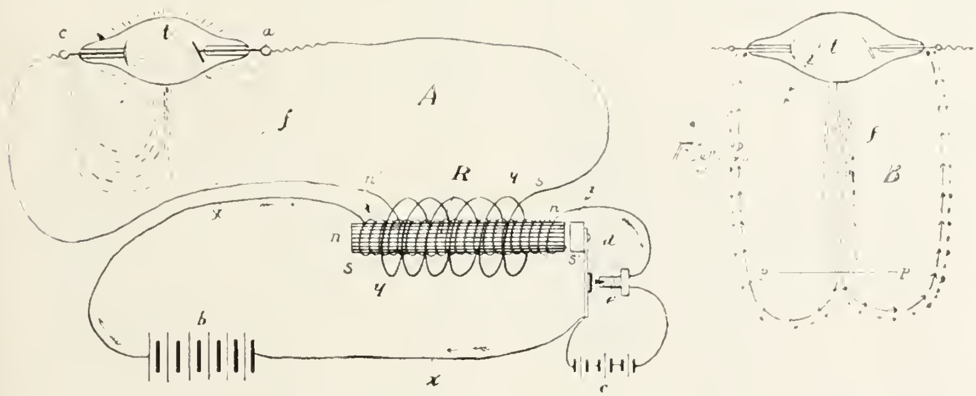
We have about seventy elements so far discovered, each one of these elements having a given electrical force, or pull, and each bearing a given relation to the other. For instance, Berzelius's according to his final series, claims that oxygen and sulphur are the strongest electro-negative, while potassium and sodium, are the strongest electro-positive.

Note the relation between all of these different elements. The two extremes will break up or separate any of the intervening elements when they are arranged in compound.

Note the relation in the list between hydrogen, the electro-positive element and So_4 the electro-negative radical of

$H_2 So_4$. Compare them with zinc which is stronger electro-positive than hydrogen; now imagine that every one of these sixty odd elements have a definite and constant pull, or, in other words, imagine that the oxygen and sulphur, the electro-negative radical on one hand represents a very powerful woman, and that zinc, an electro-positive on the other hand, a powerful man; but not as powerful a man as sodium or potassium. The intervening elements are weaker in strength in proportion to their place in the list.

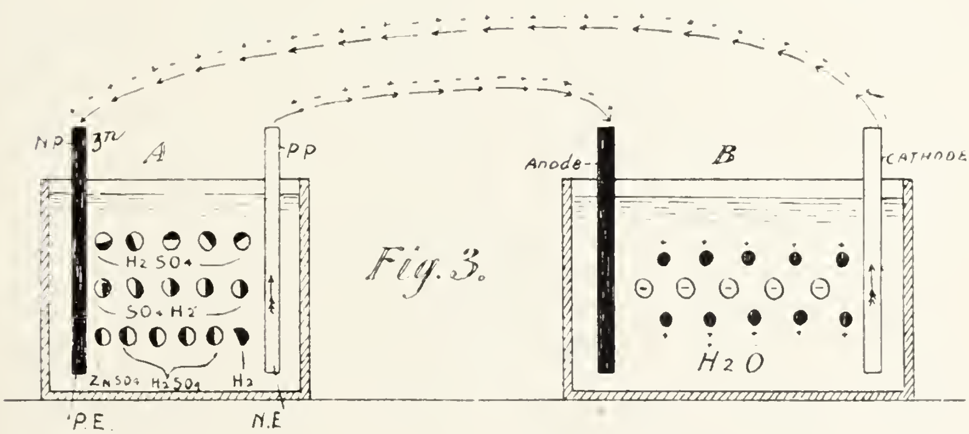
Now let us go back to what takes place in a battery which produces the force that excites the primary wire of the Ruhmkorff coil. (Fig. 2.) Take for instance the form of battery used by Phillip Leonard, or the ordinary sulphuric acid battery (Fig 3), with zinc and platinum elements. Now, in referring to this list we find that H_2 representing the electro-positive element and the So_4 the electro-negative radical of the solution H_2 So_4 we find by referring to the list that So_4 has a greater affinity for zinc than for hydrogen, it standing in the same relation as a strong man would to a weak one. Consequently hydrogen is driven off and the So_4 combines with zinc, converting the sulphate of hydrogen into the sulphate of zinc; the force that is generated by the change, is simply enormous. It is sufficient to cause a rearrangement of the molecular structure of a telegraph wire around the globe. When this change takes place, the force generated causes a rearrangement of the molecules of the wire in the same manner and following the same law regarding direction as in the magnet described a few moments ago, in which all of the north poles point in one direction, and the south poles in the opposite direction, so far as to the initial force that energizes the primary circuit. To energize the secondary coil a circuit breaker or interrupter is introduced. This primary wire is of low resistance. Surrounding this primary wire, properly insulated from it, we have the secondary wire. The molecules in the secondary wire are arranged in the same manner as the



molecules in the primary wires when excited; that is to say, they are arranged in series and in parallel. Whenever a current passes in one direction in a primary wire a current is set up in the secondary wire in the opposite direction. So when we make and break a circuit, we get a complete reversal of the current; that is to say, when the current is made, or when the battery is connected in circuit, the molecules of the primary wire are arranged in series and in parallel in a definite direction, while in the secondary wire the moleçules are arranged in the opposite direction; but when we break the circuit the molecules in the primary wire are reversed, which in turn produces a reversal in the secondary wire. So in this secondary wire the current generated must be alternating in character. (Fig. 2.) Now, we have followed a line of thought from the point of generation or the first cause, to the delivery of a current to a vacuum tube. Now, let us see what takes place in a vacuum tube. The tubes we have here tonight are of focus type. The one electrode being of aluminum, called the cathode, the other electrode being of platinum, termed the anod . These two terms are wrongfully used, as they mean a positive and negative, or the same as north and south poles, when applied to the body. With an alternating current in the secondary wire, how is it possible to have a definite positive and negative terminal connected with the vacuum tube? It is true that the force at one terminal, called the cathode, is stronger than the other, not by virtue of its being negative or positive, or cathode or anode; but by having a shunt introduced into the primary circuit, cutting down the discharge, so, when the current is made, the primary wire acting as a shunt, cuts down the force that otherwise would be equal. If it were not from this fact alone, the x-ray would not have been discovered, at least to date.

Now we come to the vacuum tube. This vacuum tube is constructed of the best German glass, as free from all metallic substances as possible, although not essential. It is exhausted by use of an air pump until there is comparatively a few molecules of gases left. When the tube is energized, the same law and the same phenomenon takes place in the tube as takes place when the impression passes over the wire to the tube. The molecules of the tube are all arranged in series and in parallel, and following the same law that governs all magnets, the outside of the tube being electro-positive and the inside electro-negative. (Fig. 2.) The tube is nothing more or less than an ordinary condensor and discharges in the same manner. The tube is really a magnet and it follows the law that govern magnets. If we take an ordinary bar magnet, or a piece of steel, properly hardened, without subjecting it to a magnetic influence, and then take a hammer and tap on the end of the steel bar, it is simply a matter of time until the whole bar will be magnetized. The magnetization is due to the hammering, which has produced a complete change of the molecules of the steel, arranging them in series and in parallel, in the same manner and way as they are arranged in a telegraph wire when the electrical impressions are being transmitted over it. Now this tube, as I said before, is exhausted to about one millionth atmosphere. There are now a comparatively few molecules of gas in comparison with what was there before the pump was applied. When the tube is excited by the coil the molecules in the tube are agitated and a circuit is established in the tube, causing the molecules of gas in the tube to be arranged in the same manner as the molecules of the wire are arranged. With every oscillation, or every break of current in the primary circuit it produces an alternation and change in the molecules in the vacuum tube, but, owing to the shunt in the primary circuit one pole or one side of the secondary wire is a trifle stronger than the other. The difference in the strength of the two causes the molecules of gas to be thrown against the platinum disc or anode, rebounding, striking the surface of the tube setting up a terrific bombardment. This bombardment presents the same phenomenon as the tapping on the steel bar with a hammer, which not only causes the molecules of the tube to be arranged in series and in parallel, but the lines of force are projected out in a straight line several feet beyond the tube. The stronger the bombardment, the longer the lines of force. Figs. 2 and 4.

Imagine that tube to be an equivalent of a magnet. The lines of magnetic force thrown out from the tube will produce decomposition in the same manner as we would find in a bath were we producing electrolysis (Fig. 3.) In the electrolysis of water, Formulae H_2O we find that the hydrogen is repelled from the positive pole or anode, but attracted to the cathode. We also find that the oxygen is repelled from the cathode or negative pole, but attracted to the opposite anode. Why is this? The oxygen being electro-negative, and as like poles repel, the oxygen is repelled from the negative side but attracted to the opposite. In the case of hydrogen being electro-positive, it is repelled from the positive side but attracted to the negative. This phenomenon takes place when we present a photographic plate, or a tungstate of calcium screen near a vacuum tube. The lines of force are thrown out from this Crooks tube in a definite direction, Figs. 2 and 4, producing decomposition with every discharge of the tube, and decomposing all substances in its track. In any chemical compound when decomposition takes place, for instance, a liquid, solid or gas, a spark is produced, we call this fluorescence. This is why in looking at a screen, the screen is lighted up by the x-ray, not from the light that is thrown from the tube, but from the electro-chemical changes that take place in the circuit, which reduces the chemicals on the screen into simpler compound or converts the bromide of silver on the photographic plate into oxide of silver. Figs. 2 and 4.



The amount of conversion depends upon the strength of the current. That, in return, depends upon the resistance of the circuit. The greater the resistance of circuit the less the change, the less the resistance of circuit, the greater the change. (Diagram C, Fig. 4.)

When we interpose between the screen or the photographic plate the hand or any part of the human body, what we see is not a picture of the bones, but the shadow of the difference of the resistance of a circuit, as determined by electro-chemical decomposition; bones affording a greater resistance to the circuit than the flesh, the decomposition is less and hence the shadow. This follows Ohm's law. The current is equal to the electro-motive force divided by the resistance.

Diagrams A, B, C and D, of Fig. 1, represent four different kinds of electrical circuits, the only difference between them being the source of electrical energy or initial force with a definite potential. So far as fundamental principles go, they are identical. The arrows represent polarized molecules or molecules arranged in series and some in parallel, the arrows also indicating the direction of the lines of magnetic force.

Diagram A, of Fig. 1 represents a magnetic circuit; the initial force is a magnet as indicated by letter *m*, *n s* is its north and south poles. The potential of this circuit is over 100,000 volts. (This is disputed by some, but there is no doubt the potential is very high, even higher than the above figures).

Diagram B, of Fig 1 represents a galvanic circuit, the initial force indicated by letter *b* is a battery of three cells with a potential less than four volts.

Diagram C, of Fig. 1 represents a static circuit, the initial force as indicated by letter *c*, is a condenser or static machine, having a potential over 50,000 volts.

Diagram D, of Fig. 1 represents an x-ray circuit, the initial force comes from the vacuum tube (*t*,) having a potential over 500,000 volts, letters *b* representing the photographic plate, letter *a* representing the object or body.

