oblique diameter; the iris protruded in part through the wound in the cornea; the lens had escaped, part of the vitreous was lost and the anterior chamber was full of blood. The edges of the wound in the lid were united by suture, the torn iris and protruding vitreous cut away and the eye antiseptically dressed and bandaged. The patient asserted positively that the iron inflicting the injury was too large to be lodged within the ball and from the extent of the superficial wounds I was inclined to concur in this opinion. After a week's vain effort to save the ball the X-rays were applied and the eye enucleated. No sections of the ball were made until after Dr. Stern's skiagraph showed positively the presence of a large piece of metal in the vitreous. Subsequently a fragment of cast-iron weighing 3 grains, of irregular shape and with very sharp jagged edges, was found in the anterior portion of the vitreous.

Thus in two instances, in October and November, 1896, respectively, skiagraphy demonstrated beyond question the presence and approximate location of pieces of metal within the eyeball. In the one the condition had been assumed, in the second, the earlier diagnosis had been proven incorrect.

The next two cases in Philadelphia, reported by Ring and de Schweinitz before the Ophthalmic Section of the College of Physicians, and published in its "Transactions," Jan. 19 and Feb. 16, 1897, may be briefly referred to. In Ring's case, a piece of steel had penetrated the vitreous eighteen months before. Two radiographs were exhibited, showing the presence and probable site of the foreign body. The Hirschberg magnet was powerless to dislodge it from its bed in the ciliary body and the ball was enucleated. De Schweinitz succeeded in establishing the diagnosis by the rays, in extracting the metal after two futile attempts by other surgeons and in restoring useful vision. The following case, the last of the published series in Philadelphia, was reported before the same section in February, 1897, by Dr. A. G. Thomson. A small piece of steel had lodged in the posterior portion of the lens in a young man. Because of the continued transparency of the lens some doubt was felt as to the nature of the foreign body. A series of skiagraphs taken by Dr. W. M. Sweet, demonstrated beyond question that the foreign substance was impenetrable to the rays. Dr. Wm. Thomson subsequently extracted the lens and with it the supposed metal. Following Dr. Thomson in his detailed description of the treatment of the case read before the Amer. Ophthal. Soc. May, 1897, Dr. Sweet demonstrated his method of localizing foreign bodies in the eye, which has proven, both in this case and in others not yet published, accurate and of great value. Dr. Chas. A. Oliver reported at the same meeting, the results of his own and Dr. Leonard's methods of localization based on practically the same principle as that described by Sweet.

It is evident, therefore, that the Roentgen process, even at this comparatively early period in experimentation, while our knowledge of the properties of the rays is limited and immature, is an extremely valuable means of diagnosis in the surgery of the eye, and it is believed that continued investigation will not only confirm the claims and statements made in this paper, but will add to our conviction that in the X-rays we have an accurate, reliable and speedy method of establishing the presence or absence of foreign bodies in the eyeball.

Resignation of Professor Forel.—The celebrated alienist, Forel, has resigned the superintendency of the asylum at Burgholzli, and also announces that he will soon retire from his professorship at Zurich, in order to devote himself entirely to his studies of comparative anatomy, especially anatomy of the brain.

THE ROENTGEN RAYS IN OPHTHALMIC SURGERY.

Presented to the Section on Ophthalmology at the Forty-eighth Annual Meeting of the American Medical Association held at Philadelphia, June 1–4, 1897.

BY WILLIAM M. SWEET, M.D.

PHILADELPHIA, PA.

The value of the Roentgen rays as a means of determining the presence of pieces of metal in the eyeball has been conclusively shown by the experiments of a number of investigators, the earliest workers in this field being Dr. Clark of Columbus, Dr. Williams of Boston and Dr. Max J. Stern of this city. The knowledge that a foreign body is in the eye, however, is not all the information required by the surgeon who operates with the electromagnet for its removal. Without some indication of the position of the body, it is not possible to reduce the percentage of failures of the magnet operation. The ordinary radiograph does not accurately indicate the position of the shadow of the foreign body on the plate in relation to the shadows of the bones of the head. Hence it is desirable to state the exact spot at which to insert the magnet with the least injury to the structures of the eye.

