THE FLUOROMETER.

Surgeons know how quickly the hope sprang up after the discovery of the X rays that that new discovery might be utilized by surgeons in the diagnosis of foreign substances in the human organism; and it is also well known that, while many brilliant operations have been performed with their aid, it was very early found that, wherever a foreign substance which was less permeable than its surroundings might be, it was certainly not in the position indicated by the so-called "shadowgraphs," and as a consequence two views taken at right angles would not disclose the location of the object. In attempting to make practical use of the Roentgen rays in the discovery and location of a foreign substance in the body, surgeons were at once confronted with the fact that the visible effect of the Roentgen rays, either on its action on the sensitive plate or paper, or its visular effect on the fluorescent screen, was a shadow and a shadow only, with all the limitations that the term implies. The surgeons found that this shadow (after the nature of shadows) was treacherous and unreliable. In other words, a positive change in the position of the patient will be marked by far less change in the general outlines of the shadow of the subject, while the shadow of the inclosed object was greatly distorted; thus producing a distortion in the picture which added a great element of uncertainty as to the exact location of the object sought with reference to any points on the subject.

Then there was the distortion caused by the angle of the rays. It was at once realized that, if this shadow was to be an aid in surgery, the distortion caused not only by the angle of rays but by the position of the subject must be eliminated. By repeated experiments it was found that locating a substance in another substance which was more permeable, by using right angles, was apt to produce unreliable results which would be likely to remain so until what, for want of a better term, may be called a "correct shadow" could be found, and then retaining the same relative position, a second angular view be taken. It must be remembered we are dealing with a shadow which is not only treacherous but is lacking in dimension of thickness.

Further investigation showed that the only practical solution of the difficulty was to establish a definite cross section of the patient or the limb by means of angle pieces, which would be less permeable than any portion of the subject and which could be made to retain their relative position to the subject and with the parallelism of the rays through the process of producing the angles. After long experimentation, an appliance was perfected which conforms in a general way to the shape of the body and at the same time preserves the position of the body squarely in its relation with an adjustable table.

The function of the instrument which we describe is to establish with precision the location of any foreign object within the human organism which is impermeable or comparatively so to the X rays. In other words, it is the province of the "fluorometer" to enable observers to form an exact and certain diagnosis of the presence of bullets, needles, calculi or any other substance which is comparatively more dense in its fluoroscopic shadow than the subject in which it is contained. It is also its function, by eliminating the distortion of position and the distortion caused by the divergence of the rays, to provide the surgeons with absolute and reliable measurements in case of dislocations, fractures or any abnormal conditions of the anatomy which are susceptible of reproduction in the Roentgen ray shadow.

It is a feature of prime importance in the fluorometer that the observations, diagnosis and measurements are made without the aid of photography, while at the same time, in case it is desired to preserve a record of the existing conditions, the fluorometer admits of producing in the form of a fluorograph exactly the conditions, including the measurements, which were shown by observations with a fluoroscope. It is hardly necessary to dwell upon the importance of this instrument as an adjunct in the use of the Roentgen rays in surgery. It is extremely ingenious from a scientific point of view, and we are indebted to the Rochester Fluorometer Company, of Rochester, N. Y., who are the makers of the Dennis fluorometer, for the particulars which we present to our readers.

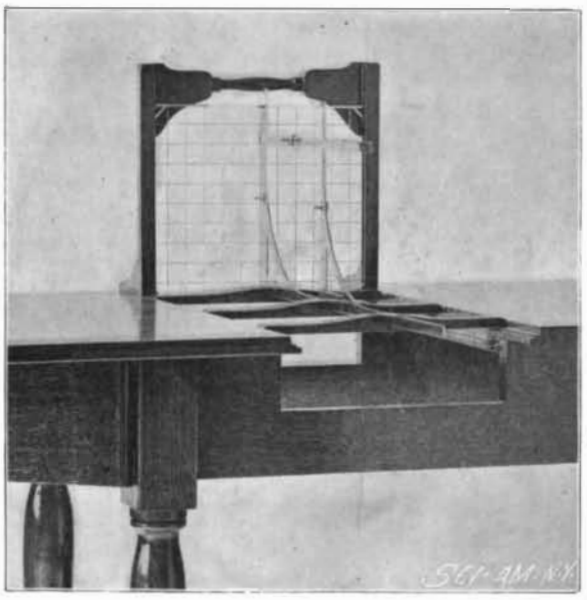

Fig. 1.—THE FLUOROMETER—TABLE AND GRATING.

