"Radiographic Projection
by Röntgen's Method"

being a Dissertation by

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Heinrich Hertz ("On the Passage of cathode rays through thin metallic films" Wiedemann's Annalen 45, p. 28, 1892 translated in the Electricalian" April 27, 1894, p. 724) showed experimentally that the phosphorescence producing rays, proceeding from the cathode of a vacuum tube exhausted sufficiently to eliminate almost all the phosphorescence attached to the anode and those which made the course of the electric discharge, are able to traverse thin metallic films opaque to light rays, even in those of extreme thinnesses, inside the discharge tube.

Philip Lenard ("On cathode rays in gases under atmospheric pressure" Wiedemann's Annalen 1, 1894 translated in the Electricalian" for March 25, 1894 to April 6 of the same year at pp. 574, 613 and 630 respectively) studied these cathode rays, after transmitting them through an aluminum window 1.77 mm wide 0.001265 mm thick into an "streaming space of ordinary air. He found that bodies capable of phosphorescing, if held near the window after in the side turned towards it with the light facing to them with increasing distance from the window, the phenomenon..."
phenomenon quickly decreases in intensity, disappearing at a distance of some feet. The intensity of the phenomenon depends on the distance from the window. He mentions among other substances sodium carbonate, flint, glass, potassium bichromate, platinum, and various other substances. Some substances, like metals, remained solid. The phenomenon was especially brilliant when certain substances were present. A microscope was used to observe the phenomena, as soon as a magnet brought near the vacuum tube deflected the cathode rays from the window. The cathode rays do not affect the eye. A quantity of gold, when introduced at any point between the window and the phosphorescent body, acting with its glowing stream of rays, emitted a duller light allowing it to remain without perceptible warming.

The property of the quantity of gold used to transmit any of the metal films is characteristic of cathode rays as contrasted with light. All substances obtained in these films proved to be non-transparent. Tissue paper, placed in a phosphorescent source, emitted a duller light. When the paper is directly less transparent. Covering paper
try to hold quite close to window in order that moon behind it might be quite perceptibly "burned out" in moon films or mm. tracks instead of all luminosity. Moon films or mm. tracks were equivalent nearly in transparency to burning paper above mentioned. Either they are moons very transparent. As soon as film about .06 mm. tracks are transparent. Soap films cast shadows where thicker than .0012 mm. Aluminimim placed close to window and .007 mm. tracks were just perceptibly transparent. Thin were fast to ordinary trifol late or mm. tracks were equivalent in transparency to burning paper above mentioned. In all cases that transparency a certain was tested by the use of the photoluminiscence screen, giving many overlying tracks.

Experiments showed that the atmosphere is turbid medium in batkade rays, they are not propagated linearly but diffused.

Batkade rays are photography visibly active. Sensitivity printing paper held near the window is blackened at about the same rate as by the sunlight. Sunshines of a foggy day behind a great cloud. It remains even if window. Dry plates with development are perfectly blackened at greatest distance in few seconds. The photoluminescent screens
may therefore be explained by the photographic plate. Fig. 4 is the copy of the image thus obtained. In this case the sensitizing layer was, as shown in fig. 4a, half covered with a quantity of plate E & F mm. thick, across which was placed the double aluminium plate W. When lead had been the agent the appearance of the copy must have resembled fig. 4a. Fig. 4 is very different from this. Not the aluminium plate but the quantity plate has cast the black shadow. In the fourth quadrant there shadow is slightly white in its centre due to the light of the air. The effect consists almost entirely in the third quadrant which increased with the quantity of aluminium. A very much stronger effect than due to light produced by the cathode varies as shown in the third half of fig. 4. The shadow of the double aluminium film is only that indicated in quadrant II. In the whole figure nothing but a faithful representation of the phenomenon induced directly by the phenomenon.

Fig. 4.

Fig. 4a.
to light effects. Wherein insuperable prevented the exposure being enough. Thus a perfectly blue screen was obtained. Which the endboard screen made. Tracing described above as impossible. The endboard made the sensitive layer quadruple the effusion metalumunum oxide between both. Then stop altered quite in accordance with their degree of transformation (in the vacuum) light on a dark ground, and the film very luminous perfectly light when attached metal furnes were led over all. So batrode lamp lead actingly penetrated the lights endboard. Although usually two minutes.

"A delicate thermometer and a thermometer placed at the "window" gave no definite indications of heat."

"Butrode rays penetrate into the interior of space almost instantaneously. They are perfectly discernible from the electric force producing them."

"Electrical body lose their rays in the obseming space."

Leonard's views substituted in the obseming space. Ordinary air a long tube (which will be estimated at will be filled with different gases) directly admitting to the windows. Arranges the obseming tube he found it impossible to produce butrode long in a high "perfect" vacuum. Concerns the obseming space he found that this length. The vacuum.
more nearly did the rays become extinguished. The
matter was they propagated nearly without loss of intensity.
"We can suppose that cathode rays are also propagated in
spaces which only contain matter in those states of matter
which are not to be seen, and which therefore can be
considered the extension of the intense effects observed. It will
be repeated in a future of the author's remarks in the
letter."

"The permeability of different gases for
cathode rays is very different; it shows a
connection with the density of the
gases. With increasing density the
transparency of the gases increases; with
increasing temperature the difference between the
gases increases. Lenard obtained fluorescence
of a screen in a vacuum in the discharging
tube of 0.003 mm mercury pressure at a
distance of 12.3 cm from the "window" even
after shading his screen with film of
silvering amounting to a thickness of
0.035 cm confined with 2.35 cm length
from the "window" in air at ordinary
atmospheric pressure. Different gases are
permeated by cathode rays to very different degrees.

"The motion is only determined by the
density of the gaseous medium."

Cathode
"Cathode rays of various kinds are diffused to different extents."

Income considered in produced by different bands of rays by varying the pressure in the discharge tube. Rays produced at lower exhaust ions are more diffused than those produced at greater exhaustion.

That time are different bands of cathode rays which differ in the capacity of phosphorescence, absorption, or deflection by a magnet. 

Henry. (Wiedemann's Annalen, 1863, p. 816).
Rays (Wiedemann's Annalen Vol. 1, 1895)


When cathode rays traverse a magnetic field their otherwise retarding path becomes in general curved. They are deflected by the magnet... In this discharge tube... the deflection increases with increasing pressure of gas. In this respect the phenomena of cathode rays agree with that of small negatively charged particles projected from the cathode.