The first attempt to determine the approximate location of foreign bodies in the eye by means of metal indicators placed without the ball, was made by Dr. H. Lewkowitch, and reported in the London *Lancet* for Aug. 15, 1896. In these experiments, which were made on sheep's eyes and the doctor's own eyes, the indicator consisted of a piece of wire placed in front of the eye, one of the arms of the apparatus pointing to the center of the cornea. Only the anterior portion of the eyeball was included in the radiograph, the eye being rotated inward or outward to include a larger part of the globe. The determination of the position of the foreign body was then made by a triangulation of two shadows on the plate cast by the foreign body, by moving the tube a known distance from the first position in making the second exposure. The photographic plate was placed at the inner canthus. In addition to these complications, and the liability of error in determining the angles of the tube in its two positions with the plate and the foreign body, the method is open to the objection that only a small portion of the eyeball is included in the radiograph.

In my early experiments with pigs' eyes placed in the ordinary Viennese mask, it was found that unless the rays were passed through some portion of the bony walls of the orbit, foreign bodies in the posterior portion of the vitreous chamber could not be shown.

In the first experiments which I made upon the human subject, the photographic plate was inserted at the inner canthus. Photographic films were used, as being more readily cut to the shape desired. Each plate-holder carried two films, and two negatives were thereby secured at each exposure, thus avoiding errors arising from imperfections in the film coating.

The indicating apparatus consisted of an aluminum frame, carrying three steel rods, each with a rounded end. The rounded extremities were adjusted to the inner and outer canthus and to the eyeball at the center of the upper lid. Two exposures were made, one with the Crookes' tube on a line with the inner and outer indicators, and the other below the horizontal plane of these indicators. In determining the position of the foreign body in the eye, the apparatus was attached to a fixed support and a lighted candle

employed to cast the shadows of the indicators on a card board similarly to those made on the negatives by the X-rays. A small object was then held in such a position that its shadow was identical with that of the foreign body. The candle was moved until the shadows of the indicators corresponded to those on the second negative. The crossing of the two lines of shadow of the test object represented the situation of the foreign body.

This method of marking was first employed in the case of a young man with a piece of steel in the lens, sent to me by Dr. A. G. Thomson. From a number of negatives I located the body 7 mm. behind the center of the cornea, and about a millimeter to the nasal side. Dr. William Thomson subsequently removed the soft and opaque lens with the piece of steel imbedded in it.

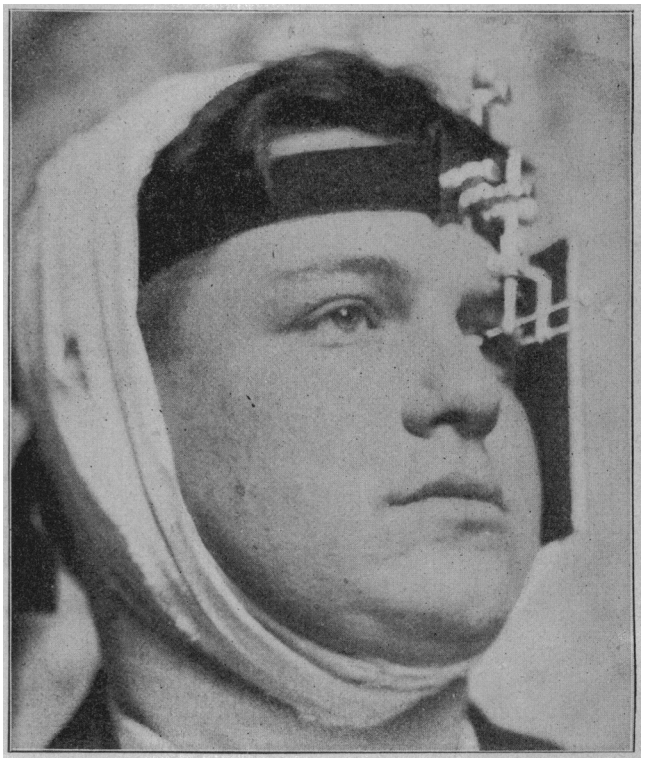
While the use of the photographic plate at the inner canthus has the advantage of bringing the sensitive film much closer to the eyeball than when in any other position, an important consideration when dealing with very small objects, it has the objection that the whole eyeball is not included on the plate. For this reason, and also because of the imperfect coating of the celluloid films, I have since used glass plates bandaged to the temple. Instead of three indicators, two only are now used.

