

LOOKING INTO THE UNSEEN.

The X Ray Experiments Rapidly Reaching Perfection.

DR. WM. J. MORTON'S MARVELOUS RESULTS.

Its Wonderful Aid to Hospitals and Surgeons in Locating Foreign Substances in the Human Frame—The Most Recent Investigations of the Great Inventors and Scientists, Roentgen, Edison and Lodge—A Valuable Work on the Subject Which Has Made a Stir in the Scientific World.

["The X Ray; or, Photography of the Invisible," copyrighted, 1896, by the American Technical Book Company, New York. All rights reserved.]

Electricity has contributed much to our present advanced civilization; much which the world could not well do without; but, if much of that which has been contributed were swept away, leaving only its last, greatest and most wonderful achievement, the X ray discovery, the world could bear the loss. There are substitutes for them; but none for the X ray.

The telegraph, telephone, electric light and electric railway, as factors in the world's progress, have gone wonders in bringing nations and individuals nearer together and increasing the volume of business transacted in a given length of time, but even these are limited in their scope, while the province of the X ray is world-wide.

As demonstrated by the experiments of Dr. William J. Morton and others, this light, which nearly all so-called opaque materials are as transparent as glass is to the ordinary daylight, enables the physician and surgeon to look into the human frame as one looks into a room through a window.

Scarcely has this discovery been published to the world by Professor Roentgen, when thousands of men of all professions are busily engaged in experimenting toward the perfection of its production and the multiplication of its useful applications. And thousands

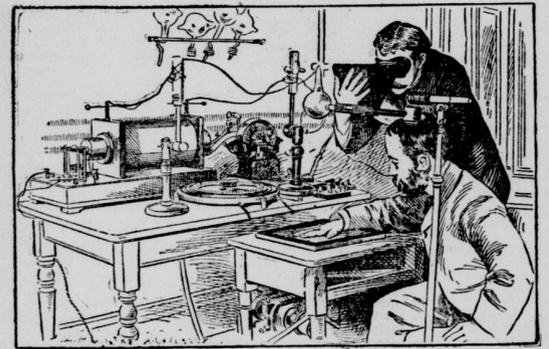


Fig. 1 is a photograph of Dr. Morton's X-Ray Laboratory, which has been pronounced by experts the finest in the country. Dr. Morton is looking at the bones in his hand through the fluoroscope, while Mr. Hammer is having an X-ray picture taken of his hand without removing the splint from the dry plate.

more are awaiting information which will enable them to handle this beneficent gift intelligently.

Never, perhaps, in all history has a discovery so far-reaching in its effects upon the well-being of humanity in general been brought before the world. It makes surgery an exact science, and places the healing art far beyond the groping and fleeting symptoms into the realms of certainty. Wherever disease or accident have preyed upon or marred the integrity of the human form, its members or organs, there will this greatest wonder of the nineteenth century, like a ministering angel, fold its wings and show its blessing.

Almost as wonderful as the discovery of the X rays is the fact that within a few months after its announcement the press is spreading broadcast the latest and most complete information upon the subject from the pens of those whose names have become household words throughout the civilized world, Edison, Tesla, Lodge, Morton, and

great centers of learning, who must rely entirely upon himself for all that is necessary of intelligence and mechanical skill to carry out his experiments, this work will prove invaluable. To the electrician and amateur it is a clear guide; each step being laid down by men who have, so to speak, paced off the entire road from start to finish. To a large majority of the intelligent public, electricity is a mystery, and is likely to remain so for aught they will do to make it otherwise. And this condition results from the erroneous impression that one must have received a special training to comprehend it. "The X Ray; or, Photography of the Invisible," makes a very successful effort to dispel the public mind of this false conception. Commencing with those words—so meaningless to the average individual—the volt, ampere, watt, etc., it makes clear their individual meaning, their relation to each other, and incidentally, the varying conditions of an electric current which makes them



Fig. 5—X ray of broken arm, showing an imperfect setting. The picture was taken without removing the woodwork of both sides of the arm. The fingers are deformed.

others are speaking to the great public on this wonderfully interesting subject through a timely contribution to popular scientific literature entitled "The X Ray; or, Photography of the Invisible and Its Value in Surgery," published by the American Technical Book Company, 45 Vesey street. The work is by Dr. William J. Morton, the famous X ray expert, in collaboration with E. W. Hammer, electrical engineer.