The agreement between cathode rays and radiating matter... can in reality be only superficial if the conclusion arrived at in my earlier paper namely that cathode rays and phenomena in the electric field exist. The resemblance is only superficial if reality seems to be proved by the following experiments which seem to have the greatest influence on the speed of radiating matter and appear quite without effect on the amount of deflection of cathode rays in a magnetic field. The experiments show that the amount of deflection is not in the least affected by the medium in which the ray goes "through" but on the contrary the deflection from the same body outside of the ray shows materially the same in all cases at all pressures, with only slight interest of ray and...
even when the rays have to traverse a metal partition placed in their path, on the other hand, there are gases at different pressures; different kinds of gases may be produced, possessing different velocities in deflection. The experiments are then detailed. "Now there appears yet another kind of difference in these two kinds of rays; the former rays (i.e., rays produced at a smaller degree of pressure) are more deflected by the magnet than the latter (i.e., rays produced at a smaller pressure). The deflection of the rays measured in the observing apparatus does not depend on the pressure of the gas, but on the pressure of the gas in the observation tube. The more deflected, the more difficult it is for the rays to pass through the tube."

The deflection of the outside rays is according to Unity experiments not an action of the magnet on the rays themselves, but an action of the magnet on the medium traversed by the rays. The force used between the magnet and the rays travelling through the magnet itself is incommensurable with the deflection of the ray, which is at the core (see, for example, the mammoth, 14, 15, 16, 17, 18). But the medium whose magnetic alterations are shown by the movement of the rays continues to work experiments to itself. In the medium it is found to be completely independent of the motion and density of any producible medium which chanced to be present, and especially to be seen in the most attainable medium of the drawing place.
Prof. Wilhelm Conrad Röntgen's well-known paper "On a New Form of Radiation" dated Jan. 1895 (Preliminary communication to the Würzburg Physico-Medical Society, translated in the "Elektrischen" June 24, 1895, p. 415 to 419; technical publications) was now to be considered briefly in comparison with Lenz's results already quoted. From a vacuum tube covered with black cardboard excited by an arc, Röntgen got a barium-platinic oxide screen to fluoresce at a distance of 2 meters from the tube. The cardboard cover of the tube was of aspect without any visible details. He found all bodies transparent to this agency from the tube, but in very different degrees. Sulphur was very transparent; the screen fluoresced brilliantly. A volume of 1000 pages of two pounds each was needed to be in several layers to give a shadow. Thick blocks of wood were transparent. A film of aluminium 15 mm. did not entirely destroy the fluorescence of a screen. X-rays from continuous cathode rays penetrated glass, sheets of soft glass, and even sheets of sheet lead. Antimony lead was much less transparent than sheet lead. If the hand is held between the discharge tube and the screen, the hand shadow is invisible within the slightly darker shadow of the hand. Water and other liquid substances transmitted. Plates of copper, silver, lead.
lead, gold, platinum if not too thick allow visible fluorescence. Platinum - 2 mm thick transmission. Lead 1.5 mm thick is as good as glass. Very similar to metals are Tantalum solids in solution. To observe the presence of fluorescent the room must be completely darkened. He concludes that the transmission of different substances of the same thickness is primarily conditioned by their density. "Within certain thickness all bodies become transparent." After bodies increase besides having platinized with e.g. phosphores, incoming undissolved, adding glass. "Photographic dry plates show themselves susceptible to X-rays," e.g., X-rays are used for intensity to indicate the intensity of the X-rays, and the producing the phenomenon more rapid.

As seen above, their sheets of wood, paper or black, we can study the behavior of photographic plates to turn in an ordinary well lit room. The same day this property of the ray only observed itself in the necessity under which we lay of not keeping undeveloped plates, washed in the usual paper or board. In any health of them in the vicinity of X-rays then. It is still clear to operate whether the chemical effect on the albumens of photographic plates is increased directly by the X-rays. It is possible that the effect is due to the fluorescent light which, as mentioned above may be generated on the glass plate.
of the rays as these rays of reflection. "They may be used just as well as glass plates."

"The nature of the ray is not affected to their rays with angle... According to
refraction made the medium contained in the rays are perfectly transparent.

A second question is that we could not detect any refraction of these rays,
except doubtlessly when using prism of 30
angle of intersection" which was observed in the
other. These metals in prism gave no
result, in account of their want of transparency
to the ray. "Condensed substances are quite as
transparent to the rays, in an solid bodies of
equal masses. Hence it is proved that reflection
and regular reflection do not exist to a notice
whereas "the rays cannot be concentrated.

Wittgenstein believed that regular reflections
do not exist but that in an experiment he
detected bodies like iron bodies to a-ray as
moderately sensible to light. He concluded
that a ray must traverse all bodies at the same
depth in a medium whose velocity in which
it which the material particles are embedded;
the particles obstructing the propagation of the
wave. In this way, the density of the body's
interference with amplitude is reduced after the wave's reflection.

An interaction of beams of this kind is about
between rays that traverse air and others in the
latter, that they pass diffusely through all bodies.
before, says he, can say the same about the
Electromagnetically accompanying the intensity
of rare fluorescence at different distances
from the vacuum tube. He found it to
vary inversely with the square of the distance
from the tube. "This absorbs a very smaller
smaller fraction of the x-rays than of the
cathode rays."

Rutgers says: "I have not succeeded,
even with very strong magnetic fields, in
deflecting x-rays by a magnet." It is
certain that the spot in the wall of the discharge
apparatus which fluoresces most decidedly
must be regarded as the principal point
of the radiation of x-rays in all directions.
This is supposed to be the point where the
cathode rays impinge on the glass. If
one deflects the cathode rays within the
apparatus by a magnet, it is found that the
x-rays are emitted from another spot
that is to say from the rear termination
of the cathode stream. If then we come to
the conclusion that the x-rays are not
identical with the cathode rays, but that they
are generated by the cathode rays at the
glass wall of the discharge apparatus.

After numerous photographs he
had taken, including one of the hand
of objects, the hand in some, he says he was

close...
"At times to investigate whether elements at
are present in the x-rays we began
but not yet concluded."

film, while the latter effectively transmits much attenuated wood or several millionths of metal
inflexible form was observed as regards the primary fluorescence that can be seen away from the
window in hydrogen gas at 0.0146 mm. Having
pressure); their indications being varied by 1500 c.m. The latter act on the fluorescent
screen at a distance of 180 cm from the discharge tube in air at ordinary
pressure.

[Redundant from bottom]

radiate from the
luminous screen
when the cathode
vaporizes or goes
wall of vacuum tube

[Redundant from bottom]

cathode rays and X-rays resemble each
other in their action on the fluorescent
screen; the photographic plate in
their beam propagates only a portion of
slowly by slow, at certain plate of
clouds of rays to the screen at passage
through water having conditioned
water by means of ionizing the cathode rays
produced sensation on the inside
of man.

It has been suggested that
that again X-rays are the least
difficult to reflect like cathode
rays produced under favorable cir-
stances.
some cases are yet not definitely known. There is a large field for experimental work on this connection. It may be noticed in this connection that Röntgen's preliminary communication in which he gave some experimental results, but not the details of his researches, as Leendard has done.