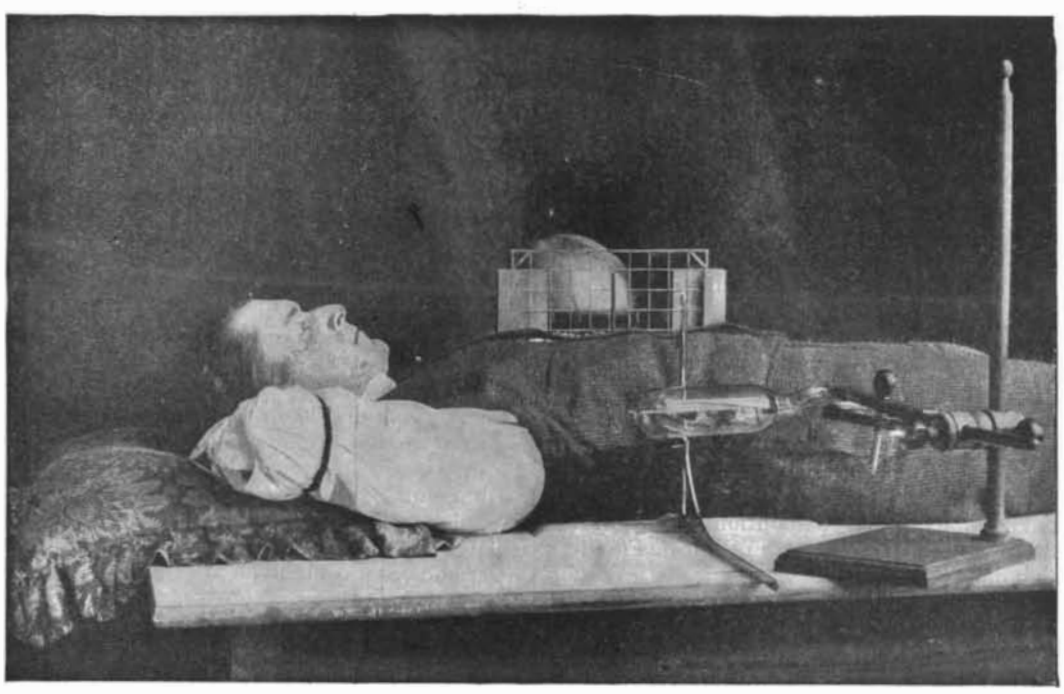

Fig. 2.—THE FLUOROMETER IN USE.

The fluorometer consists of a set of metallic angle pieces which in their use with the X rays are capable of being squared with an adjustable table. The patient is laid on the table, Fig. 1, and a fluorometer appliance is adjusted as shown in Fig. 2. The fluorometer is brought with the body into parallelism with the rays; that is, when the proper position of the cross section is obtained, the two arms of the fluorometer will present a characteristic single shadow on the field of the fluoroscope. Adjustable to the arms of the fluorometer are two pins or sights shown in our view of the table. 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 the foreign object coincident. Attached to the table is a metallic grating with meshes of exactly one inch. This grating when in position is square with reference to the table upon which the patient is placed, and the normal position is close to the side of the patient opposite to the source of the energy. The fluoroscope is placed against this grating, and it will be seen at once that measuring from any point desirable on the surface of the patient to the foreign object is but the matter of a moment. The movable pins on the arms of the fluorometer now come into use. These pins are placed equidistant from the base of the fluorometer, which is of course squared with the table; then, when the table with its patient is adjusted so that the pins or sights coincide with the foreign object, it will be known that all three are in the parallelism of the rays, and that the characteristic distortion caused by the angle of the rays has been eliminated, and the measurements taken with the eye, by means of the metallic grating, will thus enable the surgeon to chart unerringly the position of the foreign object with reference to the surface of the body which contains it.