The principle of employing two objects of known position to locate the situation of a third object from the shadows cast by these objects upon a flat surface, is extremely simple. For all practical purposes we may regard the rays from a Crookes' tube at least thirteen inches away, as being parallel in passing through a body as small as the eye. Therefore if the relative position of two objects is known, we can readily determine the situation of the third. In employing this principle in locating foreign bodies in the eye, three factors are of importance, viz., that the two indicating objects shall be at a known distance apart, and shall be parallel to each other and to the plate, and also in a perpendicular line with the plate; that one object shall point to the center of the cornea and be at a known distance from the eyeball; and that the visual axis shall be parallel to the indicators and to the plate. With the above facts known, the angle of the tube with the plate is unimportant.

The indicators may be supported by a headband and the plate held in place by an ordinary bandage, although more accurate results are obtained by employing a special form of apparatus, in which the indicators are attached to the plate holder, and are at all times parallel to each other and to the plate. The indicators are adjustable, so that one may be placed opposite the center of the cornea while the other is toward the outer canthus.

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 to 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 with the two indicators and the other 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, 24 mm. 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 is made at the center of the circle, indicating the position of the central indicator of the



Indicating apparatus supported by head band, and plate held in place by bandage.

apparatus. The distance between the two indicators is measured toward the temporal side and a spot made to show the position of the external indicator.

On the circle representing a horizontal section of the eyeball, a spot is made anterior to the center of the cornea and at the same distance that the center

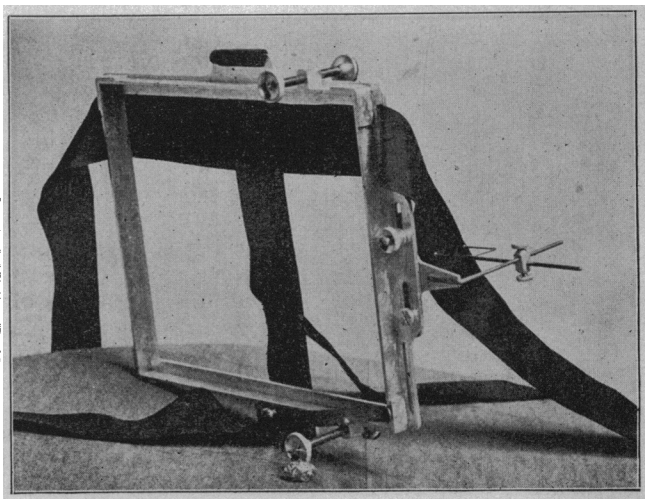
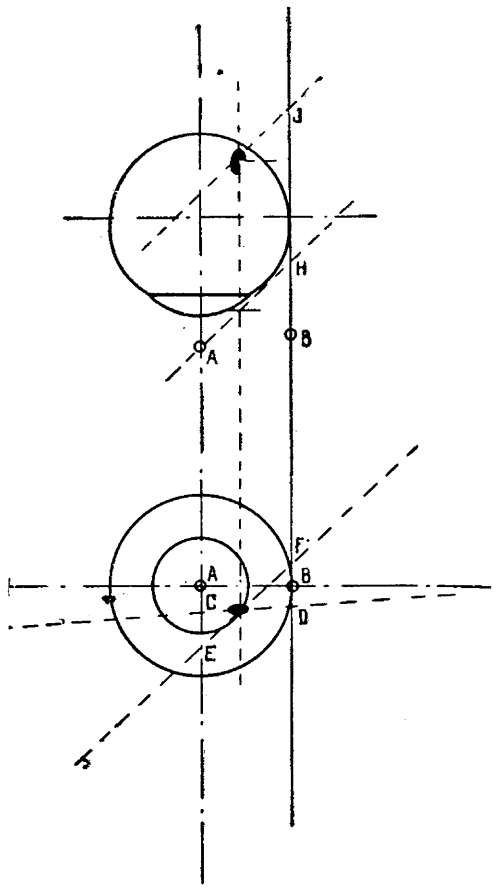


Plate-holder, with indicating apparatus attached.

indicator was from the eye when the radiograph was made. Another spot to the temporal side, measured by the distance between the two balls of the apparatus, marks the situation of the external indicator.