Physical Nature of Leonard-Röntgen Rays

Leendard (see I III) regarded his rays as occurring in the tube. The resemblance to the notion of the magnet of the behavior of his rays in the discharge tube to what might be expected of a needle negatively charged particle projected from the cathode is superficial. The deflection as observed in the discharge tube was more marked. The higher the vacuum the more it depended only on the vertical deflection of the ray entering from the discharge tube. To account for the action of the magnet must be an electric current through the ray passed or not in the ray itself (since when left uncharged the magnet itself was left undeflected) and as the highest possible attenuation of probable matter without the phenomena of deflection. This conclusion on which the magnet acted cannot be the one Leendard proposed.
itself." In opposition to this it may be pointed out
that 1/2 of the justification of the theory that light's
rays are due to the motion of small particles
that these rays might naturally be supposed
to be extraneous ultra-violet light but if
the fact that light seems to be no reason to
believe that light rays can be deflected by
a magnet at first sight there is no
need to appeal to a new property of the
light to explain the propagation of light
rays when it is remembered that in Ternath's
earliest vacuum there must still be 10
molecules per mm. of residual matter.
Even though Ternath kept things in the fact
that his vacuum do not seemly deviate,
we might imagine as many molecules
being carried with or carried into the
vacuum, and we might imagine some
bands of electricity the vibration from
molecules to molecules, without any med
ules, astronomers into a vacuum at all.

On the question (see Velocity of Cathode Ray's the
"Elektrologi", Oct 15, 1894, p. 572) have experimentally
measured the velocity of cathode rays in the vacuum.
They found it to be 1.9 X 10 m/sec. This sup the action of
an magnetic force in deflecting these rays shows, assuming
that the deflection is due to the action of a magnet and
moving electric field body. Thus the velocity of the atom
must be at least of the order we have found.
Quintus says (see IV) “may not the X-rays (i.e. line X-rays) be due to longitudinal radiation in the ether? The mathematical elements of sound of a string have been worked out by A. Fokker (‘Longitudinal Light’, Wiedemann Annalen 57 (1896) p. 147-184, 1896; translated in the ‘Electricalian’, March 6, 1896 at pp. 629, 634, 645 respectively). Some experimental evidence in support of the theoretical theory of Lummer’s wave is given by J. H. J. Smyth (on the motion of the luminolesse flow induced in gases produced by passing electricity” Wiedemann Annalen, Vol. VI, No. 12, p. 133, translated in the ‘Electricalian’, Jan. 17, 1896, p. 287). This account is by J. H. J. Smyth (Reflected Light of Electrode Spark Comptes Rendus, Vol. 57, p. 1130, translated in the ‘Electricalian’, Feb. 14, 1896, p. 523). The absence of observed deflection of Quintus’s X-rays proved the theory of Prof. Lodge in confirming Quintus’s non-observance of deflection of his rays in the magnetic field points out the investigation into this matter must be finished until a further experiment is done to verify the undeflectability of the Quintus rays seen in our field; good vacuum” (The Experimental Evidence Concerning the nature of Quintus’s X-rays, The Electricalian, Feb. 14, 1896).
1896 (p. 71) In the same paper Dr. Lodge points out that the transparency of electrical conductors to rays is contrary to the opacity they present to light—"to light of every kind they are opaque." To get over the difficulty it was supposed to be enough to assume them to be anything distinct to human eyes and merely to agree closely with the same exception. But of all ideas the theory that the rays are longitudinal or sound waves in the same "assumption" was the one that suggested longitudinal waves to Dr. Lodge was the fact that crystalline properties of transparency that behaved after repeated experiments in opaque substances were the same way you turn them.

If transmission is transmission to Dr. Lodge supposing longitudinal waves it would be much better, but this was impossible to himself. If Lodge had also found that a pair of admittance not transmission are equally transmitted whether there were an island or not

... dancing suggestive of polarization but none have been observed, in fact which tends against transparency in favor of longitudinal waves. But the strongest argument in favor of longitudinal rays is derivable from the fact that single discharge identified behind them and their interference has been observed in exactly similar conditions.
"On the Generation of Longitudinal Waves in a Tube" (Lnd. Nachr. 7th "Kriticum" Feb. 28 1876, p. 173)

Also Extract from Prof. Biotzerman's paper in the "Kriticum" für Physikalische" Jan. 6, 1896 (Sp inserted in the Kriticum" Jan. 21, 1896 p. 447)
conditions but these peculiarity is that (unlike light) they do not give positive or negative dot equally.

In addition to papers already referred to under present head (VII), the following may be noted:

"On batteude rays in gases under atmospheric pressure via "Electrochemische Vaseline"" Prof. A.T. Fitzgerald (The "Electrochemie" March 28, 1884, p. 78).

"On New Lenzian enwrustment in the magnetic action of batteude rays" G. Gooch (The "Electrochemie" June 8, 1894, p. 415).

"On the rays of Lenard Rontgen" De G. Brierly Lodge (The "Electrochemie" June 31, 1895, p. 436).

Subsequent History and Applications of Rontgen's discoveries

Subsequent to the publication of Rontgen's paper, the use of his rays to produce shadow of objects otherwise invisible, on the photographic plate is the phenomenon which has engaged the attention of many workers. Very little has been done to supplement, much has been done to verify, nothing has been done to contradict. These conclusions have been announced as results which are to be found in his very comprehensive paper itself at length, and some improvements have been actually applied to shorten the time of exposure of the photographic plate.
plate. Many names have been suggested for the actual process (with corresponding terms for the resulting image given in most cases), e.g., "shadowgraphy", "shadowgram." Though slightly descriptive, some have long been discarded. "Shadowgraphy" is much nearer 
the good understanding implying the use of the same "shade" respectfully, but the term is 
already used to signify the shadow in 
examining into the refraction of the eye. 
"Shadowgraphy" has also been proposed. "Radiography" 
"electricography" etc., which are all objectionable 
and applied to the direct radiation projection of 
X-rays. "Rontography" or "Rontography" 
are worthless as well as "Xerography." (The 
letter like "shygraphy".) The least objectionable 
would definitely distinguish them as times of 
"Radiography". "Radiography," which seems more 
versatile, coming into general use in addition 
to which of necessity the term "Radiography" 
ought to be suggested to apply to the use of the 
former. Certain indications remain more than 
a mere description of the process of projecting 
a shadow cast by presence of Rontography's rays. 
I have adopted as the title the premonition " 
Radiographic Projection." 

The further history of the 
innovation is most commonly and 
under the following heads:
A. **Experimental Work by J.J. Thomson**

Experimental work by J.J. Thomson, Electrician, London, has recently been referred to under VII.