The names of the authors are a guarantee of the excellence of the work; both gentlemen standing high in their individual professions.

Aside from his standing as one of the leaders in the medical profession, Dr. Morton has been identified with Professor Roentgen's discovery as one of the earliest and most active experimenters in this new field, and with the most fully equipped X ray laboratory, has justified all expectations by producing a large number of the finest X ray pho-

Photographic apparatus is next treated in a general way, and is followed by a carefully written and illustrated chapter on the choice of apparatus, and how to properly arrange and connect it, after which follows a valuable chapter on the nature and source of the X rays, which is exceedingly interesting.

One of the most interesting and valuable chapters to the prospective experimenter is that which, clearly and in detail, explains the exact operation involved in producing an X ray photograph both directly from the object and by aid of the fluoroscope. If the several steps of the operation are not thoroughly understood, the operator may take our word for it that it is his own fault, and read these pages over again and again until he has fully grasped their meaning.

This part of the work closes with a chapter of photographic notes on developing, etc.

A chapter of the surgical value of the X rays, their usefulness in discovering foreign bodies imbedded in the flesh or bones of a person, its application to dentistry, etc., and finally the consideration of their curative properties, brings this interesting, instructive and valuable work to a close. An appendix, or rather three of them, giving the original paper on the X ray by Professor Roentgen, etc.

Mr. Hammer is a practical electrician of large experience, both in this country and abroad.

"The X ray, or Photography of the Invisible," gives a clear and exact explanation of the theory of the X rays, as well as the method of arranging and operating the apparatus involved in their production. To this end the work commences by explaining in simple language and comparison with well-known objects the nature of electricity, the method of and means for measuring it and the various means and devices for generating and controlling it, each and all of the devices referred to being carefully illustrated and described.

Step by step, the reader is carried from one point of interest and information to another, until every detail of theory, practice, process and implement is made clear, and a complete and exhaustive information is conveyed. To the physician, far away from the

laboratory, this work will be a most valuable collection in the country. The price, as well as the work, is extraordinary, being 50 cents in paper covers, and 75 cents in cloth binding. It can be had at any book store, or will be sent, postpaid on receipt of price by the publishers, American Technical Book Company, 45 Vesey street, New York. We predict a splendid sale for this splendid book.

OF SPECIAL INTEREST TO EXPERIMENTERS WITH X RAYS.

"Many people call this the 'Electrical Age.' It is. It might also be called the 'Photographic Age.' The number of people who own photographic cam-

eras is enormous; the number who expect to some day own such apparatus is still greater. It is a difficult matter to meet a person who has not done more or less with photography, and who has not quite decided views as to which is the best camera and which the best developer. In fact, the widespread knowledge of photography is, in a large degree, responsible for the universal interest and curiosity concerning the X ray. The photographer has become so accustomed to consider 'light' to be an absolute requirement in his work that he is impressed at once by the

fact that he can see through a camera without a camera and that he can see through a camera without a camera and that he can see through a camera without a camera.

Another photographic aid will be shattered when it is found that in the

parent to the X ray, while lead is almost totally impenetrable by it.

One of the greatest difficulties which will present itself to the experimenter is the choice of apparatus for the production of the X ray effects. It must be confessed that pioneers in this field of research have made none too explicit statements as to their precise methods of operation.

Roughly speaking, there may be said to be three general methods of operations involving the use of (1) influence or static electrical machines; (2) induction coils, whose primary circuits are supplied either with continuous or alternating electrical currents; (3) Tesla transformers utilizing oscillatory electrical currents.

INDUCTION COIL.

Although the static machine may be used for the production of X ray effects, the induction coil is by far the most convenient form of apparatus for this purpose. By its use the more powerful X ray effects are obtained and the time of exposure lessened.

The first thing the reader will want to know is the size of induction coil he will be called upon to purchase if he wishes to experiment. As regards this point he must be guided by the nature of the work he wishes to accomplish. If he is content with pictures of metallic objects

REDUCTION OF VACUUM BY ARTIFICIAL MEANS.—An important tube for perfect X ray work designed by Dr. Morton when it was first noted that the vacuum of a tube became raised to an impracticable point, it was lowered by putting the tube in an oven and heating it to 400 or 500 degrees, or by boiling it in oil.