By taking the first negative with the tube horizon-

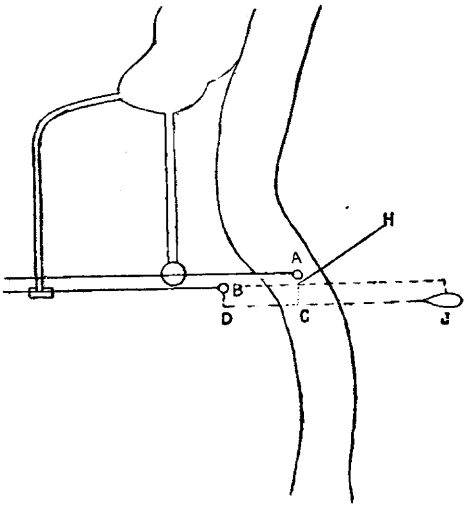
tal to the two indicators, we measure the distance of the foreign body above or below the two balls of the apparatus. These measurements are indicated on the circle representing the vertical section of the eye and a line is drawn through the points. At some point along this line is situated the foreign body. From the second negative made with the tube below the plane of the two indicators, the measurement is taken of the distance the shadow of the foreign body is above or below the center indicator, and this point is indicated on the first circle. The same measurements are made for the external indicator. 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.



Diagrammatic circles of the eye, upon which measurements from the negatives are made to show location of foreign body. Upper circle, horizontal section; lower circle, vertical section of eyeball.

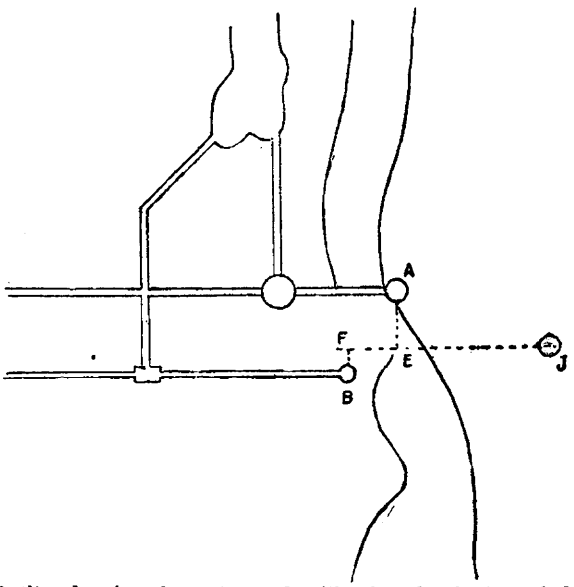
To determine the distance of the foreign body behind the apex of the cornea, one of the negatives is taken and a measurement made of the distance the shadow of the center ball is posterior to that of the external ball. The distance is entered directly above the external ball on the diagram representing the horizontal section of the eye. From this point a line is drawn through the ball of the center indicator, which indicates the direction of the rays from the tube when the exposure was made. Taking the plate again, we measure the distance that the shadow of the foreign body is back of that of the external indicator. This distance 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. Where this line cuts a line perpendicular to the position of the foreign body shown on the vertical section of the eyeball is the distance the foreign body is behind the anterior portion of the cornea. Where the foreign body is outside the eyeball, this fact will be indicated by the crossing of the lines beyond the diagrammatic circles.

The first patient upon whom I employed this method was a young man, 20 years of age, a machinist by occupation. Six months prior to coming to Wills Eye Hospital a piece of steel struck him in the left eye. Dr. William Thomson referred the case to me



Outline drawing of negative made with tube nearly horizontal with plane of indicators.

to determine the presence of a foreign body and its probable location. Examination, in April, 1897, showed a scar in the sclera, 3 mm. from the corneal margin on the temporal side, starting from the horizontal plane and extending downward, almost vertically about 4 mm. The ophthalmoscope failed to reveal the presence of a foreign body but showed a cone-shaped mass of new tissue extending through the vitreous, with the apex at the disc. The visual field was lost centrally and to the nasal side, but partially preserved downward and outward.



Outline drawing of negative made with tube below horizontal plane of the two indicators.

A number of radiographs were made with the Crookes' tube in various positions and in each of the