Much additional work has been done in investigating the effects of cathode rays on charged bodies. What has been done, but the results of different authors are somewhat contradictory. J.J. Thomson (letter to the *Elektrochemie*, Feb 1, 1876, p. 414) finds that charged, insulated plate exposed to Röntgen ray, repels the charge — positive as well as negative, and the discharge goes on when the charged plate is embedded in paraffin, bismuth, sulphur. This shows that all substances through which the Röntgen ray passes become permanent conductors of electricity.

Prof. Bouger (in *St. Petersburg* [the *Electrochemie*], Feb 14, 1876, p. 501) says, "Röntgen ray discharge rapidly from positive electricity, slower from negative. At short distance they give negative electricity. They increase spark gap. Aluminum wire shot does not hinder interaction." J. Barist

D. **Khom's Work**

"New properties of the X-rays," Compte rendus, 1876. (p. 385) translated in the *Elektrochemie*, Feb 14, 1876, (p. 501) found that X-rays immediately completely discharge the electrodes through wire, rapidly in instance of negative charge, then in the case of positive.

Prof. Bouger, in the production of electrochemistry by means of Röntgen's X-rays, *Journal of Chemical Society*, London, *Elektrochemie*, Feb 21, 1876, (p. 452) finds that both negative and positive rays do not move."
Ann. Rev. Sci. 1929

Mr. Bennett & Harewood have found no trace of electric
rotation by x-rays, but have obtained an identical
phenomenon, but described by Meichlin (Comptes
Rendus" 1976. in the "Electronics" April 1896, p. 75.) After giving their results for different substances
they indicate "When the strength with which the
different metals influence the energy of the x-rays to
discharge electricity clearly varies differently as their
temperature influences them.

Mr. J. W. C.남 ("On the effect of the
spectra of the x-rays on the intensity of the electric"
"Electronics" April 1896) found (1) that
the influence of the metal on the first to twelve plates
made in India, does not make any
shift or a marked change in the intensity of the
light. (2) The air through which the rays passed
completely separated into two electric images
from a curvature between two plates of a drop
of distilled water would do.
...charged bodies are identified by X-rays. He has also observed their electrifying power, but this is not yet
understood. E.g., Curie (Letter to the "Vestuarian" Vol. 1896 p. 497) finds X-rays to increase conductivity.
The magnetic (Letter to the "Vestuarian" March 27, 1896 p. 497) finds, "The X-rays change some bodies
positively and some bodies negatively, and other
change slowly in very rare cases. The X-rays change it both in an unspecified way
to the change where the rays independently give
to the body. One gives a positive or a negative
result. See also notice in the "Vestuarian" April 1896 p. 780 (Letter from J. Thomson to M. Macfarlane)
"(The behavior of electricity through conductors traversed by X-rays in water) will be of interest.
...and the X-rays can be detected in this manner. See section VI.

In Lodge's paper in the "Vestuarian" Vol. 1896 p. 473
it is stated H. Thomson \(\text{has applied a prototypical}
plate} incident the vacuum (i.e., of diathermy disk)
"but not very well." In "Bouque to Rounse" Vol. 1896 (the
"Vestuarian" March 13, 1896 p. 640) Auguste de Llauronn
formed trinitrates in papers to X-rays produced a photo
graphic effect. Through 250 sheets of electrod. bromide of
paper, 300 sheets of paper without the bromide reduced
the same adsorptive effect in 150 sheets with
sodium. They found photographic effects differing in
sensitivity to the varying light intensities of 10 to 50.
They found two more differences in sensitivity to X-rays.
Prof. D. von Hahn in "Comptes Rendus" Vol. XXII quoted in the "Naturwiss." April 14, 1846, p. 326, states (p. 329): "By means of the fluorescent screen we were able to show the distinctness of the image. With moderate vacuum the waves are not fitted at the glass to the exclusion of the bomb. As completely as when the illumination is common Jupiter. On the other hand, when illumination is cut off very far, the waves penetrate not only glass, but bone also. Then there is a certain degree of penetration in which the difference in the transparency of glass or bone is a maximum."
Prof. Davy from a large number of experiments 
argued that electric rays increase with atomic weight, not in the density merely. However, Adolphe 
Lemonnier (Physical Society, Madrid, 1896) has used a large number of pieces of metal, carbon, and platinum in 
sterilized roots in such a way that the electric current has 
the molecular weight. 

1. Henri B. Harnack from glass 
2. Heliotrope (Comptes Rendus, Feb. 17, 1896, in the 
3. Heliotrope, March 20, 1896, p. 646.) 
4. Hesse's research (Comptes Rendus, March 20, 1896, p. 646) found that 
numerical 
5. Coynh's formula 

Lowe ("Lecture on Progress in Radiography") 
the "Heliotrope" April 10, 1896 (p. 781-84) has 
experimentally established the source of the 
ray in the "Heliotrope" tube. He finds 
that the ray from the cathode, striking 
first on a glass surface, turns that surface 
through every point of the cathode at independent 
like a bat surface. But when the cathode ray 
first strikes a piece of metal, enclosed in the tube, 
the behavior of the ray of metal, which depends 
what it is connected to. If the boundary line of 
metal is standard to the cathode in such a way 
that it cannot receive any electrical charge,
from the cathode stream, must either decline to cut some emission of vapour or else emit them of the speed of light, but if the beam had been connected to the anode 30 or so as to be able to receive the negative charges of the cathode stream, then it would not make vigorous stream of a vapour as a simple vacuum it helped the whole energy, supplied medium to pass off as vapour. Lord's experiments were made by producing firm, bode photographs of the discharge tube in action to confirming stream with persistence if the visible phenomenon in a face screen.
After physiological (or rather pathophysiological) researches have been made by means of the
vapor.

Hippocrates' experiments have tested the relative transparency of various tissues of the
cutaneous tissues. One was a moist, cutaneous ulcer, the other a cutaneous ulcer in transparency near
the body. The cutaneous was far more transparent than the ulcer. In both experiments, although
the ulcer was more transparent than the body, an experiment with a piece of skin
was common. Hence there was no difference in
transparency of the cutaneous or the normal
parts. (British Medical Journal, Feb. 15, 1896, p. 433)

And Schäfer's and Schmiedeberg's have published
our experiments of the action of X-rays upon
bacteria. Bacterial cultures containing recent cultures
derived from a sterile culture, bacterial cultures containing cultures
derived from a sterile culture exposed to the X-ray for 15 minutes, to
20 minutes, etc., showed no difference. Bacterial cultures exposed to the X-ray for
15 minutes showed no difference. Bacterial cultures were treated
under same condition without exposure to
the X-ray. Then each tube
was made into a bundle and sterilization
was made into a bundle. A sterilization
was made into a bundle. A sterilization
was made into a bundle. A sterilization
was made into a bundle. A sterilization
was made into a bundle. A sterilization
was made into a bundle. A sterilization
was made into a bundle. A sterilization
was made into a bundle. A sterilization
was made into a bundle. A sterilization
enema foe 48 minutes lead no effect on
the result of the later (British Medical Journal
Feb 19, 1896).
Miss. Gifford of Broadwey found that certain
substances retained better than paper, which
cause would itself transform. (Photography
March 25, 1896 p. 163)

During Dr. Stenham experimented on the
eyes of a healthy British sheep found that the retina
of the eye was most slightly transparent to h
eyes. (Complete Record Feb. 21, 96 in The
"Electrocinica" March 5, 1896 p. 646).