But the delay and trouble of doing this heating of the tube in its working position by aid of a spirit lamp or a Bunsen burner. For instance, the operator begins work with a tube whose vacuum forces a six-inch spark to pass between the discharge rods of the tube. This may not leave him enough margin of capacity in his coil, so he turns off the current and carefully heats the tube with the flame of a spirit lamp. This must be done boldly and yet carefully. The flame should be ample and spread across the bottom of the tube, never resting in one place, until at last the entire tube has become evenly hot; then the lamp is withdrawn to a distance and the current turned on. If the sparks still fly around the outside of the tube the heating must be continued.

Finally there comes a moment when, upon turning on the current, it passes through rather than outside of the tube, and then X ray work may begin. The amateur will often have an exciting time sometimes keep it low by using a current strength which keeps his platinum reflector (if a focus tube is employed) red hot.

But at last the 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.

In using a spirit lamp, one precaution must be kept in mind; the alcohol will be ignited if it is brought near to the tube when the current is passing and an explosion may occur. Ahead of the vacuum may be lowered in other ways in tubes especially constructed for this purpose. One of these ways is that described by Professor Crookes many years ago. To the tube is affixed a small extension tube containing a chemical salt, which, upon being heated by flame from the outside, throws out more or less vapor.

Or, as devised by Dr. Morton, an inside carbon filament having outside electrodes is mounted within the tube. Upon passing current through the filament, heat is produced, vapor thrown out, and the vacuum lowered. See Fig. 32a. In this manner a tube may be worked for a long time and the vacuum be adjusted according to circumstances.

Another photographic aid will be shattered when it is found that in the parent to the X ray, while lead is almost totally impenetrable by it. One of the greatest difficulties which will present itself to the experimenter is the choice of apparatus for the production of the X ray effects. It must be confessed that pioneers in this field of research have made none too explicit statements as to their precise methods of operation.

Roughly speaking, there may be said to be three general methods of operations involving the use of (1) influence or static electrical machines; (2) induction coils, whose primary circuits are supplied either with continuous or alternating electrical currents; (3) Tesla transformers utilizing oscillatory electrical currents.

INDUCTION COIL.

Although the static machine may be used for the production of X ray effects, the induction coil is by far the most convenient form of apparatus for this purpose. By its use the more powerful X ray effects are obtained and the time of exposure lessened.

The first thing the reader will want to know is the size of induction coil he will be called upon to purchase if he wishes to experiment. As regards this point he must be guided by the nature of the work he wishes to accomplish. If he is content with pictures of metallic objects

REDUCTION OF VACUUM BY ARTIFICIAL MEANS.—An important tube for perfect X ray work designed by Dr. Morton when it was first noted that the vacuum of a tube became raised to an impracticable point, it was lowered by putting the tube in an oven and heating it to 400 or 500 degrees, or by boiling it in oil.

But the delay and trouble of doing this heating of the tube in its working position by aid of a spirit lamp or a Bunsen burner. For instance, the operator begins work with a tube whose vacuum forces a six-inch spark to pass between the discharge rods of the tube. This may not leave him enough margin of capacity in his coil, so he turns off the current and carefully heats the tube with the flame of a spirit lamp. This must be done boldly and yet carefully. The flame should be ample and spread across the bottom of the tube, never resting in one place, until at last the entire tube has become evenly hot; then the lamp is withdrawn to a distance and the current turned on. If the sparks still fly around the outside of the tube the heating must be continued.

Finally there comes a moment when, upon turning on the current, it passes through rather than outside of the tube, and then X ray work may begin. The amateur will often have an exciting time sometimes keep it low by using a current strength which keeps his platinum reflector (if a focus tube is employed) red hot.

But at last the 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.

In using a spirit lamp, one precaution must be kept in mind; the alcohol will be ignited if it is brought near to the tube when the current is passing and an explosion may occur. Ahead of the vacuum may be lowered in other ways in tubes especially constructed for this purpose. One of these ways is that described by Professor Crookes many years ago. To the tube is affixed a small extension tube containing a chemical salt, which, upon being heated by flame from the outside, throws out more or less vapor.