Diagram A and B, of Fig. 2, representing vacuum tubes (*t*) one disconnected, and the other in circuit with Ruhmkorff coil (R.)

Diagram A, Fig. 2, letter R, is a Ruhmkorff coil (*z*) is the wire core, with the primary wire (*x*) surrounding it, having battery (*b*) and circuit breaker or interrupter (*d*) with condensers (*c*) in circuit, surrounding the primary wire (*x*) and wire core (*z*) is the secondary wire (*y*) with its terminals attached to the electrodes (*c*) and (*a*) representing the cathode and anode of the vacuum tube (*t*.) The small (*f*) are lines of magnetic force thrown off from said tube. When the Ruhmkorff coil (R) is excited upon the closure of the circuit at the adjustable screw (*e*) the arrows indicating the direction of the current in the primary circuit. The letters (N. S.) (N' S') (N'' S'') representing the polarity of the primary coil, the wire core and secondary coil respectively, (*n*) representing the north pole and (*s*) the south pole. Upon the breaking of the circuit at (*e*) there is a complete reversal or change of polarity.

Diagram B, Fig. 2, representing a vacuum tube (*t*) with lines of magnetic force (*f*) concentrated and extending down to the photographic plate or screen (*pp*.) The arrows below the plate indicating the return circuit. As indicated by the direction of the arrow passing through the vacuum tube (*t*,) of diagram B, Fig. 2, the outside of the tube is electro-positive, the inside electro-negative. Fig. 3 representing the electrolysis of water. A, is a sulphuric acid battery (*p e*) the positive element or zinc (*zn*;) (*ne*) is the negative element: the negative pole (*np*) and the positive pole (*pp*) are connected to the cathode and anode of the bath B, respectively, in which water H_2O is being decomposed. The arrows connecting the battery A with bath B are polarized molecules and indicating the direction of the magnetic lines of force. Fig. 4, illustrating 3 vacuum tubes of varied potential, showing the direction of the lines of magnetic force, the arrows representing polarized molecules arranged in series and in parallel with said initial force, the plus and minus signs indicate the north and south poles of the molecules.

Diagram A, Fig. 4 is an x-ray circuit with a vacuum tube (*t*) of low voltage, the object or body (*o*) with photographic plate or screen (*pp*) in circuit. Note the irregular position or direction of the arrows in object (*o*.) This condition takes place when the voltage of the vacuum tube is not sufficient to hold the lines of magnetic force or molecules, in series and in parallel, the object (*o*) or body exhibiting resistance or counterforce, consequently the lines of force thrown from the tube are reflected or refracted giving a distorted image on the photographic plate (*pp*.) For this reason I have yet to see a good shadowgraph of the hip joint taken of a man weighing 200 pounds.

Diagram B, Fig. 4, is another x-ray circuit. Instead of the tube (*t*) being of low voltage, it is of high voltage. Observe the difference in effect on object (*o*). The molecules are held in series and in parallel, and hence the shadow is more perfect. To take a first-class shadowgraph of the bones through the body of a large man, it is necessary to have the voltage sufficiently high to hold the structure in series and in parallel, otherwise we would have a faulty picture.

Diagram C, Fig. 4, illustrates the vacuum tube (*t*) with a fluoroscope (*f*) and object (*o*) in circuit; the four dark circles marked 1, 2, 3, 4, on fluoroscope, indicate the difference in decomposition as recorded on the screen, the large circle indicating the greater decomposition, while the smaller one the lesser decomposition. The object (*o*) marked 1′, 2′, 3′, 4′, indicate a difference in resistance of the object to the x-ray indicated by the amount of decomposition recorded on fluoroscope marked 1, 2, 3, 4. It follows Ohm's law: $C=\frac{E}{R}$.

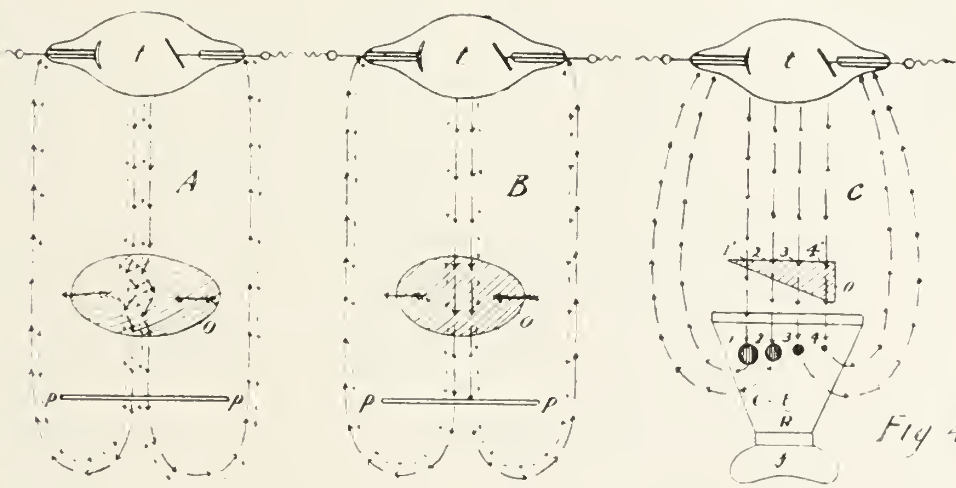


Fig 4

At the conclusion of the paper, which was a basis for argument, Dr. Pratt spoke at length, and the following is a summary of his remarks:

First, remember the difference in principle between the magnetic, galvanic, static currents and the x-ray is in potential only. They are all conditions of the same force. They are all electrical. (Note diagrams A, B, C, D, Fig. 1.) The following hypothesis was formulated by Dr. H. P. Pratt and published in all the daily papers several times during the months of February and March, 1896:

The x-ray is an electro-static phenomenon, an accumulation of the lines of magnetic force of high potential, and of short wave length in a circuit. (Note diagram B, Fig. 1, letter *f*, also diagram C, Fig. 4.) It decomposes every substance capable of being decomposed, in its path, and renders every substance over which it travels a conductor of electricity. (Note diagram A, B, C, of Fig. 4, also Fig. 3.) The result of said decomposition on the photographic plate or screen is the shadow, which is the difference of the resistance, of the circuit, determined by the amount of electro-chemical decomposition, (as recorded on the photographic plate or screen within a given time.) This follows Ohm's law: $C=\frac{E}{R}$.

For this reason I use the word shadowgraph, instead of skiagraph, radiograph, etc. The word shadowgraph is in accordance with observed effects, and conveys a better idea as to what takes place.

THE VALUE OF THE X-RAY AS A DIAGNOSTIC AGENT.

The x-ray is proving invaluable to the surgeon. It not only enables him to determine the nature of a fracture or break, but abnormal conditions; enabling him to determine whether such fracture or break is properly set and whether such abnormal condition can be corrected with surgical interference. In fact the surgeon can reduce dislocation and set bones with the aid of the fluoroscope under the ray, having his assistant apply the bandages. The effect of the ray on the nerves is sedative, and in fact there is a partial anaesthesia produced. We are now able to detect abnormal condition in the softer tissues, such as tumor of the brain and body, diseases of the lungs, stomach, heart, liver, kidneys etc., locating stones in the kidney and bladder, as well as foreign bodies in the eyes.

While the x-ray is of advantage to the surgeon, it has its disadvantages. Ever since its discovery, especially in the last year every malicious person who can scrape up enough money to pay for a shadowgraph, is having one taken for the purpose of bringing a damage suit for personal injuries or malpractice. It is coming to this: That a surgeon is not safe unless he has a shadowgraph taken before and after each operation. It is surprising to see the number of damage suits now pending against corporations, individuals and especially surgeons for supposed injuries sustained or for malpractice, depending entirely on the shadowgraph as evidence. I will say the shadowgraph is not competent evidence because there is an opportunity for a great fraud to be perpetrated. Even the operator if he is not careful can be deceived himself. I have defended several corporations against shadowgraph, which showed a fracture where no fracture ever existed. An operator skilled in x-ray work, can deceive the most skilled if they are not on their guard. Now let us come to damages attending an exposure.

First of all, no person should be allowed by law, to do x-ray work unless he is an expert electrician as well as a physician. If he is not familiar with the electrical part of it, he can make shadowgraphs that are distorted and in every way unfit for evidence, and at the same time, he can do a great deal of damage. He ought to be a physician, so that he could determine as to the amount of force that should be used, in each particular case, and in case of injury he would be familiar with the methods of treatment. As I said before while the x-ray is valuable as a diagnostic agent, it has its disadvantages. Too great an exposure and too many exposures of the same part to the ray, may prove disastrous. For instance, I can recall several cases in which united fractures have reopened, the scar tissue being absorbed, due to many exposures to the x-ray and carelessness of the operator. I have seen a good deal of damage done not only to the skin, but to the deeper tissues. I know of two cases where the jawbone had been partially disintegrated and absorbed. This is due entirely to carelessness on the part of the operator, he not being a physician, but a very poor electrician. The reason for this disintegration and absorption is as follows:

The x-ray produces disintegration or decomposition, and if the strength is increased to an extreme degree, electrocution is the result.

The x-ray is a germicide. In March, 1896, Prof. Wightman and myself destroyed the bacilli of eight different diseases in the culture tubes by the aid of the x-ray. In the same month, I placed the first tubercular patient under treatment, and I will say that the patient is still alive and enjoying fairly good health, and what is more, the whole scientific world have acknowledged the fact that the x-ray is a germicide, and they are now treating tubercular patients both in France and Germany. On December 6th and 7th of 1896, the Associated Press published the following statement made by me in defending the x-ray as a healing medium:

"Recently much has been published about the injurious effects of the x-ray upon the human body, such as its producing abscesses, burning and blistering of the skin, shedding the hair and finger nails, etc., etc. For the last eight months I have had patients under the x-ray in my labaratory from 9 A. M. to 6 P. M., duration of treatment varying from a half hour to four hours at each sitting, and not once with any bad result in any case.

"After the Crookes tube is excited by the coil, the magnetic lines of force are projected down, in the same manner as they pass off from a magnet, and traversing the intervening space, pass through the body down to the floor, and back to the coil, and tube again, completing the circuit.

"The x-ray is electrostatic in character, and of a very high potential. With every discharge from the Crookes' tube, oxygen is liberated in the body as well as the surrounding atmosphere, which, combining with nascent oxygen, forms ozone.

"It is due to the electrolysis produced in the body that we are able to destroy the bacilli in contagious disease; ozone being the most powerful germicide known.

"The ozone generated between the tube and the body does not produce the burning, etc., noted; it is the increased current which, passing through the body, produces electrolysis, the skin being of a higher resistance than the rest of the tissues.

This same condition of burning takes place under the galvanic and static currents, if excessive use be made of them. Except for potential alone, the two forces are identical.

"In one of the Eastern states criminals are electrocuted. Here electrolysis is carried to an extreme, destroying the whole body, but the product of partial destruction exhibits abscesses, etc.