Dr. von Haeckel published in British Medical Journal Feb. 9, 1896 p. 381.)


Architectural drawing relating opacity of a
cular, a fringe, tubing connections, goat stone,
c VOID glasses. Phosphate of lime. Triple phosphate
was used. A tube of iron and oxygen culture.
The culture was much more transparent than
architectural most transparent.

Drumell (Bulletin de l'Acad. de Med.,) No 10, 1876 in British
Medical Journal "Effets du traitement medical inter-entier.
April 15, 1896 p. 63.

Rheumatism is a disease in the
system. It is depression in ulceration and joint pain.

Clinical Diagnostic Appertaim.
Diseases of the Nervous System

It is proposed to notice only the most important cases of this subject.

By way of two cases, the first was a case of double distal phalangeal fracture where the photograph enabled the operator to fix on the phalanges that were subluxated to the normal one. The victim, a case of bullet in foot, was treated more severely for right medullary. Both radiographs were published in "British Medical Journal" in Feb. 1896, p. 363.

Windle's patient experiments. ("Vie. belie. Wohengen" in 1896 in "British Medical Journal" Feb. 8, 1896) Photographed a child's arm from 1 cm. of a dead branch after regeneration they were able to photograph the blood vessels.

Lamarck's case of both amputees of femur where photographed showed that destruction of regeneration was from within outward. ("British Medical Journal" Feb. 22, 1896) Windle's patients showed some of the parts of foot, hip, leg, and with radiographs (in "British Medical Journal" Feb. 15, 1896) Ionehauts, a function of the femur photographed by Dr. Windle's on June 15 and verification of a bullet in arm photographed by Dr. Windle. Both radiographs were published in "British Medical Journal" in Feb. 22, 1896, p. 493, 494.

In the "British Medical Journal" in Feb. 22, 1896, p. 493, 494, case of arteriothorax of lumbar plexus; also, radiographs of lumbar spine injected with red lead was...
nence of the disease being found.

It is necessary to say briefly what first instigated a study in human blood in which it was seen that there was the unexplained natural death rate. The most successful method was that of the STANDARD REPORT, taking an accurate picture of the infected individual's disease of heart (British Medical Journal 20, 1895, p. 557).

... Standard reports, with publication of results, occur of dissection of all human bodies containing certain bloods that were highly virulent (British Medical Journal 20, 1895, p. 523), also occurs of dissection of terminal placental organs (p. 524). These reports were attempts to radiograph through the lungs to record via a technique in tuberculin a serous plate in one side of lungs a few millimeters and a fluid has attached to these by...
It is reported (in "Photography," March 19, 1896, p. 34) that the late Edwards of Rainford found that radiography had produced a breakable from a living skeleton. Dr. P. P. B. D. E. (in "British Medical Journal," March 10, 1896, p. 360) published a radiograph of a skull, 20 minutes old. The image was taken 10 minutes before exposing the negative of plates from tube 8 inches. The heart and lungs were clearly discernible. The image was taken 20 minutes after the death of the subject. The death occurred six years after the patient died. The image shows a clear view of the spine and the ribs of the subject. The subject died six years after the image was taken. The image shows the spine and ribs of the subject.

From Lodge ("Science," April 10, 1896, p. 785), it is reported that radiography produced a radiograph of a human skeleton. The radiograph was made with an exposure of 10 minutes. The patient was alive.

Dr. P. P. B. D. E. (in "British Medical Journal," April 11, 1896, p. 437) gives an interesting list of radiography published and unpublished by his students. The list includes Joseph Bodin, the first to photograph a human skeleton.
declaration of extinction. The cortical areas of
spinal column in absence of fracture of joints. With
a view of a hypertrophy in a case able to see a
small paper into a lumen (British Medical
Journal, April 15, 1848, p. 997).

E. S. Davis (American Journal of Medical Science)

March 1846 in British Medical Journal. Death of

Hepatica nobilis, perfusing one 84 minutes after in

virus, a living plant. Deposed in a plant without for

with 15 minutes elapse.

An interesting case is last result in a case of

Hepatica nobilis, perfusing one 84 minutes after in

virus, a living plant. Deposed in a plant without for

with 15 minutes elapse.

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with 15 minutes elapse.
Improvements suggested in apparatus

There may be noted unsuitably made for
heads: electric apparatus, vacuum tube,
burner, apparatus, and photographic dry
plating. The two first producers are not
visible, the lamp; the
same
apparatus similarity the plate forever.

Electric apparatus. Various combinations of
primary current (two main entirely independent,
lead, copper, or whatever substance include,
and a metal and lead galvanic battery) with
suitable arrangement (large battery half a bottle
with a resistance) then for a tensioned
in a cell where containing in anode the primary
of a lead cell) have been made by successful
photographers. These are offered of lead and a decade
by a lead resistance. The small amount is a miniature
an
alternating current of 10,000 volt per minute which passes
with the amount of lead, through a battery of a half
gallon leaden jar, the drainage from without to
a lead cell will be returned to the inward

Now leading fundamental and generally achieving calibration
will within a lead cell. He recommends a battery of
5 to 10 selenium or some similar in excess. Dry cells are
not used at all. Lead batteries fall off so
seriously that they are unsuitable for the long exposure
continuation necessary. (New light and edition p. [182] subsection)

1896)
Dinamtsyn used a Schenklstoff oil, simplifying the tube without getting excellent results with moderate time of development. When one considers the slight difference in frequency between the capacity which ultimate connects the oil in the oil point as compared with the compensating oil spread on the electrodes of a secondary coil of this exciting type, which almost must be remembered one of the rate of movements in one direction in developed shows is compared with the other. Then it is necessary to remember that nothing is definitely certain about the conditions under which some workers obtain effective or any where obtain finds.

The ordinary method was the type of oil point recommended for tests consisting of a battery of 6 to 10 large No. 10 point ceramic plate cells, each in good order. When using a lamp of from 6 to 8 inches long.

Vacuum Tube. Various tube designs have been suggested. The essential is a high vacuum. It is then does not take into the characteristics of the glass. The tube must be carefully insulated. When using, one must be careful not to break it off and maintain it for 15 sec. during the time of development.