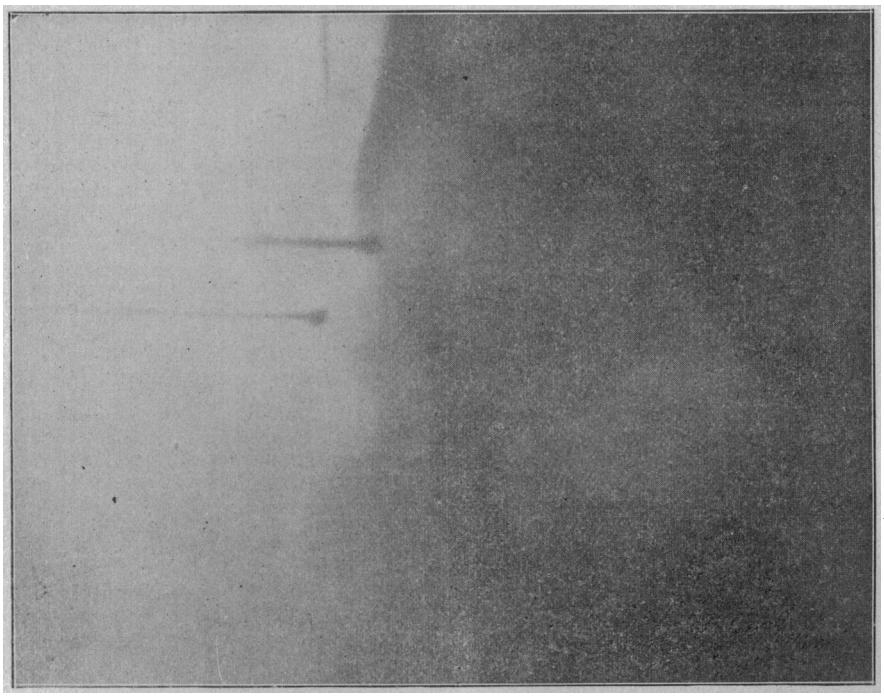
negatives the shadow cast by a foreign body was plainly visible. The two indicators in each exposure were 12 mm. apart, while the ball of the center indicator was 4 mm. from the apex of the cornea. The external indicator was inadvertently placed 2 mm. nearer the eyeball than the center indicator. This difference is allowed for on the diagrams. The exposures averaged four minutes each. Employing the method previously described, the measurements from the negatives indicated the position of the center of the foreign body to be a point 20 mm. from the center of the cornea, 5 mm. to the temporal side and 3 mm. below the horizontal plane. The negatives also gave the probable size of the body to be 4 mm. long, 2.5 mm. wide and 1 mm. thick.

In reporting the case at the Washington meeting of the American Ophthalmological Society, Dr. Thomson stated that, owing to the mass of tissues surrounding the body it was found to be impossible to remove it by the magnet and that recourse was had to dissection. The body was extracted with some of the cicatricial mass surrounding it from a point in the sclera corresponding to that shown in the diagrams made from the radiographs.

The second patient from whom radiographs of the eye were obtained came to the Polyclinic Hospital to have a piece of steel removed from the surface of the cornea. Dr. H. F. Hansell noticed that the right lens was opaque and, suspecting a foreign body in the eye, asked me to make some X-ray pictures. The man, a machinist by occupation, stated that he had been blind in the eye for several years and had never suffered any pain or irritation from it. A number of negatives were made, and in each instance two shadows made by foreign bodies were shown upon the plates, one in the region of the eye and the other about an inch below the eye. There was every reason to suspect that one of the bodies was in the eye or in the orbit, but upon employing the system of measurements previously described with several sets of negatives, the body in every instance was shown to be situated at a point corresponding to the tissue covering the outer and upper crest of the orbit. The other foreign substance was in the skin of the nose. The man has failed to appear since the negatives were made, so that no opportunity was furnished to verify the findings.

I also employed the rays on a patient sent to me by Dr. Jackson, who presented the history of a piece of metal flying into the eye twenty years ago. Ophthalmoscopic examination by Dr. Jackson and by many other gentlemen at the time the case was shown at a meeting of the section on ophthalmology of the College of Physicians, showed a dark mass lying to the temporal side of the disc, about one-half millimeter long and one-third millimeter in width, in an area of atrophied choroid and pigment deposit rather smaller than the disc.

Notwithstanding that over a dozen negatives were made of the case at different times with Crooke's tubes running under various degrees of vacuum and placed at various positions, no evidence of a foreign body was shown on a single negative.



Radiograph. John Routledge. Tube below horizontal plane of indicators. Exposure four minutes. Queen Self-regulating X-ray Tube.