"In the disastrous treatment given and reported, the unskilled operators used a current in the apparatus of too high tension, and instead of hastening normal physiological change, carried their treatment to a point of electrocution. Strychnine is a good drug when used by a skillful physician, but a danger in the hands of a tyro.

"It must not be forgotten that electric phenomena are very powerful, and not every man who can buy a machine is capable of applying it. The electric machine must be as skillfully adjusted to each individual as the microscope to a specimen submitted to it. It is a treatment full of danger if ignorantly or rashly handled, but beyond price in value to the skilled and careful electro-therapeutist."

The diagrams of Figs. 1, 2, 3, 4, I do not claim are absolutely correct in detail, but only in general. For instance, from all experiments I have conducted so far, I am led to believe that the lines of magnetic force are thrown off at right angles to the surface of the vacuum tube. The more nearly flat the surface of the tube, in the field of bombardment, the greater the concentration of the lines of magnetic force, and consequently the more perfect the picture.

The apparatus for demonstrating was kindly furnished by Charles Truax Greene & Co.

IZAMBARD PROCESS OF PRINTING BY X-RAYS.

George Izambard, who has been experimenting in Paris with the Roentgen rays in the hope of adapting them to commercial use in the printing industry, announces that he has succeeded in producing a machine for the purpose. He reasoned, it is said, that if the x-rays would penetrate oaken logs they ought to penetrate piles of paper, and that as photographs could be taken with x-rays, it ought to be possible to reproduce a picture or printing through every sheet of a pile of paper. The invention is so far matured, that, according to some of our exchanges, M. Izambard is able to expose a pile of paper between two Crookes tubes and print both sides of all the sheets in the pile at the same time. He can also place a series of piles of paper around a Crookes tube, making use of the x-rays by radiating them from a centre.

It was suggested many years ago that the printing of the future would be done by electricity, operating, not on single sheets, but on all the sheets of a pile at the same instant. Various inventions have made some approach to a solution of the problem, but none of them has been successful in producing satisfactory printing. M. Izambard's first success was obtained by sensitizing the paper, on the side that was to be printed, with a gelatino-bromide emulsion, such as is commonly used in photography. A pile or block of paper thus prepared was placed in a position of exposure to the x-rays. On top of the paper was placed a copy of the thing to be printed. This copy being proof to the x-rays, in a trice the thing was done, and on developing the pile of paper the inventor found a copy clearly printed on each sheet.

To print in this manner, it is necessary that the copy or original shall be nearly impervious to the Roentgen rays and that it shall be placed between the Crookes tube and the pile, where the rays may be directed to it. The copy is preferably first printed or written in what is called radiographic or x-ray proof ink, composed of a material calculated to intercept the rays. A few seconds' exposure is sufficient to effect the printing through the entire pile of paper, but it is at first invisible and requires to be developed or fixed, after the method of a photographer. The piles of exposed sheets are trundled into a red-light room and suspended in vats, where the developing and fixing liquids are applied. Rinsing and drying follow, and the latter may be hurried by mechanical and chemical means. It is apparent that the process is really a sort of wholesale method of photography with the x-rays, and is printing only in the photographic sense of the term.

The inventor admits that there is a difficulty in printing on one side only of the paper, owing to the tendency of the print to show through on the reverse side. He proposes to overcome this by sensitizing the paper in stripes, printing the lines on the stripes, and causing the lines on one side of the paper to fall opposite the spaces between the stripes on the other side. Until he can improve upon this method the process must be limited by these restrictions. To offset this drawback, there are peculiar advantages in the process. It is just as easy to print in white on a black ground as is black on a white surface. Typewritten matter can be reduced in size and reproduced, thus saving the expense of composition.

For printing very large sheets, such as newspapers, M. Izambard uses several Crookes tubes, which are shut off from one another by partitions of a metal not easily penetrated by the rays. Thus the tubes send their rays through the paper in nearly straight line. The limit if thickness of the pile that can be printed at one exposure is reached when the rays are so distributed as to distort the image. Probably no pile of more than a couple of inches in thickness could be impressed at a single exposure with satisfactory results.

The x-ray proof ink used is made in part of finely divided metallic or calcareous powder. Bronze, copper, white lead or white zinc may be used. As a writing ink white lead in a solution of gum has been found most satisfactory. When the matter to be printed is first typewritten, the metallic powder is mixed with boiled linseed oil.

A peculiarity of this x-ray printing is that it affords opportunity for printing copies of private or secret matter, without the printer's being able to see or read what he is printing. A customer desiring copies of private matter may deliver his copy written in the x-ray proof ink and securely sealed in an envelope. He may also see that the paper on which the copies are to be printed is securely sealed. Then the printing may be done by the x-rays and the developing, executed without once breaking the seals, so that no one through whose hands it passes can know the contents. If desired, the envelopes may even be made of stout canvas or leather and securely locked.—*Electrical Engineer, N. Y.*

Measuring the Area of the Heart.

In view of the difficulty of measuring the area of the heart upon the anterior thoracic wall by percussion or phonendoscopy, M. M. G. Variot and G. Chicotot advocate the use of the fluorescent screen. It is easy, they say, to trace with a pencil the radioscopic image of the heart on tracing paper fastened to the screen. This, of course, does not give the true size of the organ, but magnifies it: but when one knws the distance between the anode of the Crooks' tube and the screen and the distance of the anode from the heart, it is a simple application of the rule of three to correct any given diameter of the radioscopic image. The distance of the heart from the anode can be calculated by subtracting the distance of the screen from the heart from the distance of the screen from the anode, and the distance of the screen from the heart has been determined in the case of young children by a series of observations upon cadavers, supported by calculations made in living children confirmed in autopsies. The distance that separates the right and left borders of the heart from the surface of the skin varies with the age of the child; it is about 25 centimetres (one inch) at 18 months, 3 cm. (1.125 inches) at 2½ years, 4 cm. (1 9-16 inches) at 5 years, and about 5 cm. (2 inches) from 10 to 12 years.—*Journal of Electro-Therapeutics.*

Therapeutic Effect of the Roentgen Ray.

Southgate Leigh, M.D., reported to the Seaboard Medical Association a few cases which bear on this subject. The first was that of a young man with a bullet in the thigh. At the time of the examination, the knee was very much swollen, exquisitely tender and painful. The slightest touch or motion made him cry out in agony. The doctor, having at that time an imperfect coil and poor tube, exposed the knee to the x-rays for four hours, in order to get a photograph. The next day the patient moved about the bed without pain; the second day he was up in a chair, and the third day he was walking around on crutches.

A second case was one of tuberculosis of the elbow joint. Prof. Wyeth had advised excision. Nicola Tesla, when consulted, advised a trial of the x-ray. Accordingly, the joint was exposed to the ray two or three times a week for two hours each time, until the total exposure was about twelve hours. After each exposure a wet dressing was applied. In a short time all signs of inflammation had disappeared, and now eighteen months have passed without any return of the diseases.

The third case was an examination for gall stones. For several months the patient had been suffering frightful attacks of pain at frequent intervals. No stones were found on examination, which was prolonged. Since the examination, however, the man has not had an attack, and is in perfect health. Two other cases of a similar nature were apparently relieved by the use of the ray.

THE X-RAYS AT OMDURMAN.—In a recent paper read before the Roentgen Society, Surgeon-Major Battersby related his experiences in the use of X-rays in the last Soudan campaign. After the battle of Omdurman 121 British wounded were taken to the base hospital. In twenty-one cases the bullet could not be found, and in twenty of these an accurate diagnosis was obtained by the use of the rays. The electric current was obtained from E.P.S. cells charged by a hand dynamo, and much ingenuity was displayed in utilizing the back wheel of a tandem bicycle, stripped of its tire and geared to the dynamo, for driving power.—*The Med. Surg. Review of Reviews.*

THE Mississippi Valley Medical Press Association has been organized in St. Louis with an initial membership of 15, Dr. C. H. Hughes is president. The selection of Dr. Hughes as president speaks well for the organization as he is one of the most scholarly and widely known physicians in the world.

The object of the Press Association is to further the interest of Medical Journals wherever the English is read, fraternize more closely the editorial members and aid with all its might the success of the Louisiana Purchase Exposition.

Missouri State Medical Association.

Officers: President, G. R. Highsmith, Carrollton.

Vice Presidents, W. A. McCandless, St. Louis; C. F. Wainright, Kansas City; W. S. Allee, Olean; J. D. Drummall, Salisbury; W. E. Lucas, Minden.

Recording Secretary, B. C. Hyde, Kansas City.

Corresponding Sec'y., E. Van Note, Hamilton.

Treasurer, U. S. Wright, Fayette.

The annual meeting of the Missouri Medical Association will convene in Sedalia, Mo., on Tuesday, Wednesday and Thursday, May 16 and 17 and 18, 1899. All members of the profession are cordially invited.

A notable feature of the programme this year is that three-fourths of it is furnished by members practicing in the country. The claim heretofore made, that the city members monopolize the time, cannot be justly made this year, as it has been the aim to give the country practitioners every opportunity to present the results of their labors.

The Medico Chi. Wins.

Supreme Court says it can grant degrees in dental surgery. The Medico-Chirurgical College petitioned the Common Pleas Court No. 3, for leave to amend its charter so as to grant the diplomas and degrees in dental surgery, etc.

This was resisted by the Philadelphia Dental College on the ground of want of authority to do so, etc. The Common Pleas Court decided in favor of the Medico-Chi., and the Dental College took an appeal from his decision. The Supreme Court in an opinion by Justice Dean, this morning confirmed the decision of the lower Court, and dismissed the appeal. L. Webster Fox is Secretary of the Board of Trustees.

Duration of Roentgen Ray Emission.—Roiti, Trouton and Colardeau have by various means endeavored to ascertain the duration of a single x-ray impulse. The values arrived at varied from 1-300th to 1-10,000th of a second. H. Morize has devised and carried out a method of determining this duration, which he believes to be capable of great accuracy. A photographic plate is fixed on the end of the shaft of a highspeed motor. A metallic slit is mounted in a radial direction just in front of the plate. Photographs are taken when the motor is at rest and when it is moving at a known speed. The images of the slit appear drawn out sideways when the plate moves, and the amount of the broadening is a measure of the duration of the x-ray impulse. The results obtained by this method show that to each current impulse in the primary of the induction coil there correspond several successive impulses of the rays. Successive images of decreasing intensity are thus produced, separated by uniform intervals. On some plates four images can be traced, the last being very feeble. The durations obtained ranged from 65 to 107 millionths of a second, with a mean of 82×10^{-6}. The intervals were 0.00033 sec. on the average.—*Morize, Comptes Rendus*, Oct. 17, 1898.

One of the Oldest Antiseptics, But One of The Best.

There are thousands of physicians, yes, tens of thousands, we doubt not, who can say with "Doctor," in "An Interview," "Why, I absolutely depend upon Listerine in most of my throat work, and find it of inestimable value in my typhoid cases (as many a poor soldier boy can testify,) and there are a number of purposes I put it to in the sick room, where nothing can take its place, notably, as a douche, mouthwash, and in sponging my fever patients. Furthermore, I always deem it my duty to see that my patients get exactly what I order for them, therefore, I always order an original package, thus avoiding all substitutes. That is just where my views upon professional attitude and sound business policy consolidate into one joint effort for the patient's benefit, and incidentally, my own."