Dinamtsyn treats the tube as the best, which in a scientific manner has been placed in the apparatus under which it was carried by the author under some other conditions.
The cathode-ray spot is produced at a certain point near the center of the bulb. The anode plate is the small piece of platinum held at an angle a short distance beyond the focus of the electrostatic lens. The cathode-ray spot is not well defined, for it is not focused at the point of contact. The cathode-ray spot is sometimes described as a double pointed spot. The point where the ray leaving the cathode is not the same as it was in the small diffuse luminescence seen through the glass is placed somewhere behind the point of contact. Platinum is used to make the most efficient substitute for the cathode ray, and for the halogen lamps of the cathode ray focus through the platinum wire. The cathode ray is absorbed by the platinum wire, and the cathode spot is a ray from the luminescence point by a kind of different reflection. The anode plate is placed at an angle, the best part of the cathode ray, as indicated, is directed through the cathode of the bulb, where it can be conveniently maintained to produce the cathode spot in the adjoining tube. The tube is strengthened with the tube to be fixed in a stand and at the required depth. The anode and anode wire are inserted to the terminals of the side, and by platinum wire passed through the glass. (Lighting Electrical Journal, 1896, p. 748.)
By the use of this tube the time of exposure has been much diminished. Some portion of the explanation given are somewhat questionable.

In reference to nitrate, Saff. Lodge appears splendid performance of the flume built is hardly in any other but has further advantage...

The light and toner in the bath can be used and I doubt if many such advantages will long remain by explaining it by aluminium. I cannot say however that this particular medium seems to me to be any way to be used in a non-plummet substitute, unless fluorescent substance transforms may be readily written for the words of the tube. I anticipate that the use of aluminium and the under glasses would be a step in the wrong direction. “Christian Science” in "Audivisory" "The Bacterium" August 6, 1876, p. 784)

According to him the phenomenon of imaging as it is due to the occurrence becoming too good under portable exposures, the sandwich intaglio of the gun penetrating the glass from which they can be liberated by the forces of a Bacterium Bence.

Of the Alumnumium written a summarizing form in "Bacterium" "The Bacterium" "and described that

[Signature]
dark room in which Kistern showed phosphorescence to occur. At any
take this form of light to put into a box to which
are already saying the photograph with the "screen"
at the far end shielded from any light by
and the "screen" frame
should be thin to which screen can
exist point in a dark light. A screen
in boxes to observe with that tent is
not necessary.

Photographs made from platinum
and with us the phosphorescent substance
(Br 55.7.6 + 429). Photographic platinum on the
up to screen of solid body (a 55), 609.

In the paper a large number of substances advised
the use of phosphorescent "metal" which
in the good arrangement contained the plate at first
without means to screen the screen of substances
and platinum made of "metal" to screen to "liquid" in the "metal" and 270
(55, 7.6.5 # 79) are also "Photography" April 23, 1896 p. 278.

According to him the phosphorescent "metal" must
be "properly destabilized". On since the
difficulty seems to be to get an even uniform
layer. The substance seems to have made up
into quarts with some "metal" and screen
within the wing-shaped shield or made up
silver backing, or the support is wrapped with
screen a piece of the phosphorescent substance.
truly desired var.

Netrophilic

Dry plate. Defeci. seem to agree.

At the same time the plates to the

Kinin to the large number of the same

suitable the plate for radiophoto work.

Consequently plates except for their relitf

were no special advantag. One would

become members of plates were put a special

"outlook" plate in the market, but

no special particular is given up to the

constructive. Films are extremely good to

offset plates. One the other hand is extremely

transient to a very several radioactive

since it is stated be taken simultaneously

of the same subject.

Experiments are being made

out to the trial of removing fluorescent

substrates with the activated body, and

of (fluorescence a medium incorporated

with fluorescent substances a part of an

bath of rainwater). (R. A. R. R. R.


one. L. D. B. in his paper "Radiation Physics in Radiophotography." "If the films themselves can be made

fluoresce without otherwise being damaged,

it may be a step in the right direction; but

are a matter of fluorescent material near

the film tends towards scattering and

diffusion.
diffusion of light—a poor substitute for the straight neutralizing property of the
waves themselves. (In Campbell & Sumner,
1846; p. 661.)

A radiograph is not an image, it is a projective shadow, its
counterpart in real photography is the
cold telltale, the movement of heat in
a photographic printing frame when
a sensitive piece of fabric, a piece of
steel, was accidentally heated. No method
yet been discovered of reproducing a map of
a live surface, and the data appear
to be insensibly reflected. It has been suggested
that a wave surface effect might
be obtained by reflecting objects of
a live object with a relative displacement
of the inverse tube. We could检验 the
same problem to a body in space. The
point too distant and reflected in a
wavefront. This has been done very successfully
by an Lilium sp. 

(1846, p. 661.)
Some other forms of energy which act on the "Dry-Plate".

Quinetes discovered radiation the fact, that besides being sensitive to the undulations of the visible spectrum and present other positive radiation of the "Dry-Plate". Today is a very delicate instrument for detecting otherwise invisible effects, partly because the silver salt is in a state of unstable equilibrium and partly because the time of exposure may be prolonged at will of the experimenter. Since the publication of two papers many strange effects of the photographic plate have been reported. Some reports undoubtedly suggest an imperfect use of the darkness and want of photographic chemicals, but often excluding any means of manipulation between the removal of the dry plate from the covering and the process of fixation. Some well-attested phenomena remain to be briefly noted here.

Inkograms. If the vacuum tube be dispensed with, and the sensitized plate with metallic wires be in contact be placed between two and the terminals of the electrical discharge in the neighborhood of the reproducing pole, small inkograms result.
he occasionally got a shadow of the disc. When two of the discs were adjacent he found, however, the impression of points discharges. In one case he only got impressions as broad like discharges. He used an Alpko coil ("The New Light" 5th edition p. 14, being special view of "The Electroscope" Feb. 1896). Memory

of a Thiemanns coil is in these similar results seem to have been got by Mr. vector (communication by his letter to the Academy of Sciences Feb. 7, 1890).

On July 20, a transformation, Mr. Thiemann got the images of coins in contact with a sensitive plate, not nearly the shadow of a minute but a point of the whole spanning on the same side of the image. Thus a shadow side of the plate the coin was placed.


These Thiemanns? Regent? results are also probably similar to results ("Photography" Hansens Feb. 1896 p. 104) Mr. Regent got results by using a sensitive plate in metal with via coin.

These effects are all probably due to induced electricity in the metallic bodies affecting the sensitive plate in contact with them. They are not due to Rupple's or Rupple's effects. These are points of coins.
Dr. Anna Maguire's results in printing from a negative by means of a potassium lamp are probably due to the action of light, a subject also dealt with in this country by Dr. A. Bravais. The process was called "flame lamp".