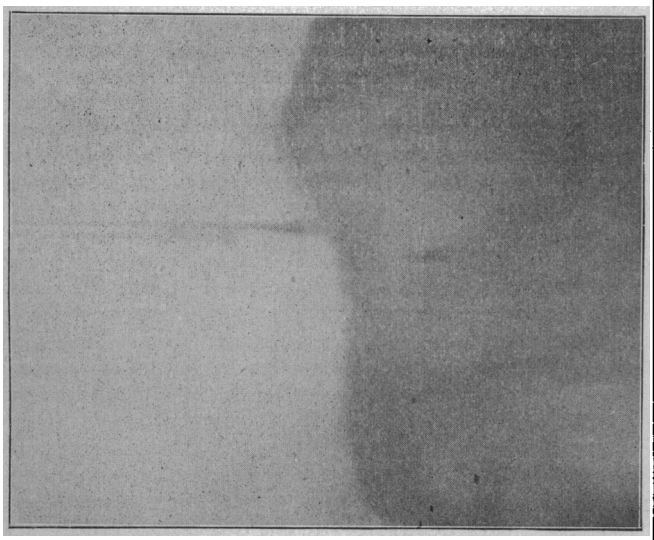
The failure of the Roentgen rays to show on the photographic plate the presence of a foreign body in the eye of the patient of Dr. Jackson, when the ophthalmoscopic examination apparently indicated the existence of a body in the eye, led me to make a number of experiments on the cadaver to determine if possible:

1. Whether very small metallic bodies in the eye could be located by means of the Roentgen rays.
2. To what extent the bones of the orbit interfered with the passage of the rays.
3. The character of the tube and the vacuum at which it should be operated to give the best results.
4. The best point at which to place the tube.

Experiments were made in the pathologic laboratory of Jefferson Medical College on a fresh, well-developed male subject. The shrunken eyeballs were removed and fresh pigs' eyes employed in which pieces of iron had been inserted. In this way the nearest

approach to the ordinary conditions met with in the live subject was secured.

In making the experiments exposures were made with two forms of the Queen self-regulating X-ray tube. In one tube the rays from the concave cathode focused to a small point on the platinum plate, while in the second tube the focus was larger. In one of the pig's eyes a piece of fine wire was passed through the center of the globe in its antero-posterior diameter. In another pig's eye three pieces of wire, about one and one-half inches long, were inserted in the nasal half of the pig's eye, entering it at the corneo-scleral margin and passing through the ball to the retina. The wires were respectively .9, .5 and .3 mm. in diameter. The largest piece was partially cut through at intervals of 1 mm. In a third pig's eye, pieces of iron were inserted in the ball, each about 1 mm. long and varying in thickness from .3 to 1 mm. The bodies were inserted in the eye at the nasal side. A number of exposures were made with each tube, several at an angle of fifteen degrees with a vertical plane passing through the two eyes, and a number at an angle of about forty degrees in front of this plane.



Radiograph. John Routledge. Tube nearly horizontal with plane of indicators. Exposure four minutes. Queen Self-regulating tube.

These experiments seemed to leave no doubt as to the great superiority of the small focus point tube as compared with that of large focus. The shadow of even the finest wire is distinctly shown on the negatives made with the former, while in those made with the latter, the shadow of the wire is blurred and indistinct. This is in harmony with the well-known fact that the distinctness of the shadow of an object some distance from a plane surface depends on the size of the source of light, and where the point of illumination is large, as compared with the size of the object, the shadow cast may be indistinct or even imperceptible.

The negatives also show to what small degree the bones of the orbit obstruct the rays. The thickest portion of the external orbital wall is where the frontal and malar bones join, forming the external angle of the orbit. In the deeper portion of the orbital wall the bones are relatively thin. Notwithstanding the difference in the thickness of the bones, the shadows cast by the steel wires are perfectly distinct throughout their entire length. In making radiographs of the eye, the best results are secured when the tube is run at high vacuum, so that there shall be great penetration of the ball and the muscular and bony structures. In this way the shadow of the denser metallic body is more clearly shown upon the plate.

In the experiment with the small bodies in the eye, the superiority of the small point focus tube for eye work was again shown. The exposures made with the large point focus tube failed to show any shadows on the plates of the bodies in the eye, while in the negatives made with the small point focus tube, each of the five foreign bodies can be clearly seen. In dealing with the live subject the possible slight movement of the head during the exposure is a factor of importance.

In my experiments I have used several makes of Crookes' tubes, although the majority of the exposures were made with the Queen self-regulating tube. In this tube by an ingenious arrangement of a shunt circuit, the current passes around the tube when the vacuum becomes too high, heating up an auxiliary bulb of potassium hydrate and bringing down the vacuum. The gap in the shunt circuit may be adjusted to any desired vacuum, and the tube then runs automatically, irrespective of the length of exposure. The time of exposure was varied from two to six minutes, four minutes appearing to give perfectly satisfactory results, although in one instance an exposure of thirty-five seconds gave an negative of excellent detail.

Both X-ray plates and rapid landscape plates were used in the experiments, and so far as could be seen from the negatives, the landscape plates gave as good detail and as sharp outline of the foreign bodies as those made with specially prepared X-ray plates, besides which the landscape plates required much less time in developing and fixing.