How far "in" from the surface of the body it may be, however, is at this point a mystery. Now, without moving the patient or disturbing the position of the fluorometer, the second observation is taken. For convenience in using the fluoroscope a section of the top of the table is removable, as shown in our first engraving, and a proper fluorometric appliance substituted by means of which the second right line of the right angle is determined. The aperture in the table is also provided with the metallic grating and the fluorometer is provided with an attachment which closes the side of the instrument which was opened during the first observation. When the surgeon takes a position below the table, he obtains a view which is exactly at right angles with the first. The pins are again brought into use, and the table, patient and fluorometer together brought into parallelism with the rays, the tube having now been placed over the patient. 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. The position of the foreign object again with reference to the points on the cross section of the subject and with reference to certain points on the fluorometer is at once charted by the aid of the meshes of the metallic grating. Necessarily, the foreign object must be situated at the point where the two lines coincide. All the elements of distortion have been eliminated—both the distortion caused by the position, also the distortion caused by the angle of the ray. Where the point is can, of course, be at once ascertained by measurements on the surface of the body.

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 which is necessary is to produce a fluorograph by substituting the sensitive plate for the field of the fluoroscope back of the grating and making the necessary exposure.

In the case of a bullet in the brain cavity, elements of uncertainty of location, having in view the desirability of a possible operation for its removal, become very

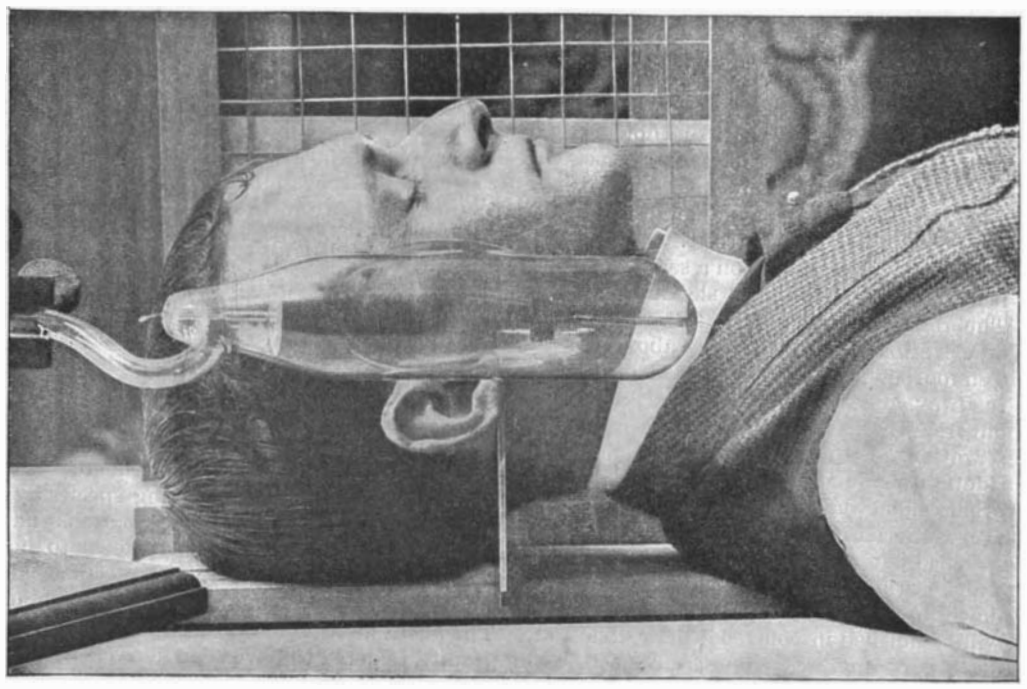

Fig. 3.—LOCATING A FOREIGN BODY IN THE BRAIN CAVITY WITH THE FLUOROMETER.

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grave. After what has been said about the nature of the Roentgen shadow, it requires no argument to show that a very slight variation of the position occupied by the head would produce a distortion which would preclude successful exploration. By means of the fluorometer the position of a foreign object in the brain cavity is ascertained with precision, as in the case of the body already given. It becomes merely a matter of cross sections and surface measurements, a definite base line being at the service of the surgeon. Our third engraving shows the method of using the fluorometer on the head.

