

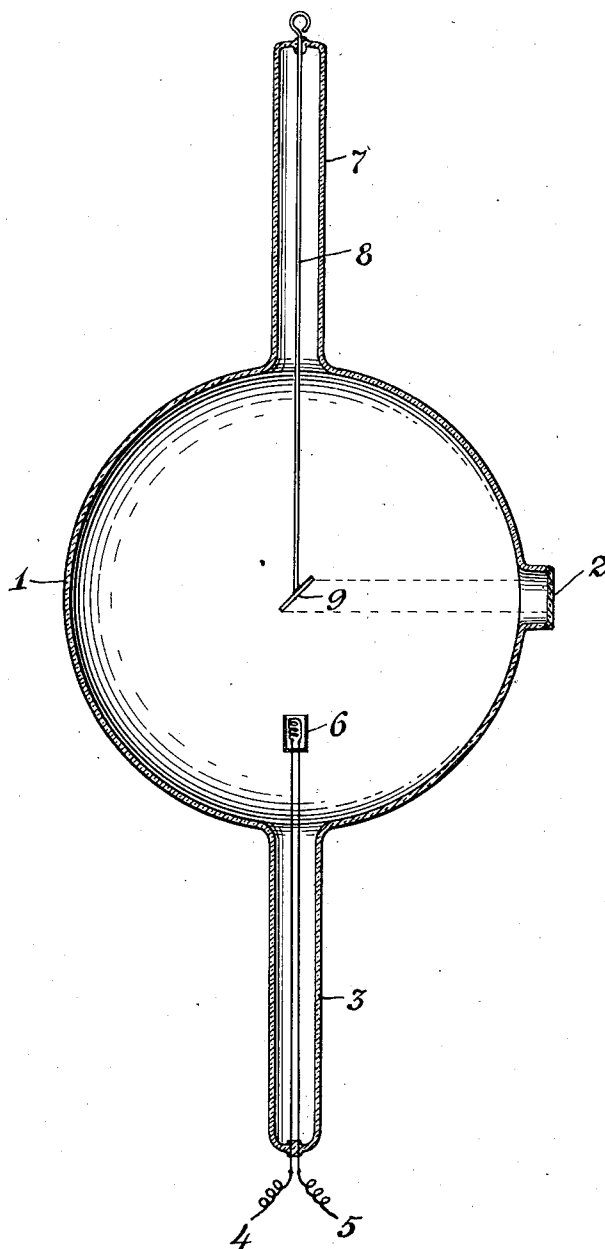
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X-RAY TUBE

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WITNESS

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X-RAY TUBE.

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My invention relates to X-ray tubes and particularly such as are intended for medical purposes. It is well known that X-rays have different degrees of penetration and that an X-ray tube may be caused to emit waves having a higher or lower degree of penetration by adjusting the voltage impressed on the electrodes of such tube. It is also well known that X-rays of high penetrating power, so called hard rays, have to be employed with great care on account of the danger of serious injury to internal tissues. On the other hand, rays of low penetration may be handled with greater safety, as they will affect only the outer layers of skin; still, even in that case, too long exposure may work harm. With X-ray tubes as constructed hitherto, one does not obtain in available form the very soft rays that are requisite for the curative purposes to which reference will be made later. It is easy enough to produce soft rays within the tube, but in order to reach the patient, such rays must pass through the walls of the tube, and when the tube is made in the ordinary way of ordinary glass, very soft rays can not pass through it. It is however only such very soft rays which have been found to be especially available for the treatments with which I am particularly concerned in this case. In order to enable the soft rays to pass out of the tube, I have provided such tubes with a window made of a material which affords much less resistance to X-rays than ordinary glass of the ordinary thickness used in X-ray tubes. The resistance which a substance offers to the passage of X-rays depends in many cases on the atomic weight of the chemical elements of which such substance is formed. Ordinary glass consists chiefly of sodium or potassium and silicon, the atomic weights of these three elements being 23, 39 and 28 respectively. In my improved X-ray tube, I preferably employ a window made of a substance the constituents of which have a much lower atomic weight than those of ordinary glass. For instance, I prefer to employ a window of so called Lindemann glass which is made of elements none of which has an atomic weight higher than 16. It will be obvious that with such a window X-rays of much lower penetrating power can pass through to the outside of the tube, and become available for curative purposes, than when the entire bulb consists of ordinary glass of uniform thickness throughout. It is important, however, that the X-ray tube should be of the character which enables the penetrating power of the rays to be adjusted as desired; in other words, the tube should be of the so-called heated cathode type, as illustrated, for example, by various Coolidge patents, for instance, No. 1,203,495.