In carrying out the experiments, Queen & Co. of Philadelphia kindly placed at my disposal their X-ray laboratory, with full facilities for testing the value of various forms of tubes and apparatus. Throughout the work I have had the assistance of Mr. H. Lyman Sayen, the expert of the laboratory, whose help has been of value in contributing to the success of the experiments.

DISCUSSION.

Dr. C. F. CLARK of Columbus—The only two points I can take up that are perhaps of some importance, and which have not been dwelt on very thoroughly, are questions as to the method and as to possible accidents. The question of holding the plate in the angle of the eye has been touched on. That is the method I found most satisfactory in the first case I had; it was a very minute piece of metal imbedded in the base of the iris and it was impossible to locate it without this method. Every other method had been tried. The patient had good vision and I could get a perfect view of the fundus, and though there was a chance to save the eye, and I did save it. If I had used the ordinary method I believe I would have failed. I held the plate next the nose for eight minutes while the patient sat in the chair, and it proved very satisfactory. The piece of metal was 1.5 mm. thick.

As to accidents, I heard a paper by Dr. Scott of Cleveland, not the oculist, but a physician there who had found, in recording the cases given throughout the country, some fifty or sixty cases of accidents from the use of the Roentgen rays. In one of my cases, which I made no report of because the result was negative, the patient came back with the usual result as shown on the skin. A dermatitis had set up, the hair over the whole exposed region had fallen out and though it returned after a few months it was white. Dr. Scott says he has found that these accidents occur with every form of apparatus and in whatever way it is used. All the precautions now known may be taken and still this may result. The apparatus we used was perfect and yet a few weeks later his

wife remarked that "the barber had cut his hair too close," and when finally he came to me the head was absolutely bare at the exposed points.

In regard to the method, I tried some experiments with inserting the plate into the nose, getting the thin bones of the ethmoid as the only resistance. I do not know whether it can be retained long enough to take a good picture.

Dr. MAX J. STERN of Philadelphia—At the request of my friend and colleague, Dr. Hansell, I undertook a series of experiments last year, and developed our present method of taking the pictures. I recognized that the simpler this method is made the better the results must be. The way I started out was to bandage the plate to the side of the head and I have determined that that is by far the best way to take them. I allow the plate to overflap the face one or two inches, tilting it a little forward. The exposure has been reduced from forty or forty-five minutes to one-half a minute, which I now consider sufficient. I have now been using the higher vacuum tubes which give a much shorter definition and better penetration, and one-half minute is sufficient to get a foreign body anywhere in the eye. The tube is always placed eight inches from the face.

The admirable pictures shown by Dr. Sweet certainly shows his to be a good method, but I never used it because I believe that the shortness of the image and a knowledge of the anatomic points will, in the majority of cases at least, give the location of the body. There are two planes always shown in these pictures, the one at right angles to the other, and with these and the known location of the tube the object can be located. The closer the object to the plate the clearer will the shadow be, and the greater the haziness the further is the object from the plate. I always fix the patient's eye in a line with the pin point from which my X-rays emanate. A body seen directly in that line will show the plane in which the object lies. In this way the diagnosis can be made as to position. In Dr. de Schweinitz's case the location was pointed out, the body cut down upon and removed. The same was done in Dr. Hansell's case.

Dr. LUCIEN HOWE of Buffalo—After such an excellent presentation as we have had I hesitate to show such imperfect work as I have done; still there is one point which one of the pictures illustrates that has not been touched upon. I present these two pictures [passing them]. The first one shows two rabbit's eyes, a needle having been passed through one with the object of showing how distinctly the object could be traced. The second was an attempt to ascertain the relative opacity of different portions of the eye. Taking the eye of the hog and putting it in the curtain ring and having the rays come down upon it I thought I might get some hint of the relative opacity. It was imperfect but shows that the lens region is the most opaque.

Dr. ALBERT B. HALE of Chicago—I want to report one failure in the use of the ray. It was similar to the experiment just reported. The case was that of a girl of 20 years, who, several years ago, had one discission performed for a high grade of myopia. She had never gone back for another examination. When I found her the vision was very much reduced in that eye. Ophthalmoscopic examination showed the iris adherent to what was left of the capsule in an irregular way, but there had been no great iritis. In order to see what the lack of vision was due to, I had a photograph taken, which showed very distinctly the opacity of lens substance as mentioned by Dr. Howe. The question occurred to me, has the lens matter left there become opaque or has the vitreous become atrophied and induced atrophy of the retina. There was distinct opacity where the lens ought to be. Encouraged to think it was the lens, and that if removed rays of light might pass more readily, I did a very thorough discission. With the ophthalmoscope you could see very much further in toward the fundus. But there was no improvement of vision.