Like every other good thing, Listerine has been counterfeited, as many a physician has found to his regret, none of the "just as good and cheaper" preparations approaching it for trustworthy antiseptic service.—*Mass. Medical Journal.*

Better Still.

The influenza has been quite prevalent in a number of cities during the past month. In Richmond, there have been many cases, though no deaths distinctly attributed to it. It is affecting mostly those who have had the disease almost annually during the past few years. Although the attacks of this year are relatively mild, they are severe enough to keep business men away from their places of business. Phenacetin, or better still, antikamnia, with salol or quinia, and a little powdered digitalis added, has proved a satisfactory plan of treatment, presupposing, of course, that the bowels are kept open, the secretions of internal organs are attended to, and that the patient is kept indoors, especially at night or in bad weather.—*The Virginia Medical Semi-Monthly.*

Rothwell's B. B. Mineral Springs.

These springs are located at Bowling Green, Mo., and the waters are for sale by all first-class druggists and also by many saloons and general stores. The B. B. Mineral water is a genuine Missouri product and a natural blood purifier. For persons who have weakened their system by excesses of any kind, it is valuable. None of the imported or manufactured mineral waters can vie with it. It is, really, the king of all healing waters, restoring health to those who use it. For persons who experience evil effects from drinking, it is especially efficacious, clearing the mind and cleaning the system. Headquarters of Rothwell's B. B. Mineral Spring are at 2937 Olive street. All orders are filled promptly and any information or advice desired cheerfully given. J. S. Rothwell, the manager, refers to the following well-known gentlemen: Allen and Geiger, 714 Olive street, Meyer Bros. Drug Co., John G. Joyce, Surveyor; Gov. Colman, *Rural World*; F. R. Dunn, commission merchant; Wm. N. Tivy, commission merchant; F. W. Brockman, commission merchant; Arthur Kruer, Lafayette Brewery; J. H. Farley, Merchants' Exchange; Fred Deibel, Hay and Grain Exchange, and thousands of others. Where the names of such fair-minded people can be used it is worthy the consideration of fair-minded people.

An Excellent Uric Acid Solvent.

Individuals with a marked uric acid diathesis, who exhibit the various symptoms produced by this effete product of disturbed metabolism, are promptly benefited by the use of Tongaline and Lithia Tablets and eventually cured.

The high-colored urine which deposits a thick, reddish sediment is soon restored to a normal light color; the urinous odor of the breath and the hyperacidity of the system are no longer manifested. The urinary canal recovers tone and all traces of irritation then disappear.

In a word, as a uric acid solvent Tongaline and Lithia Tablets are unexcelled, a conclusion which is not the result of experiments in vitro but of actual experience.

Samples of Tongaline and Lithia Tablets can be obtained by applying to Mellier Drug Company, 2112 Locust street, St. Louis.

Intestinal Antisepsis.

For intestinal antisepsis you cannot find anything better than W-A Intestinal Antiseptic used in connection with Abbott's Effervescent Saline Laxative.

"I have found your 'Intestinal Antiseptic' and 'Saline Laxative' to admirably fulfill the claims you make for them."

J. B. Goodnough, M. D.
Long Branch City, N. J.

"The Intestinal Antiseptic (W-A) you sent me I have tried on three cases of diarrhea in children and on one of severe diarrhea in adult—all with the most satisfactory results."

W. R. Marriett
Capron, Ill.

"I have cured a case of chronic dysentery with your 'Intestinal Antiseptic' and 'Saline Laxative' which was pronounced incurable, and given one year or less to live. Many physicians in different parts of the country had unsuccessfully treated the case.

C. H. B. Gill
Falum, Kansas

Manufactured by the Abbott Alkaloidal Co., Station X, Chicago.

THE AMERICAN

X-RAY JOURNAL.

Devoted to Practical X-Ray Work and Allied Arts and Sciences.

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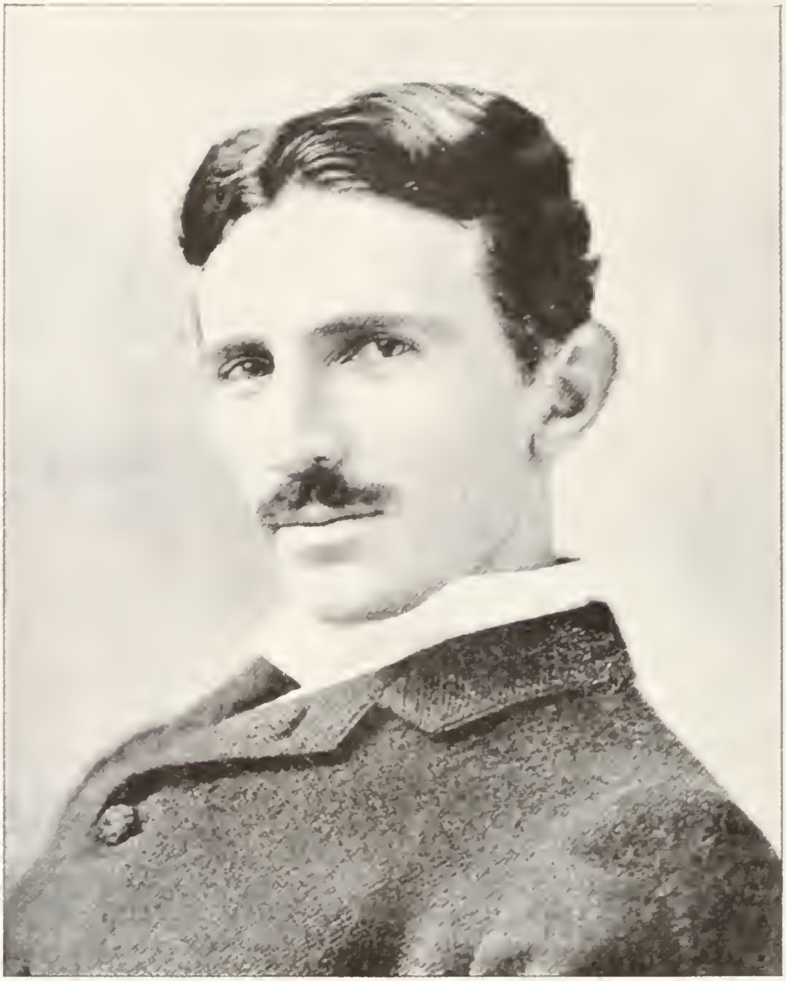

NIKOLA TESLA, E. E.
55 West Twenty-Seventh Street, New York City

The American X-Ray Journal.

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VOL. 4. *ST. LOUIS, MAY, 1899.* *NO. 5.*

A PHYSICIAN can not be well informed in x-radiance unless he reads THE AMERICAN X-RAY JOURNAL.

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THE AMERICAN X-RAY JOURNAL is the only publication in the world that gleans all the useful matter from the world's store of x-radiance.

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DR. C. B. CLAPP, of Moberly, Mo., has just installed a large 10-plate static machine in his office. The doctor is surgeon of the Mo. Pac. Ass. Hospital.

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DR. GEO. W. COX, formerly of Murphysboro, Ills., now of Iola, Kans., has recently put in his office an 8-plate static machine for x-ray and electro-therapeutic work.

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X-RAY cases that become medico-legal and all suits in which x-ray testimony is used are reported fully in THE AMERICAN X-RAY JOURNAL. In no other single publication can all these facts be found.

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DR. H. V. L. BROKAW, Professor of Anatomy in the Mo. Med. College, St. Louis, has added a 10-plate 30-inch x-ray apparatus to his office. The doctor finds the x-ray indispensable in his surgical practice.

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DR. WAITE, the well known physician and inventor, and head of the Waite & Bartlett Manufacturing Co., of N. Y. City, has been in St. Louis for the past month. The doctor has made many friends here and been successful in placing his electro-therapeutic and x-ray apparatus in the office of several physicians and hospitals. The doctor has had a most successful tour.

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DR. S. H. MONELL, the eminent author and teacher, is making a tour of some of the leading cities of the U. S., for the purpose of instructing physicians in x-ray technique and clinical electro-therapeutics. The doctor is at the head of the Post-Graduate School, of Brooklyn, N. Y., which has just closed its third most successful year. We predict for him a successful and useful trip.

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DR. H. A. ROGERS, of Isabella, Tenn., has equipped his x-ray laboratory with the Dennis fluorometer. This is proof that the doctor has an apparatus for x-ray work that will shadow any portion of the interior of the body. It is unmistakable evidence also, that the doctor will not be caught in the court room with apologetic evasions when he is questioned in a medico-legal case involving x-radiance.

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W. R. ROCHELL, M. D, of Jackson, Tenn., has replaced his old x-ray apparatus for a more modern machine of the highest grade. The doctor is surgeon to the railroad lines that pass though Jackson. He says that the x-rays render true service and that it would be now impossible to do without it. Dr. Rochell keeps a record of his work, when received and when discharged, in radiographic pictures.

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DR. WM. W. GRAVES has placed in his office a 10 plate, 30 inch x-ray and electro-therapeutic apparatus. It was with an 8 plate machine that Dr. Graves labored with such fruitful results. Very early he demonstrated that a Crookes' tube need never be re-exhausted, but to the contrary, such tubes as formerly were considered worn out, had now just arrived at the most useful condition. This principle applied to static machines.

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THE "biggest-hearted man in the world," Edward Lewis—the man with a musical heart—has been recently radiographed by Prof. W. O. Horner, of Cleveland, Tenn. The Professor reports the organ to be eleven inches long, by nine inches through, which is larger than that of a horse. The normal human heart measures about five inches long by three inches through. The probability is that distortion by position had something to do with the size of the shadow of the heart.

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OUR advertisers of x-ray machines report more sales for the three months ending with March than for the full year of 1898. This growing interest in x-radiance is largely due to the teachings of the AMERICAN X-RAY JOURNAL. Nearly all the manufacturers in the United States that have a legitimate x-ray machine to sell employ the only medium of recognition for that purpose. We have kept a watchful eye upon those who work for the improvement of this diagnostic means and use our utmost endeavor to further their interest. Public reproach and condemnation should fall upon those houses that are full of the commercial idea and offer with flattering terms worthless apparatus for x-ray uses. Prospective purchasers who desire the truth can always find full and explicit information through the columns of this Journal.

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DR. J. T. MOREHOUSE of Orange, N. J., writes to us the following: "I inclose you two prints of a guinea pig, you will notice how entirely different the skeleton from that of the rat, and yet we are told that the cavey and rat belong to the same family.

When we consider the radiograph depends for its sharpness of definition on the density of the structures involved it is truly wonderful that such sharp outlines of structure can be obtained. You will notice that even the ears are outlined in the prints and the contents of the intestines. It shows what fine work can be done with the x-rays. It is not at all rough work. Little by little improvements are taking place and before long the progressive physician that realizes human beings should have the benefit of everything that will make a diagnosis certain instead of being satisfied at a blind guess, will become, yes, he must become convinced that he is not honest with either himself or his patient if he accepts a fee on a guess diagnosis."