THE RIVERSIDE DRIVE VIADUCT, NEW YORK.

The handsome steel viaduct now in course of erection across Manhattan Valley, which latter runs in a general east and west direction in the neighborhood of One Hundred and Twenty-ninth Street, New York, is intended to form a connecting link between the Riverside Drive and the newly constructed Boulevard Lafayette.

The Riverside Drive is the main thoroughfare through the famous Riverside Park, a strip of ornamental park land extending along the lofty banks of the Hudson from Seventy-second Street to Claremont, in the neighborhood of One Hundred and Twenty-seventh Street, a distance of two and three-quarter miles. Here the ground falls somewhat abruptly to One Hundred and Twenty-ninth Street, and the drive swings around the brow of the hill, forming a loop by which horsemen and vehicles can return.

The Manhattan Valley has a width of about a quarter of a mile and is intersected by six different streets, one of which constitutes the main approach to the Fort Lee ferry and is traversed by horse and cable car lines, the latter feature alone rendering the valley unsuitable for the construction of an intersecting public driveway. At the north end of the valley the ground rises abruptly to the Washington Heights, a ridge or tableland which extends northward between the Harlem and Hudson Rivers to the extreme limits of Manhattan Island. At One Hundred and Fifty-seventh Street a handsome driveway, known as the Boulevard Lafayette, diverges to the left from the Boulevard—the main driveway of New York, practically a continuation of Broadway—and follows the lofty banks of the Hudson River for a distance of three miles, or nearly to the northern limits of Manhattan Island. Both this boulevard and the Riverside Drive to the south of it are rich in features of natural beauty. Following with easy curvature the bluffs of the lofty river banks, they give a broad outlook upon the waters of the Hudson River, the frowning cliffs of the Palisades and the distant hills of New Jersey. Among the many handsome drives in suburban New York these are, in some respects, the finest—certainly they are the most unique.

The handsome viaduct which forms the subject of our front page engraving is being built for the purpose of connecting the two drives and affording a continuous high level boulevard from Seventy-second Street to the west end of Dykeman Street, a distance of seven and a quarter miles. The latter street is practically the northern terminus of the Harlem River Speedway, which will shortly be opened to the public, and when this is completed it will add another three miles of spacious roadway, thus providing a continuous drive of ten miles along the picturesque banks of the Hudson and Harlem Rivers. An illustrated account of the Harlem Speedway will be found in our issues of February 6 and 13, 1897.

The viaduct has been designed with a view to harmonizing its appearance with the surrounding natural and architectural features. Including the masonry approaches at either end, it will be 2,074 feet in length. The southern approach is located just below Claremont, a villa rich in historic interest, and immediately to the south of Claremont rises the majestic pile of the Grant Memorial Tomb. The viaduct connects with the Riverside Drive at the center of the loop by which the latter encircles the northern span of the high land on which the drive is located. The entrance will be carried on a masonry approach 262 feet long, which includes a stone arch span across one of the east and west streets. The steel structure, 1,564 feet long, is carried on a series of steel arches of 65 feet span, supported on slender steel lattice piers. The roadway, which is 60 feet in width, is built at an elevation of about 70 feet above the ground level. Ten-foot sidewalks are provided on each side of the roadway, and at regular intervals balconies are built out from the footways to afford places for rest and observation. Elaborate scroll railings will protect the sidewalks, and upon these will be placed thirty-six ornate cluster lamps, a pair of lamps being placed over every alternate pier. The southern entrance will be widened out and bounded with semicircular parapet walls, at the center of which stone staircases will lead down to the lower level of the valley. The masonry will be finished in coursed ashlar limestone. The pedestals, copings, capstones, etc., will be of granite, hammer dressed.