Dr. A. N. ALLING of New Haven—I am interested in these papers because I made a few experiments and came to the conclusion that it was possible to locate a body by these means. I must say, however, that I think cases in which this is a great help are extremely rare, that is, where our treatment of the case would be modified by the result of this experiment. It is of scientific interest more than of practical service.

Dr. J. A. LIPPINCOTT of Pittsburg—I would like to report briefly a case of this kind where I obtained a very satisfactory skiagraph of a body in the lower part of the eyeball. The case was an easy one, as the foreign body was large, being 2 cm. long and 1 cm. thick. Its position was satisfactorily demonstrated and we were enabled to extract it with a powerful magnet.

Dr. WILLIAM THOMSON of Philadelphia—In regard to the value of diagnosis in this case of Dr. Sweet, the wound of entrance was in the ciliary region and when I saw the man, vision was almost entirely lost. The media were transparent to the inner half, but to the outer part you could see a connective tissue deposit about the wound of entrance and back of that the retina seemed to be separated and there was a distinct tract of connective tissue in the vitreous. The papilla could be distinctly seen and the vessels were swellen. I became satisfied that it was impossible to gain any further knowledge of the condition by such examination and that it would have to be determined by the X-rays. This was done by Dr. Sweet and with great satisfaction I was able to do what I promised the patient. The eye was turned strongly toward the inner canthus and I passed a strong magnet in but failed to remove the metal because it was entirely encapsulated. I then passed a strabismus hook into the wound, picked up the mass of connective tissue and with a little effort brought it forward to the lips of the wound. I then passed the hook back and forth to see if I could detach this tissue, but failed. I then seized it with forceps and with the scissors cut it from its attachments, and upon removing it found the foreign body encased. When the mass was placed in the hand and a magnet approached it, it would move but could not of course adhere to it. One of my friends asked me when I concluded the operation, "Doctor, when will you remove the eye?" It did not seem to me necessary to do so, and a week later the eye was in good condition and now it is all right, though the pupil is blocked by a dense mass of connective tissue.

Dr. G. E. DE SCHWEINITZ of Philadelphia—Through the skill of my friend, Dr. Stern, I think I have saved at least one eye by the use of the X-rays. The details were localized without the excellent apparatus of Dr. Sweet which we did not have at hand at that time. It is now five months since the operation and the vision is 20–50.

THE ELECTROMAGNET OF HAAB IN THE REMOVAL OF PIECES OF STEEL FROM THE INTERIOR OF THE EYE.

Presented to the Section on Ophthalmology at the Forty-eighth Annual Meeting of the American Medical Association, held at Philadelphia, Pa., June 1-4, 1897.

BY JOHN E. WEEKS, M.D.

NEW YORK, N. Y.

The introduction of the large magnet for the removal of pieces of steel or iron from the interior of the eye, which we owe to the enterprise of Prof. O. Haab of Zurich, provides us with an instrument of much value in a large proportion of such cases. It is of no value whatever in the cases where the foreign body in the interior of the eye is non-magnetic; fortunately such cases are not the most common.

Haab's interest in strong magnets for this purpose was engaged by the first case which he reports ("Trans. Oph. Soc.," Heidelberg, 1892, p. 162). The patient was a woman 32 years of age. On June 10, 1892, a piece of steel passed through the cornea and anterior chamber and lodged in the posterior part of the lens projecting into the vitreous. Haab thought that if he could bring the piece of steel into the anterior chamber its removal would be easy. Three weeks after the accident, the patient was placed so that the cornea approached the conical end of the soft iron core of a large electromagnet belonging to the physiologic laboratory in Zurich, and Haab was overjoyed to see the piece of steel retraverse the path which it had made through the lens and lodge in the anterior chamber, from which place it was easily removed. The results obtained by the use of a large magnet in three cases caused Haab (*Beiträge z. Augenheilk.*, vol. xiii, p. 68) to have a special magnet made after designs suggested by Professor Kleiner in charge of the physical laboratory of the high school in Zurich. The dimensions are as follows:

Core of soft iron; diameter, 10 cm.; length, 66 cm.; weight, 30 kg.; beveled at the ends at an angle of