Or, as devised by Dr. Morton, an inside carbon filament having outside electrodes is mounted within the tube. Upon passing current through the filament, heat is produced, vapor thrown out, and the vacuum lowered. See Fig. 32a. In this manner a tube may be worked for a long time and the vacuum be adjusted according to circumstances.

"photography of the invisible" no camera is needed. How this simplifies matters. Only a sensitive plate which can be bought of any dealer, and a suitable holder for the same are required. If you have no camera and no dark room, no developing utensils and no knowledge as to the development of negatives, you may still take X ray pictures. If you

denser to control by watching the spark. On the whole, basing the opinion on practical experience, it is almost impossible to get along without a blower when dynamo currents are used. To demonstrate this in practical working, if the supply of air is temporarily cut off from the break wheel, these things will occur: (1) A considerable lengthening of the spark on the break wheel will appear; (2) a spark previously

With such large primary currents it is not only necessary to connect a condenser around the break-wheel as was done with the circuit-breaker B in Fig. 24, but it is also desirable to have an air-blast directed at the sparking point on the wheel so as to keep down the spark as shown at C in Fig. 25. This break-wheel was one of many results of a long course of experimentation leading to the X ray work done by Dr. Morton, and is likely to become a standard article. In its present form it was invented and is now made by E. E. Viney, Master Electrician, Brooklyn Navy Yard. It is invaluable in connection with the production of X rays, where the smaller or "cleaner" spark at the circuit-breaker in the primary circuit, the finer will be the effects produced.

Just able to pass between the discharging rods on the induction coil will cease to pass; (3) the vacuum tube heats up more rapidly; and (4) the most important of all, the actual production of X rays in the Crookes tube notably diminishes. It would appear, therefore, that both a condenser and a blower should be used to produce the best X ray work with high voltage current in the primary.

The only other necessary apparatus required in this connection are the proper rheostats to govern the current respectively supplied to the primary of the induction coil, the motor which drives the break wheel and the motor which drives the blower.

The connection between the different devices will be readily seen from an

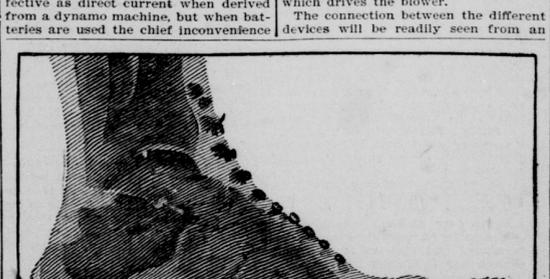


Fig. 3, showing the bone in a man's foot, taken through the boot. The outline of the flesh and leather is distinctly shown, iron pins and fasteners of the shoe are especially prominent, while the joints in the bones are very clear.

in altering the direction of the primary current is the necessary use of a double break-wheel. It is therefore advised that the direct current be used in the primary circuit, interrupted by a break-wheel.

If the Edison current (supplied by a dynamo of 110 volts) is used with a vibrator, its platinum contact points will speedily be ruined. This will not happen if the source is a battery of a few primary or storage cells, as then the voltage is quite low. But batteries are quite expensive, and take up much room and need constant recharging and refilling.

On the other hand, if a dynamo cur-

examination of the diagram given in Fig. 4. It only remains to be said that the break wheel in the combination of apparatus here described has eight teeth per minute, so that there are 48,000 makes and breaks each minute.

Out of Style.

MIXED BATHING.

Mrs. Grannis Sees No Impropriety in It.

In Sweden the Bath Attendants Are Women and it is All Right.

When Mrs. Elizabeth B. Grannis, President of the National Christian League for the Promotion of Social Purity, was asked for her opinion on the question of "mixed bathing," which is just now agitating England, she furnished the following statement for the "Sunday World":

The co-relation of the sexes is, in my opinion, one of the main factors in the future development, enlightenment and improvement of mankind; therefore I can see no possible harm in "mixed bathing," as it is called.

To me it seems almost impossible that an American could object to the custom on American beaches. At the same time I can readily understand that it might seem to be improper in England, for a great many of these distinctions between propriety and impropriety are a question simply of country and climate.