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Dr. J. C. DAVIS of Rochester, N. Y., while examining the head of a 13-year-old boy with the x-rays for the purpose of determining the cause of epilepsy found a depression of inner table of the skull in the anterior central portion of the head. The boy had fallen upon the corner of a marble slab when 5 years of age and almost immediately developed fits which grew in severity until his mind was materially affected. There were no external signs to determine the exact point where the head struck the marble slab. The divergence of the x-rays was sufficient to mask the exact location of the depression although the boney projection was readily seen. The Dennis Fluorometer was used to correct the divergence and the location fixed. The skull was trephined and the boy has made a happy recovery.

It is clear that even with exploratory surgery the location of this depression of bone would have been very uncertain. With the x-rays it could be seen, but for accurate surgery another adjunct to x-radiance was necessary. The use of the Dennis Fluorometer afforded every essential.

Physicians up to date of this kind deserve the praise of their fellow men.

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X-Rays as Motor Power.

Rays similar to x-rays are proposed for motor power. In fact Axell Orling gave a practical demonstration recently in London, Eng. The transmission of motor power was by waves of light and by this method he was able to steer a torpedo from a distance. Mr. Orling fitted up a model of a torpedo with a rudder like the tail of a fish and placed it in one room with the controlling power in another, the rooms separated by double partition walls. The spectators were astonished to see the rudder of the torpedo turn to the left or the right at the will of the operator.

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Styloid Process and Colles' Fracture.

J. Lynn Thomas, F.R.C.S., Surgeon to the Cardiff Infirmary, in five consecutive x-ray examinations of Colles' fracture, found the styloid process of the ulnar broken in four of the five cases. Authors writing upon the subject, speak of this fracture as "sometimes" or, "exceptional." In Trevis' System of Surgery, it is stated in connection with Colles' fracture that "the carpus moves outward with the lower fragment, and sometimes carries the ulnar styloid process with it." In Keen & White's *American System of Surgery*, we find these words: "Exceptionally, the styloid process of the ulna may also be broken off."

Professor Thomas is of the opinion that fracture of the styloid process of the ulna, is of frequent occurrence when the radius sustains a Colles' fracture, and to ascertain the facts, he is gathering statistics from surgeons who make use of skiagraphy in their practice—the only source of true evidence.

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Use of the X-Ray Is a Duty.

Medical journals reflect the thought of medical men and every invention or discovery worthy of a few or many, find full expression therein. In proportion to the usefulness of the invention or discovery do medical journals give space editorially. During the past year no one subject has occupied so much attention upon these pages as the subject of x-radiance. Every enlightened person now knows that there are many ill conditions the result of disease and violence that can not be ascertained by any means except by the means of x-rays. A medical man can not play ignorant of these facts for he is repeatedly apprised of the truth through journals, free or otherwise, that have been put upon his desk. If he has not read he is culpable and if he does read and heeds not he is the more blamable. This evasion is mostly found in the ranks of those who have plenty of surgery to do in the "old way."

Apparatus are expensive and technical knowledge is required to obtain the best results from any machine. This knowledge, however, is easily acquired. The expense of an apparatus can not be properly used as an excuse for not employing this aid for there are good x-ray apparatus in every city. The places, however, where we would expect to see efficient machines are the places where this diagnostic aid is woefully neglected. The hospitals have generally been very slow and give the reason that they have not the money. An institution that can not treat its patients fair and honest should close its doors. As a rule they send out inducements that allures the unwary to their beds which they have no moral right to do unless prepared to render honest service. The naming of college professors as their operators and attending surgeons draws the innocent from the better comforts of home to undergo the ordeal of "head or tail diagnosis" and exact surgery. Exploratory operations have but little favor, the probe has been laid in the archives, and commercial surgery is being revealed. A revolutionary tide in methods of diagnosis is on and the beginning of the 20th century will witness the conquering lines in surgery controlled by those who can grasp the spirt of the age—the workers in x-radiance.

THE X-RAY IN LAW.

Balling vs. Schmidt and Fuchs.

A brief personal history which induced Frank B. Balling to bring damage suit for $25,000 against Dr. Otto L. Smith and Prof. W. C. Fuchs of Chicago will be of general interest and is herewith appended. Judge Chetlain the judge in the case refused an exhibition of the x-rays in court, an opinion not equally shared by all the lawyers. The attorneys for the prosecution Stirlen and Dickson, after the jurors had been polled and discharged repaired to Dr. Pratt's office to witness the workings of the x-rays.

This suit was commenced over two years ago and is said to be the first started for alleged damages resulting from the application of the Roentgen discovery.

Mr. Frank B. Balling is of German descent. Age 37; weight, about 270. While driving a fractious horse Mr. Balling was thrown from his buggy, striking square on his feet. As a result, his right ankle was broken. This was on September 2, 1895. The limb was set by two surgeons and in about three months Mr. Balling was able to get out with the use of crutches. A short time after that the crutches were discarded, and by May 1, 1896, he was able to attend to his duties in his lumber office and yard, practically as well as before. There remained, however, a slight stiffness in the right ankle. He suffered no pain from it, but it would swell some during the day and that swelling would disappear by morning. On Sept. 19, 1896, x-ray photographs were made by exposures occupying from thirty-five to forty minutes, by placing the tube from five to six inches from the ankle, the tube being about the same distance from the top of his foot. While under the exposure he experienced and complained of sharp tingling pains. Three days after a slight redness appeared between the big toe and first toe, which, in three weeks had spread to almost the entire surface of the top of the foot, and later, formed a blister. This blister was opened and attended to by a surgeon, but it continued to spread until it covered the whole foot and ankle and formed a very ugly looking ulcer, which penetrated the deeper tissues of the foot. The foot was never free from a burning sensation, after the exposure to the x-rays. In three weeks from the time of his exposure, he was using crutches again after having discarded them several months before. Nov. 28, 1896, the patient entered Englewood Union Hospital, where the surgeons amputated the foot, which amputation was made on account of the ugly looking ulcer, and the intense pain with which the patient was suffering. The surgeons testified that they, of course, hesitated less in making the amputation on account of the stiffness which had existed in the foot prior to the x-ray exposures. After the amputation, all of the parts which seemed to be affected were removed. The wound healed rapidly. On Dec. 12, 1896, all the stitches were removed. The patient went home the same day and was cared for by his regular physician. Three weeks later pus formed, and the wound opened, but healed in a week. A month later the wound opened again but there was less pus. The limb was never free from the burning sensation, and occasionally had an acute pain in the bone. In May pus formed again, and a drainage tube was put in, which remained four weeks. This was irrigated daily. At the end of four weeks the tube was removed. The burning sensation continued. The acute pain in the bone was still very severe. Aug. 2, surgeons removed two or three inches of fibula, and ends of two nerves. The wound healed again but the burning pain continued. Returned to hospital Aug. 23, for re-amputation of the painful stump. Friday, Aug. 27, 1897, at 9 A. M., patient was anæsthetized, by a physician, chloroform being used. The patient took chloroform nicely. Two surgeons performed the amputation by two anterial posterior flaps, four inches of tibia and an inch and a half of fibula removed by the saw. All of the cicatricial tissue was removed. The nerves as they were found, were drawn down and cut short, removing about four inches of nerve. The end of the tibia was severed with the periostial flap. Arteries were ligated with silk worm and catgut. Flaps were united with silk worm. Soft rubber drainage tube was used, and removed the third day. There was no shock after the operation, patient rallied quickly, but a small amount of oozing occurred. Dressings were removed the second day. A moist dressing of boro glyceridi and formolin used Iodoform and glycerine emulsion was injected each day at a point of drainage. One stitch removed fourth day. All stitches removed fifth day. Aug. 29, lay free from pain, first since injury.

Professor H. P. Pratt, M. D., was called as an x-ray and electrical expert for the purpose of establishing the fact that the x-ray or the electrical discharge produced while the x-ray was in operation, was competent to produce injurious results, and that such injurious results were more apt to occur in an exposure where the tube was placed as close as from five to six inches, than at a farther distance. There were four or five x-ray and electrical experts called, by the defense, who disagreed widely, one from another, with reference to the effects of the x-ray and the distance of the tube from the part exposed which would produce those effects, yet, taking the testimony of each one, as a whole, there was no substantial difference, so far as to the fact that injurious results might follow an exposure to the x-ray The jury awarded $10,000 damages.

IN PROVIDENCE, R. I.

A medico-legal case has just been concluded in Providence, R. I. About two years ago a woman of Bridgeport, sustained a Colles' fracture. There was disagreement as to the nature of the injury, some consultants contending that it was a Barton's fracture. It appears that some of the physicians that felt responsible for the deformity held to the opinion of Barton's fracture, this being the more hazardous of the two injuries, inasmuch as the fragments extend into the articulation. The plaintiff tried to prove that treatment was directed to the cure of Colles' fracture when she had no such injury. At the trial which was brought for $4,000 damages, the x-ray was invoked, and solely upon its revelation was it possible for a just recognition of the injury to be made and equity to be meted out to the parties in the case.

Radiographs of the right and left forearms and wrists of Dr. Green, of Bristol, produced as normalcy and likewise, those of the plaintiff, but for the purpose of disproving a former existence of a Barton's fracture. The radiographs indicate a characteristic deviation of the hand to the radial side. The defendant contended that this deformity was voluntary on the part of the plaintiff and resorted to for the purpose of deception.

Dr. Green explained the radiographic picture. He said that about one inch from the carpal end of the radius there were slight prominences which could be seen extending laterally from the surface of the shaft of the bone. This could not be seen over the shaft of the bone, because the density of the provisional callus was less than the shaft and would, therefore, become transparent before the rays would traverse the denser structure. At this point was located the site of the fracture which is known as Colles' fracture. According to Dr. Green, Barton's fracture was not confirmed by the evidence of the x-rays, and the court accepted this as final and dismissed the case.

The report of this case does not read as if the evidence was all brought out. In the x-ray examination the writer would judge that the radiographs of the hands were taken in opposite directions on the same plate. It is a well known fact that the right and left hand and forearm laid evenly and opposed, will not show corresponding space between the bones of the carpus and radius. If the physician understands anatomy and radiography very well, he can at will, distort a normal joint in a picture, or favorably present the condition of an injured one. The normal divergence of the x rays, which is constant always to some degree, makes the picture untrue. The distortion by position can be of almost any degree, and with an operator who is an expert, we must rely on his oath. If he is not an expert his testimony is faulty. It was not shown in this case that *any means were taken to obtain parallelism of the x-rays.*

It is now history, that if provisional callus in considerable amount remains about a fracture, then x-rays will show on the screen and on the sensitized plate a line between the fragments. The distortion by position and also the normal distortion should have been corrected with impervious devices and these shadows should appear in the picture, in order that the judge and jury might have the truth understandingly. Certainly from the report of the case, as it comes to us, we can not resist the feeling that the evidence was insufficient to prove a Colles' fracture, and lacking in x ray expert testimony, sufficient to disprove a Barton's fracture.