The semicircular arches of the viaduct will be of plate girder construction. They will be 3 feet in depth and will have a riveted connection to the tops of the steel columns. The latter will be oblong in section, measuring about 3 feet by 5 feet, and of latticed plate construction. The plating of the columns will be carried up between the spandrels of the arches to the level of the floorbeams, where it will finish off against a continuous cast iron fascia plate which will form an ornamental cornice below the footwalks. The spandrels will be filled in with vertical posts which will transfer the load of the floorbeams to the arches. These posts will be stiffened by light semicircular struts. The floor will be carried on floorbeams 5 feet in depth, of which there will be six to each span, and upon these will be thirteen rows of 12-inch longitudinal I-beam floor joists. The crowning of the roadway will be secured by placing cast iron blocks of varying depth between the joists and floorbeams. Above the joists will be a solid floor of riveted ⅜ inch buckle plates. The sidewalks will be carried upon brackets of ⅜-inch steel plate, and covered with corrugated iron floor plates. The plating of the roadway and sidewalks will be covered with a paving composition of coal tar residuum and broken stone and upon this will be laid the asphalt surface.

The structure is designed to carry a moving load of 100 pounds on every square foot of roadway and sidewalks, and 10 pounds per foot is allowed for snow and slush. In addition to this, provision was made in designing the steel work for the following concentrated loads: Twenty tons on two axles of a wagon or truck spaced 12 feet apart, the wheels being 5 feet apart. The roadway must be able to sustain this load safely at any part of the viaduct. The wind pressure is calculated at 500 pounds per lineal foot. The contract price of the structure is $570,000.

It will be seen from our engraving that the viaduct will present a bold and yet graceful effect, and will be thoroughly in harmony with its surroundings. The point of view is supposed to be from a position above the Hudson River to the south of the Grant Memorial, and we are therefore looking in a northeasterly direction. The easterly brow of the Washington Heights is easily recognizable, and beyond it may be traced the course of the Harlem River, while on the distant horizon are the wooded hills of Long Island. To the west of the viaduct is the Fort Lee ferry and its adjacent wharves and along the base of the bluffs at tide level are the freight tracks of the New York Central Railroad.

The plans of the structure were drawn by Mr. Francis Stuart Williamson, M. Am. Soc. C.E., of this city, to whom we are indebted for the data from which the present article was prepared.

Recent Archæological News.

After more than twenty years of discussion, and in spite of the systematic opposition of the military engineers, the French government is submitting to Parliament a scheme for the demolition of the fortifications of Paris from the Seine to the Porte de Flandres, a stretch of about eight miles. It is expected, says The Builder, that the Chamber will ratify the proposal, which will be of great service to Paris, in removing a boundary which stands in the way of free extension of the city, while it is no longer of value as a fortification, and, in fact, counted for nothing in the defense of Paris in 1871. In its place (if removed) a grille or wall of some kind will be erected, in order to recognize the rights of the octroi; and around this it is proposed that there should be a zone of public squares and new roads, which will probably have the satisfactory effect, among others, of lowering house rents in Paris.

The new year will hardly have got well on its course when to the Doges' Palace in Venice will be restored the great lion, erected there by Doge Andrea Gritti, who ruled from 1523 to 1538. To Gritti belongs the honor of restoring to Venice all the possessions she had held before the League of Cambrai. Gritti's monument was this lion, set up before the middle gallery of the palace on the west side, twenty-three meters from the ground. After the fall of the Venetian oligarchy vandals swept the lion away. The restored work, from the sculptor Urbano Bottasso, represents a majestic beast, at whose side kneels a doge in robes of state.

The record of the antiquity of domesticated dogs does not even stop with the earliest known Egyptian monuments, says Knowledge. Not only were such breeds known in Europe during the iron and bronze ages, but also during the antecedent Neolithic or polished stone period. These have been described by Profs. Rütimeyer and Wöldrich, and those who are acquainted with the difficulty of distinguishing between some of the living species by their skulls alone will understand the laborious nature of the task. Still these authorities appear to have made out that the Swiss, Neolithic dog (Canis palustris) had certain cranial resemblances to both hounds and spaniels, and thus indicated an advanced type, which is considered to have been derived from neither wolves nor jackals, but from some species now extinct. Two other breeds have also been recognized from the superficial deposits of the Continent; and if, as is very likely to be the case, any or all of these races are the forerunners of some of the modern breeds, it will readily be understood how complex is the origin of the mixed group which we now call Canis familiaris.