The "flame lamp" may influence the dry plate shielded from visible light. From experiments found that light from a flame of 93 ampere current exposed a dry plate to intense light in 10-12 seconds, through a wooden board 2 mm. thick. At the same thickness in both cases, the flame exposed was transferred, and exposure of itself in too long being required to produce the same effect. (Photographische Rundschau" 1896 quoted in "Elektrische Nachrichten 1896, p. 645).

It is very difficult whether this effect was due to processing analogous to "thorne" in Dr. A. Bravais's way or not.

Thione hexagonal artificiali, a hexagonal
Thione sulphide aqueous phosphorescence after a momentary exposure to sunlight. In fact, states that the substance gives not rays which affect the phosphophrene plate similarly to rays.

Purified in a box, it may be substituted for all the electric armatures of the electric lamp. "Photography" mention.
The details as to the forces of phosphorescent bodies to
quickly irradiate rays which pass through dry air
bodies after minute phosphorescence has ended
in "Communications" March 2, 1846 No. 9, before Mr.
Henry C. Broughard, also in the same for March 24, 1846.
(Announcement in the "Electrolyte" March 20, 1846 p.580)

The complete phosphorescent reflector.
March 19, 1896, p. 200, and "British Medical Journal" March 20, 1896, p. 743, whose original reference are given. In absence of details no comments are necessary.

"Black Light." A series of demonstrations have been obtained during the last two years and described under this title by H. G. Le Blanc. He took a plate of aluminium with figures in relief in one side. Against the other side he pasted a sensitive dry plate, exposed it in a permanent light but in red light and exposed to a red light for three hours. On developing the plate he got an image in relief, the figures in relief, the thickness of the plate being more of pyroxine than the thickness. He took a photograph of the negative and against it he past a sensitive plate, in part he past another plate. He then exposed it in a frame designed to known light as before. After three hours he developed the plate. After processing, development he got a print, but incapable of being printed from its negative. He was successful with daylight. Since two experiments have succeeded in obtaining same result, others have failed. Sunlight also produced these effects. He was able to include heat or fluorescence as a cause, in experimenting to see whether clariety may not have something to do with it. He believe here very an intermediate in nature.
Nature, between mass of light and mass of electricity. He prints a cardboard and black paper and uses such in wrapping for dry plates of paper to his "rare" drops, but that in his text is not entirely different from Lewis' "

a" of a complete set from the beginning. See also the "Black Light" by Lewis in the "Philosophical Transactions," March 1876, p. 77; also Lewis' "Nature of the Bichromate of Black Light" and "A New Process" in April, 1876, p. 93."
In a second communication ("On a new form of Radiation" The Electrical April 24, 1896 p. 850) Prof. Pictet gives some new results. He says that at times his first communication (already communicated) became aware that to rays discharged electrified bodies, "I suspected it was a ray not the invented outside ray... that indeed led to do it in connection with different electrified bodies." To protect his observations against influence of an electrified atom from vacuum with earth and wind, Pictet got into one unlighted box, lined with lead opposite the source of the ray, around the one with wires except on the side toward the discharging apparatus, where a slit was made in one wide "insulatingly blind with a thin aluminium sheet." Though this slit the ray would enter the observation box. He formed (a) "critically a negatively electrified body inside an electrified body placed in the path of a ray. The ray passed the screen without the ray". It did not matter whether the body inside were conduct in a conductor. He observed "no specific difference in the behavior of different bodies, with regard to the nature of the charge or to the behavior of positive or negative electricity." (b) "Electrostatic induction is surrounded by a disk insulating, under a priniciple, instead of wire. The indications are with this insulating knowledge can except by influence connected to earth."
After induction, a conductor is closely surrounded by a conductor connected to earth, which should 
hide the induction by transforming to zero the induction... sufficiently to change into the 
inner electric field... conductor. If these observations tend to show that "air temporarily 
may preserve the property of discharging electrical bodies with which it came in contact."

If the air retains this property for some time after the wires have been extinguished, it 
might be possible to discharge electrical bodies by such air, although the bodies themselves are 
not in the path of the wave. By means of an 
explosion the air inside a vessel had been played 
only to very part an electrically insulated 
body in the protected part of the explosion so 
that the body was far from the shot. The charge 
of the insulated electrical body at one diminished 
comparatively, as measured by a standard electrical 
Battery, the insulated body was brought to equilibrium, hence the 
charge was eliminated and if the insulated body had been connected with the rest of the apparatus by a 
load resistance. (4) How does the air lose this 
property? "Whether it loses it entirely as an 
untouched medium into contact with other bodies 
is in dispute. It is quite certain that a short duration of the air by a body 
of large surface, which itself must be insulated,"
can understand this new configuration. He made a study of wire work, and found that if one had to etch a triangle with a wire, the electrolyte circulated slowly, leading to a slower etching rate. Several layers of anodized metal were then etched in sequence. (A) Electrolyte baths in the electrolyte bath were circulated equally well, perhaps more slowly. (B) He thoroughly investigated the theory of the body in the plate of the array to make sure there was some air in hydrogen at atmospheric pressure. (C) Observations within systems of hydrogen evolution have been recorded. (D) Results of the investigations with sputtering particles of the thyme in which the influence of the surrounding gas was not taken into account should [the text must be unclear].

Accordingly, application work to obtain

the vacuum tube. Detecting feedback is a fundamental problem, and the text is unclear. A transformer. The following advantages were obtained: (1) The application gets low cost; (2) The vacuum is produced; (3) The vacuum is produced; (4) The vacuum is produced. The question was raised: whether it be possible to generate a vacuum by means of a continuous discharge at a constant discharge potential? A solution followed: if the potential required was excessively necessary, further precautions were necessary.
...which bodies are incapable of generating a ray under the influence of certain rays. "Quantitative differences in the behavior of different bodies have however revealed themselves to me by my experiments up to now. Platinium is the best for generating the most powerful visible rays," he evidently alludes to the Jones tube as "the only one" which they observe. He adds that "the intensity of the ray it is a matter of indifference whether one starts at which point or which method of light one starts." With a special view to experimenting with alternate currents he uses a "hidden transformer. Platinium is being investigated as a discharge apparatus in which both electrodes are in the same vacuum. It was discovered that under any conditions, at the same center of current, there was a "steady and constant" sheet of platinium, which doubles" your time.

The date of this paper was communicated in March 9, 1896.
"Radiographic Projection
by Röntgen's Method"

Examples etc.

being part II of a Dissertation
for the degree of M.D. in the
University of Edinburgh by
William Cotton
M.A. MD BDM Sc.
D.P.H. Cantab.