IN BANGOR, MAINE.

Miss Gertrude E. Jameson, of Great Works, Me., brought suit against Dr. G. Gilmore Weld, of Old Town, for $4,000 damages, on account of alleged malpractice of the defendant, in setting her dislocated right elbow.

It appears that the physician dressed the injured elbow on the day of the accident and on the following day removed the dressings because he was not satisfied. Dr. Weld had consultation with Dr. Norcross, and massage treatment was instituted for several days without avail. Dr. Pease was then added to the consultants. Repeated failure to render relief and a perplexed countenance on the part of the physicians induced the patient to suggest the use of the x-rays. Dr. Weld objected to its use as he claimed to know just how the conditions were. According to the plaintiff's testimony, Dr. Weld said that she had a fracture of the olecranon, fracture of both condyles and dislocation. This is substantially as the case came to us.

The plaintiff went to the Eastern Maine hospital for treatment when an x-ray picture was made, the same being admitted in evidence by Justice Haskell. Dr. Rome refused to have anything to do with the case after he had examined it at the request of Dr. Weld. Drs. E. T. Nealy and W. L. Hunt, of Bangor, made the x-ray examination and discovered that there had been no fracture of either the olecranon or condyles, but there was a backward dislocation which they successfully reduced. This appears to be one of those trying cases in which the "old way" causes the doctor to grope in darkness, feeling content that his faults can not be uncovered. The x-rays used in this case would have saved the woman physical pain and the doctor mental anguish.

Justice T. H. Haskell admitted the x-ray picture in evidence. No objections filed. He admitted the bared arm to be witnessed by the jury. Objection filed by Attorney Carleton for the defendant. He would not permit medical text books to be read and used as evidence.

The legal ruling in this case was certainly in line with the intelligent opinions of judges in higher courts.

The x-ray picture was the principal factor in the plaintiff's case for it told the true condition of the arm at the close of the defendant's treatment. This put the defendant to an excuse of his treatment resulting so disastrously.

The jury found a verdict for the plaintiff.

IN PARIS, FRANCE

Mme. Mochert, a young lady of Paris, France, recently brought suit for 5,000 francs damages on account of an alleged x-ray burn. The plaintiff had an affection of the thigh which the doctors advised should be radiographed. The thigh was exposed three times without protection, with a total duration of 60 minutes.

Dr. Bardet, one of the witnesses, testified that burning would result in rare instances from the use of the Roentgen rays. Everything depended on the patient's physical condition. Susceptible subjects could not be pretold. He maintained that if the doctors were made responsible for such accidents they would be obliged to renounce the use of the x-rays. Acquittal.

OBJECT LESSONS IN RADIOGRAPHY.

BY J. T. MOREHOUSE, M. D.

The few radiographs I am sending by this mail, are some of the many interesting ones which I have recently taken.

The one with the broken bones of the right hand was taken by myself as the result of a little joke at the dispensary near here. The hospital to which it is attached has no x-ray apparatus and this boy was taken there in the ambulance and had his hand set (?) by the good (?) old-fashioned method like our grandfathers used. It was not a compound fracture and the hand was supposed to be in excellent condition. When I first saw the boy he had just had his hand dressed, and I was asked by the dispensary physician: "If I would like to take a radiograph of the hand and watch 'the process of healing'". He told me that it had happened three weeks before. The boy was feeding a printing press and accidently caught his hand between the type and the platten, and had thus crushed his hand. I radiographed the hand through splints and bandages and also discovered the piece of type metal in the finger and the pin which was driven through the nail. The boy was fourteen years old. The radiograph will tell the rest. I might say that the hand has been reset and is now believed to be all right. It was set under the machine and it was found that when the hand was set abducted that the bones went in place without trouble. The second picture is of a lady's hand. She was shot with a 22 bullet and after many unsuccessful attempts by the good, old-fashioned doctor, to extract the bullet, she was brought to me. It was absolutely impossible to feel the bullet, and might have been treated as a sprain, and it is remarkable how often an impacted fracture is so mistaken, and only discovered after weeks of needless suffering.

The fourth that I send you is another needle in the hand and again the old story. The woman was washing clothes and on the scrub board while rubbing hard, she found that some one had used a needle instead of a pin in some clothes

FIG. 1.

FIG. 2.

the radiograph only could tell where it was. It went in at the lower part of the thumb, and lodged in the interspace formed by the third and fourth metacarpal bones, where it was readily located.

The third radiograph is that of an old lady's hand, she having fallen down stairs and supposed that she had "sprained" her wrist. The radiograph tells the true nature of her injury. This is one of several Colles' fractures, which

and in consequence, she drove it with great force into the palm of her hand. It was removed with a great deal of difficulty, being broken even with the bone, and considerable fat had to first be removed before it could be seen, but the first cut struck it all right, and this could not have been done without the radiograph. I am astonished at the large number of needles that find their way into people's hands in various ways.

There is such satisfaction in knowing just what you have and being able to help the patient immediately, that I can not see how any physician can do without some kind of an x-ray apparatus, and how can the managers of a hospital that claims to "afford succor to those that meet with sudden accidents only," do their duty to the public and their patients unless they have proper radiographic apparatus. Surely the day is fast coming when the people will demand it.

FIG. 3.

FIG. 4.

The fifth is a broken radius. The boy ten years old. He went to our dispensary to get a sprained wrist attended to, giving a history of his having sprained his wrist while playing ball, claiming that in catching the ball it struck his thumb unusually hard. The good (?) old-fashioned doctor painted his wrist with iodine, and this was repeated the following day, and then every other day for three weeks, then as the arm was very painful and useless, he became disgusted with the good old way of treating "sprains" (?) and went to a prominent physician who requested me to "radiograph the wrist." The radiograph shows how it appeared after it was placed in splints. Just think, three weeks with an arm in this condition and the arm allowed to go flopping around, and the only thing that was done was to paint it with iodine.

The sixth radiograph is the elbow of a seven-year-old boy who fell and broke the humerus in the lower fourth. He was taken to our "hospital," and I am informed that he was a pay patient for four weeks and his arm was set (?) perfectly straight, in the good old way, by those that *"afford succor to those that* *meet with sudden accidents only*," and was discharged with a supposedly straight arm. A glance at the radiograph will show how straight it really was. Why an institution that receives thousands of dollars every year, and with the above motto, can tolerate the above, is beyond my comprehension. The seventh radiograph is another elbow joint. A little girl of three years, fell off the back stoop and cried because she had bruised her

FIG. 5.

elbow. Her parents happily took her to a physician who believes in finding out at once what the condition is, and as a result, we radiographed the elbow and found the internal condyle broken off and separated by an eighth of an inch from the shaft of the radius. The elbow was immediately set and has united perfectly, the child being able to use the arm as before the accident. The eighth radiograph is that of another sprained wrist. This was a puzzle, as a look at the radiograph will show that none of the signs of fracture could be made out by the usual means. There was no loss of motion. The hand could be pronated and supernated and there was no crepatus, and but little swelling and very little pain. The radiograph shows the styloid process broken off and displaced, and an extensive impaction of the shaft and head of the radius. The wrist is now well, and has healed in the position shown and is as useful as it was before. The case was a woman fifty years old and she caught her foot in a piece of ragged carpet and fell down stairs. The ninth radiograph, is the hand of a bride, (notice how a true diamond disappears in the radiograph) and the ends of her fingers were crooked. The question was, could they be straightened? This radiograph shows the fault is at the end of the bones and it can not be remedied. The tenth radiograph, is the wrist of a man, and a close inspection reveals the increase of bone on cuneiform bone, and a destruction of bone on the outside of the head of the radius and changes in the density of the bone. This was due to specific disease, and the history of the case bears it out. It was radiographed because it was supposed that the stiffness was due to an injury to the wrist. There has been a great improvement in the use of the wrist since the condition was thus discovered, by the use of iodide of potassium treatment.

Orange, N. J.

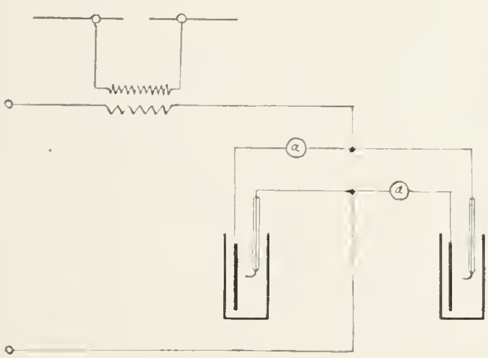
CHARGE CARRIED BY ROENTGEN RAYS.—J. J. Thomson. "*Phil. Mag.*," Dec.—A long article describing some experiments made to determine the magnitude of the charge of electricity carried by the ions which are produced when Roentgen rays pass through a gas. The paper does not admit of being abstracted here.

THE WEHNELT INTERRUPTER WITH ALTERNATING CURRENT.

BY W. S. ANDREWS

The Wehnelt current interrupter may be used in connection with an alternating current for the excitation of an ordinary induction coil providing its natural periodicity exceeds the alternations of the current, as already pointed out by Prof. Elihu Thomson. The natural periodicity of the interrupter being governed by several factors, such as amount of exposed anode surface, impressed voltage, and self induction of circuit, the above condition is not difficult to fulfill.

As might be naturally expected, the



a a Electro-chemical rectifiers

secondary discharge produced by primary excitation with alternating current is not equal in strength to that which is obtained by direct current at same voltage.

It is evident that with alternating current used under ordinary circumstances the platinum point can only be charged positively during one-half of each cycle. There may be also some interference between the natural periodicity of the interrupter and the alternations of the current. The most serious drawback, however, which accompanies the use of this interrupter with an alternating current is the disintegration of the platinum point, which does not occur to anything like the same extent when a direct current is employed.

This disintegration probably takes place during the half of each cycle during which the wire is negatively charged.

The trouble could probably be obviated, at the expense of a little complication, by arranging two interrupters in one circuit with a pair of electro-chemical rectifiers interpolated to act as a sort of electrical check valve to prevent the current passing in the wrong direction through either of the interrupters. As each cell of the electro-chemical rectifier has about 20 volts counter-electromotive force in one direction only, one cell in each branch might be effective.

The accompanying sketch illustrates the above arrangement, the rectifiers being shown at A. A.

Schnectady, N. Y.

RADIOGRAPHY OF ARTERIES IN THE LIVING SUBJECT.

BY DUDLEY TAIT, M. D.

M. Leray, of Paris, recently reported the case of a woman of 72 years, paralyzed since the age of 45, and presenting multiple deformities of the bones. Radiographs were taken which illustrated the possibility of obtaining a clear definition of the deep arterial system in arterio-sclerotic subjects. The tibia was markedly curved ; the fibula, on the contrary, was rectilinear, although somewhat thickened. Between these bones, the anterior tibial artery stands out very clearly. On the plate it was even possible to note the principal branches of this artery.

Carl Beck (New York Medical Journal, January 22, 1898) was the first to call attention to the use of radiography in arterio-sclerosis. In his case, a man of 68 years, it was proven that arterio-sclerosis involved only the arteries of the forearm. A few months later, Professor Potain presented to the Academy of Sciences (Paris) a series of radiographs of the cubital, radial and pedious arteries, made by Imbert, of Montpellier.