Cleaning Old Oil Paintings.

Long articles can be found on this subject in a great many books, of which the commencement has already been forgotten when the end is reached. If one desires to clean old oil paintings, the first thing to be done is to find out the cause of the darkening of the picture, and according to this the remedies are applied.

It is obvious that the darkening of the picture must primarily be ascribed to the dust which has accumulated upon it and to the products of bad combustion, soot and its companions, and these parts one must always first strive to remove, which is either done with water or with soap and water (best fat soap). This will generally also take off some of the accumulated smoke which has covered the picture with a brownish-yellow veil and which is removed with spirit of sal ammoniac, diluted with twelve parts rain water, whereby the former is sufficiently thinned so as to be perfectly harmless to the oil paint, while it is still strong enough to dissolve the smoke; whether it will do the work if still more diluted can be readily ascertained by experiments.

If this does not render the picture lighter, it has usually been varnished, in former times, over the accumulated dirt and smoke and frequently, in the case of old pictures, with a very fat copal varnish, i. e., one rich in oil, which became quite dark yellow itself, through age, and underneath which lies another smoke film. This layer is one of the worst. It may be removed in various ways, but great caution is necessary. If the picture is not too large, the varnish may be dissolved by alcohol vapors and removed with a turpentine wad. For the former purpose place pieces of cotton or linen cloth upon a glass or metal plate, saturate them with alcohol and lay wooden strips about 2 to 3 centimeters (¾ to 1¼ inch) high around, and upon this the picture with the face downward. The spirit vapors soon soften the varnish, and when this is done it is taken off with turpentine. Care must be taken that the oil paint is not softened and taken off at the same time. Or mix two parts of turpentine to about one part of spirit; pour the mixture into a bottle which has a fine tube leading through the cork and sprinkle some of it upon the picture, whereby the oldest varnish will be dissolved in a short time. Soft colors, such as the blue of the sky, covered flesh tints, draperies, etc., are less apt to be attacked by this tincture than the glazings in the shadow sides, and particular caution should be exercised here. Fortunately, these can be easiest restored by a skillful hand. After the varnish has been removed there is frequently still some smoke on the picture, which must be taken off with the first-named sal ammoniac water, using clean water to rinse off with.

In place of the last mixture one may be prepared of copaiva balsam and spirit in equal parts, or of the latter and caustic ammonia in equal parts. The latter will likewise dissolve the varnish, although more slowly, which is no disadvantage, however. The ammonia will at the same time dissolve the soot.

When the picture is clean it is saturated with oil, which is allowed to soak in for a couple of hours; then all that has remained on the surface is carefully wiped off with cotton wool and a little powdered starch. No oil should stay upon the colors, because it will turn yellow in a short time and render the picture dark again.

For revarnishing the picture, we have found most suitable a thin dammar varnish, as it does not darken and can be readily removed.

Repainting or restoring pictures with colors is the most difficult job of all, and, if possible, recourse should be taken to erasing and then cleaning the spot under which there was still dirt.

For renovating, lakes of dammar varnish with a little oil are best suited, as they do not become darker to such an extent as oil colors.—Translated from the Maler Zeitung.

Influence of Wealth on Mortality.

On the influence of wealth on mortality, the Breslau statistician, Neefe, publishes an interesting paper in the Zeitschrift fuer Hygieine und Infektions Krankheiten. As a criterion of the means, the amount of the rent paid was taken. In 1896 there died of every 1,000 living persons who paid a rent up to 300 marks, 20·7; with a rent of 301 to 750 marks, 11·2; the rent ranging between 751 and 1,500 marks, only 6·5; the average being 17·6 persons. While according to these figures the mortality of the Breslau poor population is three times as large as that of the rich, it is in reality much larger, because the deaths not included therein (servants, journeymen, persons who died in the hospitals, etc.) may be assumed to belong almost exclusively to the first class. The greatest difference in the mortality was, of course, shown by the babies; more than half of those born alive belonging to the poor population died in babyhood, while the deaths of babies of the rich amounted to only one-sixth.

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