May 5, 1896.
List of Illustrations

I. Apparatus found up. (photograph)
II. Fingers, little,
III. Illustrating faint tracing (radiographic negative)
IV. Proper of a long
V. Miscellaneous objects (radiograph)
VI. Normal adult metacarpus & phalanges
VII. Normal carpals and metacarpus in adult
VIII. Adult hand with recent middle
      vol. traumatic lesion
IX. Rheumatic chronic metatarsal,
     arthritis - hands (photograph)
X. Hands chronic rheumatoid
    arthritis (radiograph)
XI. Normal adult elbow -
     extension
XII. Normal adult elbow -
     flexion
XIII. Normal adult elbow -
      flexion
XIV. Adult metatarsus (photograph)

The majority of above are printed in
photostar. Solid ink paper which shows much
detail is taken at high finish (intest per
moment in the same way as as a photostar
paper is. BCM photostar available as suit).
Published Papers.

By Dr. WILLIAM COTTON, M.A., M.D., D.P.H., on X-rays.


2. 1901. “X-ray Photographs as Pictures.” (Bristol Medico-Chirurgical Journal—June.)

3. 1902. “Stereoscopic X-ray Representation.” (Bristol Medico-Chirurgical Journal—September.)


5. 1903. “Some Peculiarities of the X-ray Image.” (Edinburgh Medical Journal—July.)


10. 1907. “Proportional Representation and the Comparison of Radiographs.” (Bristol Medico-Chirurgical Journal—December.)


15. “Some Practical Points in the Interpretation of X-ray Pictures and Outlines.” (Letters to the Editor of the British Medical Journal—June, July and September.)

16. “Proportional Representation.” (Archives of the Röntgen Ray—October.)

17. 1911. “The Fluoroscopic Diagnosis of Direction by a Plane Mirror upon the Screen.” (The Practitioner—May.)


19. 1912. “The Right and the Wrong Side of the X-ray Picture; has a mistake been made?” (Lantern Slide Demonstration.) (Journal of the Röntgen Society—April.)

20. A complete Paper with the same title as the last. (Bristol Medico-Chirurgical Journal—September.)


27. “An Apparatus for X-ray Localisation.” (Bristol Medical Journal—March.)


29. 1920. “Three Years Radiography at the Base in France.” (In the Press.)

30. “Triggraphic or Anatomical Localisation.” (In the Press.)
Also in Collaboration:

1897 "The Effect of the Nutagen Tongue on Calculi"
by James deering F.R.C.S. Assistant Surgeon
United Royal Infirmary

1899 "A Simple Form of Influenza invented for
Young valleys"
by Thomas Clark, Plumber

PUBLISHED AND OTHER PAPERS ON X-RAYS
By Dr. WILLIAM COTTON

1. 1896—"Radiographic Projection by Röntgen's Method."
   (Thesis for Graduation as M.D., Edinburgh.)

2. 1901—"X-ray Photographs as Pictures."
   (Bristol Medico-Chirurgical Journal—June.)

3. 1902—"Stereoscopic X-ray Representation."
   (Bristol Medico-Chirurgical Journal—September.)

4. 1902—"The True and False Perspective of X-ray Representation."
   (Archives of the Röntgen Ray—July.)

5. 1903—"Some Peculiarities of the X-ray Image."
   (Edinburgh Medical Journal—July.)

6. 1904—"Perspective Nature of X-ray Projection."
   (Journal of the Röntgen Society—December.)

7. 1905—"Twin X-ray Representation and the Reflecting Stereoscope."
   (Bristol Medico-Chirurgical Journal—September.)

8. 1905—"The True Principles of X-ray Interpretation."
   (Archives of the Röntgen Ray, No. 63, Vol. X.)

9. 1906—"Some Principles and Fallacies of X-ray Interpretation."
   (The Practitioner—"X-rays in Diagnosis.")

10. 1907—"Proportional Representation and the Comparison of Radiographs."
    (Bristol Medico-Chirurgical Journal—December.)

11. 1909—"The Principle of Proportional Representation in Clinical Radiography."
    (The Practitioner—March.)

12. 1909—"Radiographic Localisation by means of Visible Shadows."
    (Journal of the Röntgen Society—July.)

13. 1910—"The Essential Ambiguity of X-ray Representation and some Methods of Solution."
    (Journal of the Röntgen Society—April.)

    (Bristol Medico-Chirurgical Journal—September.)

15. 1910—"Some Practical Points in the Interpretation of X-ray Pictures and Outlines."
    (Letters to the Editor of the British Medical Journal—June, July and September.)

16. 1910—"Proportional Representation."
    (Archives of the Röntgen Ray—October.)

17. 1911—"The Fluoroscopic Diagnosis of Direction by a Plane Mirror upon the Screen."
    (The Practitioner—May.)

18. 1911—"Design for an Elementary Radiographic Camera."
    (The Bristol Medico-Chirurgical Journal—June.)

19. 1912—"The Right and the Wrong Side of the X-ray Picture: has a mistake been made?"
    (Lantern Slide Demonstration.)
    (Journal of the Röntgen Society—April.)
20. 1912—A complete Paper with the same title as the last.
   (Bristol Medico-Chirurgical Journal—September.)

21. 1913—"The Episcope—an Optical Instrument for X-ray use."
    (Archives of the Röntgen Ray—February.)

22. 1913—"Direct Combined Examination of Single Radiograph and Patient: the Episcope."
    (The Practitioner—June.)

23. 1913—"The Episcope—a new Instrument for the Utilisation of the Single X-ray Print."
    (Journal of the Röntgen Society—July.)

24. 1914—"The Radiographic Centroscope, and the Radiographic Episcope."
    (Bristol Medico-Chirurgical Journal—September.)

25. 1915—"The X-ray Episcope, and the X-ray Camera."
    (In the Press.)

26. 1915—"Some Principles of X-ray Localisation."
    (The Practitioner—April.)

27. 1915—"An Apparatus for X-ray Localisation."
    (British Medical Journal—March.)

28. 1916—"Ten Months in France with a Field-Service X-ray Outfit."
    (Bristol Medico-Chirurgical Journal—December.)

29. 1920—"Three Years Radiography at the Base in France."
    (The Practitioner—October.)

30. 1920—"Trigraphic or Anatomical Localisation."
    (The British Medical Journal—March.)

31. 1921—"X-ray Localisation at the Base in France."
    (The Practitioner—March.)

32. 1922—"Hints for X-ray Medical Officers Overseas."
    (In the Press.)

33. 1923—"The Perspective Delineation of the Heart by X-rays—the Episcope and the Skiaphore."
    (In the Press.)

34. 1924—"Some Elementary Pitfalls of X-ray Interpretation."
    (The Practitioner—July.)

35. 1925—"Perspective in Relation to X-ray Interpretation."
    (Privately Printed.)

36. 1925—"The Readings of Skiagrams."
    (Letter to the Editor, B.M. J.—March.)

IN COLLABORATION:

   (Bristol Medico-Chirurgical Journal—March.)

1899—"A Simple Form of Influence Machine for X-ray Work" (namely Mr. Thomas Clark's Sectorless Wimshurst Machine).  
   (Bristol Medico-Chirurgical Journal—September.)