Such facts as these are of extreme interest, and it may be safely asserted that, with but slight improvement in technique, one will be able to discern with accuracy the arterio-sclerotic lesions of the deep arteries. We shall then be in a position to clear up many a preplexing case of internal pathology.

Since the publication of this radiograph in the Pacific Medical Record, several physicians have remarked that such accuracy of definition could only have been obtained through manipulation or so called "retouching" of the plate. Had these gentlemen read the entire article with attention, they would not have overlooked the very important facts recited in the necropsy report; they would have noted the marked and extensive arterio-sclerotic lesions involving the aneurismal sac, and thereby explained in a rational manner the accuracy of the radiograph.

San Francisco, Cal., 1054 Post street.

TRANSLATIONS.

BY FRANK RING, M. D.

M. M. Ansset and Bedart report the cure of a case of *chronic tuberculous peritonitis*, as a result of x-ray treatment.

The patient was a girl of four years, upon whom laparotomy and other methods had failed to produce benefit.

Radiography was practiced daily, with the tube at distances of from 13 to 20 centimeters from the skin, and with the tubes of great intensity. The ascites became reabsorbed, the abdominal walls became supple and the indurated masses disappeared.

Review Internationale d'Electro-Therapie et de Radiographie. Dr. G. Gantrie reports the cure of a vericose ulcer by means of the x-rays. The treatment extended from Nov. 5th, 1898, to the 1st of February, 1899. He made eight applications with the tube at 25 centimeters distance from the surface of the ulcer. The first application was of 5 minutes' duration, and the subsequent ones of ten minutes duration.

In a communication to the French Society of Dermatology and Syphilography, on Jan. 12th, 1899, M. M. Balzer and Mousseaux presented a patient who had been daily exposed to the x-rays, in a museum, for about a year. The result was multiple lesions of the skin, nearly all localized on the right side, which was the most exposed. The right hand, arm and wrist are invaded by a hard and red edema, the skin is violet, fissured and covered with yellow crusts, or scales of epidermis, which are reproduced incessantly. The nails had fallen and again grown thickened, incurved and with longitudinal striations. Other skin alterations are found, although less accentuated, on the neck, upon the cheek and right ear. The right parietal region is the seat of a complete alopcia. The beard, moustache, and the eyebrows have almost entirely disappeared in the region exposed to the x-rays. Finally, the right vision is indistinct and a conjunctivitis exists.

It seems to be incontestable that the troubles here are of a trophic nature, due to the action of the x-rays.

THE WEHNELT INTERRUPTER.—At a meeting of the Hunterian Society at the London Institute was exhibited the above interrupter working with 14-inch spark coil. The tube used was a Cox Record. There were 24 2-volt accumulators employed, and no resistance was used. The tube worked with perfect steadiness the whole of the evening and the interrupter was almost noiseless.

Open Letter to Patrons.

Boston, Mass., March 28, 1899.

Dear Sir.—We beg leave to announce that we have purchased the business and good-will of the American Roentgen Ray Co., of Bedford street, this city, and have removed the same to the above address.

We hope that you will continue to favor us us with your patronage which will receive prompt attention.

We are prepared to furnish, immediately, anything in the line of static machines, parts and supplies, x-ray tubes, fluoroscopes, spark-gaps, tube-stands etc. Also everything in the line of electro-medical apparatus.

Our new Barium Fluoroscopes are very brilliant and will last indefinitely.

Special Static tubes price $5.00 and $6.75, also type M. for the largest machines, price $8.00. These tubes are superior to any on the market for brilliancy, penetration and life. Thanking you for past favors, we are, very truly yours, Swett & Lewis Co.,

Successors to American Roentgen Ray Co.

In the heart of the Hoosier hills and charmingly situated on the banks of Pine Creek, a picturesque tributary of the Wabash, is located the Magno-Mud Cure. This is not a sanitarium, but a health resort, endowed by nature with a specific for uric acid diathesis and all diseases of the blood. It is the only one exactly of its kind in the world. The surroundings of this cure, at Indiana Mineral Springs are as excellent as the location is beautiful. No intoxicating liquors are sold within a radius of miles of the springs, and no doubtful characters are entertained. Attica, the nearest town to the springs, is at the junction of the Wabash and Eastern Illinois Railroads, 125 miles south of Chicago.

The restoration to health, of hundreds of patients who suffered from rheumatism and kindred diseases, has yearly given positive proof of the curative qualities of the Magno-Mud and Lithia Water at this resort. Two constituents of the utmost value in all diseases where alterative and sedative effects are desired, magnesia and lithia are contained in this water. While they have a sedative action on the kidneys and bladder, they aid in the cure of such diseases as gravel, catarrh of the bladder, and painful urination. In rheumatism, gout and all those diseases which arise directly or indirectly from the excess of uric acid in the blood, muscles and joints, this water is of immense value, owing to the presence of bi-carbonate of soda, as well as that of lithia. Organic matter and potash are missing from this water. A person may drink unlimited quantities of the water without feeling the least discomfort. This lithia water contains only the carbonates; it is free from all bacteria, ammonia and albuminoids. It is as pure as boiled or distilled water, without being deprived of its vital principle. The drinking of large quantities of the water begins at once to dissolve the uric acid in the blood, the calcareous deposits, adhesions and calculi, causing quantities of impurities in the urine to pass away, while preparing the greater portion for expulsion through the pores.

What is called "mud" is not the heterogeneous and impure stuff which the name suggests. It is as pure as the water from the spring which medicates it. The solid portion of the "mud" is pure humus. The leaves, flowers, grasses and plants which grow upon the hillside above the Magno-Lithia Spring, reach their maturity and die annually. The disintegrating forces of nature step in and return them to their original elements. The gases escape into the atmosphere and are inhaled by new plants. The solids are changed to dust. This is the humus, and out of its bosom spring new plants. It feeds them and gives them vitality, but only a small portion is thus used. The residue remains upon the surface and each year adds to it until what was originally a fraction of an inch thick, became, during centuries, ten, and even eighteen feet in depth.

The humus used in the cure, contains the same chemical constituents as the water from the spring. It is black, soft, odorous and without a trace of gravel, sand or clay. This mud lies in a natural basin, almost three acres in extent, and at the rim of its highest side, the Magno-Lithia Spring pours out its water and saturates the contents of this little basin. For centuries the water has kept the humus saturated until it is thoroughly medicated. The prefix, "Magno," given to the mud, simply means powerful, potent, great, and alludes to the curative forces of the humus.

The Magno-Mud and Lithia Water baths are given in a brand new and magnificent bath house attached to the big hotel. The appointments of the bath house rival the best establishments of this kind in the world. The first result of the application of the mud is the opening of the pores, the removal of superficial substances and the stimulation and absorption of a constant stream of impurities, in solution, through the pores. At the same time, the Magno-Mud stimulates the superficial nerve-fibers and capillary blood-vessels, and the reactionary results are a soothing of the nervous system and a strengthening of the entire circulation. The mud bath never results in colds nor does it have a weakening effect. In many cases the results of the treatment at this resort have been seemingly miraculous. W.

"One evening I was called to attend a gentleman, a member of my own family, who had just returned from a trip during which he had contracted a well-developed case of catarrhal fever as the result of a severe cold. His pulse was 120 degrees, temperature 102-2.10 degrees, skin hot and dry, pain all over the body and a splitting headache; all the mucous tissues were inflamed, involving the nasal tract, throat and bronchial tubes; the eyes were watery, the nose was running, throat sore, in fact, his whole system was thoroughly congested.

It was very important that he should be able to travel within a day or two. I ordered him to take a hot foot bath, then drink a hot lemonade and go to bed. I left six Tongaline & Quinine Tablets with instructions to take one every half hour, washing it down with plenty of hot water.

I saw him about 7 o'clock the next morning and received the following report:—About one hour after going to bed he commenced perspiring and began to experience a feeling of drowsiness, so that before he had taken all of the Tongaline & Quinine Tablets he fell into a refreshing sleep, from which he did not awake until 5 o'clock. I found his pulse was normal, temperature 99 degrees, skin moist, the pain entirely gone and all the unfavorable sysptoms decidedly improved; in fact the trouble was thoroughly under control. I prescribed a mild cathartic and by the following day he was able to go on his way rejoicing.

Since then I have frequently given Tongaline & Quinine Tablets in similar conditions with marked success in each instance."

Frank A. Barber, M. D.,
Chicago, Ill.

"Listerine is Listerine." "The best antiseptic is Listerine." These are the words which adorn the white handle of the best paper cutter that ever came to our desk. We suspect that any one writing to Lambert Pharmacal Co., could obtain one of these useful instruments.

THE AMERICAN X-RAY JOURNAL.

Devoted to Practical X-Ray Work and Allied Arts and Sciences.

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CONTENTS VOL. 4 No. 6.

CHARLES REA DICKSON, M.D.

296 Sherbourne Street. Toronto, Canada.

The American X-Ray Journal.

Devoted to Practical X-Ray Work and Allied Arts and Sciences.

VOL. 4. ST. LOUIS, JUNE, 1899. NO. 6.

THIS is the Index issue.

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STUDY the index and see how much you know about x-radiance.

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THE physician is very much polished if he is in possession of useful x-ray information.

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DOCTORS doing surgery in the "old way" will be benefitted by reading the observations by Dr. Morehouse published in THE AMERICAN X-RAY JOURNAL for May.

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An evidence of the value of THE AMERICAN X-RAY JOURNAL to the general practitioner is noticed in the fact, that not one of the thousands of physicians who read this publication has ever been prosecuted for causing x-ray injuries.

......

"THE X-RAY" is the title of a paper by G. G. White, M. D., of El Kader, Iowa, read at the sixth annual convention C. M. & St. P. Ry., Surgeons, Chicago. The article reflects credit upon the author and deserves careful reading by all surgeons employed in R. R. practice. The full text can be found in the *Railway Surgeon*, for April.

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THE lay press has given the public some smattering knowledge of the x-rays ; and since it is a purely medical question the people have a right to expect intelligent answers to their questions from their family doctor. The intelligent only can answer and it is for this reason that physicians who read THE AMERICAN X-RAY JOURNAL stand first in the community in which they live.

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PROF. W. C. FUCHS of Chicago has specialized his "Observations in Radiography" and frankly made concessions in the Electrical World and Engineer that the cause of backing up pictures are unknown to him. He says: "Experiments made by me have shown in many instances that objects back of the plate appear upon the plate, and this is something that it is necessary to avoid. It also opens up a subject for discussion, for it would be interesting to know definitely the cause of this freak, as it might be termed."

If Prof. Fuchs will read, "Further Observations on the Properties of the X-Rays," by W. C. Roentgen, (third communication to the Royal Prussian Academy of Science, Berlin) he will find this simple explanation: "The effect just described might be due to the deflection of rays of very long wave lengths, or to x-rays emitted by bodies in the field of the discharge apparatus, such as the air. The latter explanation is the correct one, as may be readily shown by the apparatus about to be described."