It depends altogether on local customs and traditions where the line is drawn. The same thing that is considered proper in England is considered not up to the standard of dignified propriety is considered proper enough in another.

Look at the inconsistency of this non-sensical agitation about so trifling a matter. Now, why don't the moralists of England look across the channel to America before they rush so violently into print and denounce the American way as wrong.

BATHING IN SWEDEN.

How about Sweden? That is certainly a matter and a civilized country. There is no nation in Europe where the standard of morality is higher or where the people on the average live better or purer lives, and yet it is the custom in numerous Swedish steam baths to employ none but women attendants. I mean the baths of the same grade as the several excellent and reputable Turkish baths for men in this city.

Remember, the baths in Sweden are thoroughly respectable places and are patronized by the best class of citizens. They are not resorts for the depraved or dens of vice and debauchery. On the contrary, they are healthful and well-conducted luxuries.

Women are employed simply because they make better attendants. They are cleaner, quieter and generally more efficient than men servants would be. They are also much more deft in giving massage. In a way, they are physicians, and are selected for their special training for the purpose of attending patients in our hospitals and generally. They are trained for their work much the same as are nurses. Even in England they can see nothing out of the way in having women nurses for male patients and male doctors to attend women. The difference between the two customs is only a step.

NO IMMORALITY IN SWEDISH BATHS.

To be sure, in Sweden the male bathers are unclothed and the female attendants are but partially clothed, yet, so far as I can learn, that fact has not resulted in any known detriment to the morality of the nation, as the women behave like automaton.

I am aware that they are imitations of these Swedish baths right here in New York, but many of them are, perhaps, not run for any good purpose, and are simply a bait to lure the curious and depraved.

Of course, this Swedish custom is shocking to a foreigner, and the fact that it is so universally countenanced and approved seems inadmissible.

Now, why should our English cousins create all this commotion about the very sensible way in which we take our ocean dips when there is "mixed bathing" with a vengeance on the great northern peninsula right at her back door. Doesn't it seem far-fetched?

THE ENGLISH SYSTEM CRITICIZED.

I believe the English method of separating the sexes is not only detrimental, ungracious and ungenerous, but dangerous. Inexperience, women should not go in the surf without being accompanied by men or women who can swim. But I believe in their going in anyway, and not being dependent upon men if it is not convenient for men to accompany them. The majority of men are enough at home in the water to rescue a woman in danger, and so are a great many women.

Then, again, under the English rule, a husband cannot teach his wife to swim, nor can a brother his sister. I don't believe in lovers going in with their sweethearts. It is simply absurd to deny husbands and brothers this privilege and pleasure.

MIXED BATHING NOT DEPRAVING.

I cannot see how mixed bathing in public places, as a custom, can result in any evil. Now and then there may be individual exceptions, but they are far outweighed by the benefit and pleasure derived from it.

With this general association between the sexes we would never hear of young girls running away with their fathers' coachmen, falling in love with a waiter or disgracing themselves in any similar manner. There would then be no occasion or temptation to do it.

There is only one phase of the association of the sexes that I object to or believe results in any evil. That is fancy dances as they are danced now in fashionable society.

Sensible people should aim to avoid inconsistencies. Let us not watch for errors on the beach so closely that we become blind to the flagrant evils of high teas, fashionable receptions and cabinet banquets. The ultra-decollete style of dressing is neither pretty nor safe. It caters to the low taste of the participant and the observer. I cannot imagine anything in the unattractive bathing suits so detrimental in its effects as the indecent exposures at fashionable functions.—Elizabeth B. Grannis, in New York World.

The game of draughts made its appearance in Europe, it is said, about 400 years ago.

Ott's Household Remedies.

3 Day Malaria Cure for Malaria, Chills and Fevers..... 75c

Ott's Liver Pills, best pills on earth..... 25c

Ott's Liver Cure..... 50c

Ott's Kidney Cure..... 25c

Ott's Corn Cure..... 50c

Ott's Catarrh Balm..... 25c

AND MANY OTHER REMEDIES OF UNDOUBTED VALUE.

FRANCIS S. OTT, Druggist

107 K Street, south side Second and K.