It is not a "freak" but a universal fact that bodies such as air in the field of the discharge apparatus emit x-rays. If the rays are permitted to diffuse in all directions from the surface of the platinum disc the screen and the sensatized plate must to some degree be influenced by x-rays that have their origin outside of the tube. Prof. W. S. Andrews of Schenectady, N. Y., has devised "Non-Metalic Draphragm for Radiographic Work," full account of which was printed in THE AMERICAN X-RAY JOURNAL for March, 1899. With this diaphragm all the direct rays are cut off from the body except at the circular hole made for radiographic work. The impervious material used in these diaphragms was first suggested by Dr. Wm. Smith, full account of which was printed in the Dec. issue of this journal for 1898.

To restrict wider diffusion of the rays emanating from the tube Dr. Wm. Rollins, of Boston, Mass., has confined all the rays not deemed necessary for radiographic work. With the observance of these precautions it may be possible to avoid all backing up rays except such as directly pass through the parts intended to picture.

TRANSLATIONS.

BY FRANK RING, M. D.

THE EPILATING PROPERTIES OF THE X-RAYS.—Following the Electrical Exposition at New York, a gentleman who explained the apparatus and used the cathodic rays, brought an action for $10,000 damages against the Company. His cause of action was the loss of his hair and beard of the right side of his face. The Company is sought to be held accountable, because they knew, or should have known, the epilating virtues of the x-rays.

An electro-therapist of California, has drawn a practical lesson from this incident. In California, bearded women are very rare. On the other hand, there are sufficient female moustaches, and even the use of the razor does not make this manly ornament disappear.

Certain of the fair sex have the arms hairy, not like an ourang-outang, (this would be saying too much) but, like a blacksmith. This down is far from contributing to the increase of their graces or their charms. Hence our coquettish sisters would willingly give all the gold of California which is in their possession, to be relieved of this superfluous covering.

A doctor of Los Angeles, after having read in his journal of the misadventure of the New Yorker mentioned, conceived the very practical and productive idea of using the cathodic rays, to relieve the most beautiful half of the human race from their moustaches, and the downy growth from their arms. As the doctor has not taken out a patent, and in order to gain the grateful favor of all French women, I will make known his method of proceeding.

There are certain precautions necessary to preserve the epidermis of our amiable companions; the current must not surpass an intensity of two amperes, and the tension of the volts; the Crookes' tube should be placed at a distance of one foot from the face, naturally gracious, or from the admirable arms of the patient, and finally in order not to try her patience, the application must not last longer than ten minutes. Naturally, one seance will not suffice, but the patient is free to return again, and pay accordingly at San Francisco or Los Angeles, after eighteen seances, the best results are obtained, and the mother-in-law loses her moustache of an angry cat. As to the young ladies, three or four seances are sufficient.—*Revue Internationale d'Elektrik.*

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In *Footschritte auf dem Gebrik der Roenigensprahler*, Hamburg, Band II, Hoft IV., Gassman & Schenkel report progress and improvement in cases of lupus treated by the Roentgen rays, in the University clinic at Bern. They describe the technique as used by them, as follows: Primary current, 30 volts, verging between 3 and 4 amperes. The greatest length of the spark was 45 cm. and the number of interruptions was from 1400 to 1600 per minute. For the protection of the sound skin, a mask of sheet-lead ¼ mm. thick was used. Daily seances of 30 minutes' duration were held at 20 cm. tube distance.

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INSENSITIVENESS TO FRACTURES.—McLean (in *Medical Age*, Detroit) describes a case of fracture of the astragulus, which was contested by an accident insurance company, which claimed that it was a sprain. The Roentgen rays established the diagnosis, and payment was made. Subsequently, the same patient presented an unrecognized fracture of the ulna, followed in three weeks by fracture of the adjoining radius and the x-rays were again used to make the diagnosis complete.

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Prof. Dr. G. Julliard, of the Cantonal Hospital at Geneva, reports the case of a man of 34 years, in perfect health, who was suddenly attacked with complete suppression of urine. Examination by the x-rays gave a clear image of the place, form and volume of a vesical calculus, which upon removal by the hypogastric route, was found to be 25 mm. long, 15 mm. wide, and weighed 4 grammes.

———

Dr. Jimmelman of Berlin, at the Balneologic Congress, proposed the question, "Can one recognize phthisis pulmonalis by means of the x-rays, in cases in which it is not possible to recognize it by the methods heretofore in vogue?" In an exhaustive demonstration of the subject, he claims to prove the affirmative of the proposition.

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In *Munchener Med. Wochenscrift*, No. 50, 1898, Alsberg submits report of a case of venal stone, in which the diagnosis was made by the aid of the x-rays. A successful operation followed the radiographic indications.

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At the "Arzlichen Verein" at Hamburg, on February 7, 1899, Dr. R. Hahn, gave an interesting demonstration illustrating the application of x-rays, to the diagnosis of tertiary syphilitic lesions. Among the lesions made manifest by this means, were gummy tumors in various locations, as well as various bone changes, such as periostitis, osteo-slerosis and osteo-porosis.

UNIVERSITY OF PENNSYLVANIA,
THE COLLEGE,
Philadelphia, May 19, 1899.

To the Editor of THE AMERICAN X-RAY JOURNAL:

In your last issue I read a note entitled, "Styloid Process and Colles' Fracture," in which attention is called to an observation by J. Lynn Thomas, F.R.C.S., that fracture of the styloid process of the ulna is not as rare an occurrence as it was thought to be. He mentions that fracture of the styloid occurred in four out of five cases examined for Colles' fracture. On looking over my collection of radiographs to determine my own experience in the same line, I am surprised to find that it agrees closely with that of Prof. Thomas. I have on hand six cases of Colles' fracture in four of which the styloid process of the ulna is unmistakably fractured also. In one case the process itself is divided into two fragments. Respectfully,

ARTHUR W. GOODSPEED.

CURRENTS GENERATED BY ROENTGEN RAYS.—In 1897 Perrin succeeded in obtaining differences of potential between two different metals when exposed to x-rays, and even observed a small constant current of about 10^8 amperes on joining them by a wire. A. Winkelmann has made further observations on this interesting subject. He placed a Roentgen apparatus in a leaden box with an aluminum window. In front of the window he mounted an aluminum plate, and behind that a copper plate. On working the apparatus and connecting the two through a galvanometer, a small current was indicated, which was increased by reducing the distance between the plates. A battery of plates could be constructed by mounting plates of the two metals alternately one behind the other, taking care, however, that the insulator between them was not, like mica, for instance, impervious to x-rays. The resistance of one such battery was found to be 130 million ohms, and to increase as the battery was moved away from the Roentgen apparatus evidently owing to the lesser degree of ionization of the more distant air. Further, the resistance of the layer of ionized air diminished as the thickness of the layer was diminished, down to a certain minimum. At very small thicknesses the recombination of the ions is so rapid that the current intensity is thereby diminished. The author calculates the proportion of ionized molecules of air in the total number of molecules at 4.6×10^{-13} at least, in a position of maximum conductivity. —Winkelmann, "*Wied Ann.*," Nov. 9, 1898.

NATURE OF CATHODE AND ROENTGEN RAYS. Walter, *Wied. Ann.*, 66, p. 74; noticed briefly in *Elek. Zeit.*, Nov. 17. *Electrical World, N. Y.*—If cathode rays are moving particles charged with negative electricity, as now generally accepted, then, according to this author, Roentgen rays are nothing more than the reflected cathode rays which have deposited their charge on the anti-cathode. This explains why x-rays are not deflected by a magnet, as the particles no longer carry an electric charge; that they have a higher penetrating power may be explained by the fact that when the particles carry a charge they are attracted by the body through which they are passing, while particles without a charge pass through them without meeting this opposing force.

CORPUSCULAR THEORY OF ROENTGEN RAYS. Walter. *Wied. Ann.*, No. 9; abstracted in Lond. *Elec.*, Oct. 28. *Electrical World*, N. Y.—He works out a theory similar to that of Vosmaer and Ortt, the truth of which is said to appear obvious and palpable at first sight. He supposes that Roentgen rays are discharged cathode particles; they are therefore not deflected by a magnet; after striking the anti-cathode and discharging themselves they are reflectedin a diffused manner and penetrate the walls of the tube. These particles must be much smaller than the electro-chemical ions. That Roentgen rays have a penetrating power is due to their electric neutrality; a copper bullet, for instance, could penetrate a forest of magnets easier than an iron bullet.

CURRENTS PRODUCED BY ROENTGEN RAYS. Winkleman. *Wied. Ann.*, 66, p. 1: abstracted at some length in the *Elek. Zeit.*, Nov. 17.—He shows how a continuous current may be produced from one metal-plate to another, between which Roentgen rays pass.

X-RAY.—An x-ray photograph of a fractured arm is being used as evidence in a damage suit at Henderson, Ky., in which a physician is sued for $10,000 damages for malpractice—the first time in the history of the court, at that place.

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Defective elimination is without doubt the cause of a large number of diseases.

Usually when the kidneys fail to do their work the skin comes to the rescue and vice versa. Occasionally when both are derelict the bowels may help, but to a small extent only. Again all the excretory organs may be ready, able and willing to perform their functions but there is an emunctory at fault, which has become gorged and fails to carry to the "main" that waste product over which it exercises particular care, causing an interruption of metabolism. As a result there is an attack of a rheumatic or neuralgic character.

Tongaline, on account of its extraordinary eliminative properties, especially when administered with copious draughts of pure water, hot preferred, flushes the emunctories, thoroughly removes the obstructions and promptly restores normal conditions.

The American Electro-Therapeutic Association.

The ninth annual meeting of the American Electro-therapeutic Association will be held in Washington, D. C., on December 19th, 20th and 21st, 1899, under the presidency of Dr. F. B. Bishop, of Washington.

Quite a number of papers of great scientific value have been promised and the Committee of Arrangements insures the members a very entertaining and pleasurable meeting. Aside from the sessions of the Association, the committee has completed arrangements for a trip to Mt. Vernon, one to Arlington, and several other social features.

The headquarters of the Association will be at Willard's Hotel, where special rates will be given to members and their families during the meeting.

St. Louis, Mo., May 15, 1899.

To the Trade:

We take peleasure in notifying our friends, and the photographic fraternity, that the recent extensive additions and improvements which have been under way for over a year, are now practically completed, so that we are in a position to fill all orders entrusted to our care, *promptly on receipt of same*, with plates of unsurpassed quality.

Thanking our many friends for their kind forbearance during the time when we were short of goods, and hoping to be favored with their future orders, which shall have our prompt and careful attention, we remain,

Yours Fraternally,
G. Cramer Dry Plate Co.

Reduced Rates to Columbus, Ohio,

account National Meeting of the American Medical Association, June 6th to 9th inclusive. For this occasion the Missouri Pacific Railway will sell tickets at one fare for the round trip, plus $2.00 from certain points on the line. See local agent for dates of sale and further particulars. H. C. Townsend, General Passenger and Ticket Agent.