When I refer to a tube of the heated cathode type, I mean a tube which permits the penetrating power of the X-rays to be varied by altering the voltage of the discharge passing through the tube, but keeps such penetrating power constant as long as said voltage remains unchanged.

By a combination of these features, I obtain results which have not been available hitherto as will be partly understood by the reference made above to rays of greater softness than any produced hitherto and partly by reference to certain novel effects explained hereinafter.

The invention may be employed in various constructions and in the accompanying drawings I have illustrated a typical example thereof in longitudinal section, it being understood that I do not wish to restrict myself to the exact construction shown but that any modifications within the limits of the appended claims may be made without departing from the spirit of my invention.

At 1, I have indicated the bulb body made of glass or other suitable material and having at one side a window 2 made of Lindemann glass or other material pervious to X-rays, but having constituents of relatively low atomic weight. At 3, I have indicated a tubular extension in which are sealed the wires 4 and 5 leading to the cathode 6 which has a heating arrangement, for instance such as the one employed by heated cathode, enabling the degree of hardness of the rays to be varied in the well known manner. At the other end, the bulb body 1 has another extension 7, in which is sealed the conducting carrier 8, leading to the anti-cathode 9 which is shown as inclined to the axis of the tube so that it may reflect the rays out of the tube through the window 2. This anti-cathode 9 may be made, for instance, of aluminum or magnesium. It has been ascertained that these metals, which have a low atomic weight, are of especial advantage in the production of soft X-rays. Not only do tubes with anti-cathodes of such metals produce a very high proportion of soft rays (accompanied by a rela-

tively small proportion of harder rays) but the potential employed may be much lower than with anti-cathodes of high atomic weight, and the potential may be increased
5 up to about twice the initial or starting potential without altering the characteristic that the discharge consists predominantly of soft rays.

A tube of the character set forth is very
10 efficient to produce X-rays of very great softness, in fact, X-rays having a penetrating power considerably below any available hitherto. In other words, my improved tube enables X-rays to be produced and to be sent
15 outside of the tube which have a wave length greater than any X-rays produced hitherto, it being well known that the greater the wave length, the smaller the penetrating power. Owing to the employ-
20 ment of the Coolidge type of tube, I am enabled to vary the penetrating power of these soft X-rays. The curative effect of these extra-soft X-rays is very remarkable, and a very important feature of their use is that
25 harmful effects are not likely to result even when the exposure is very long. I am enabled, for instance, to produce X-rays which will affect only the outermost horny layer of the skin, and this is a result which has
30 never been obtained hitherto with X-rays. The results obtained with my improved tube show that very special conditions must exist, that is, that it produces entirely novel effects. For instance, in the treatment of
35 eczema, it was found that itching was stopped within two hours, after a treatment,

and the eczema itself disappeared within twenty-four hours; each of these effects can be produced with ordinary X-rays only after several days. Acne and psoriasis dis-
40 appear within relatively short periods after application of the new X-rays. Exposure to X-rays such as produced by my improved tube will produce a diminution of the leucocytes lasting for a short time, the effect be-
45 ing similar to that observed when the Mueller intracutaneous injection is employed. This diminution of the number of leucocytes is characteristic of reactions taking place only within the skin but not below it, and
50 therefore the strong diminution of the number of leucocytes for a short time is evidence of the fact that the improved rays produce a strong intracutaneous reaction.

I claim:

1. An X-ray tube of the heated cathode type for emitting X-rays of adjustable penetration, and having an X-ray emitting portion constituted of material non-absorp-
60 tive of the softer X-rays, said tube also including a cathode and an anti-cathode and being adapted for operation at sustained low tensions.

2. An X-ray tube of the heated cathode type for emitting X-rays of adjustable pene-
65 tration, having a cathode, an anti-cathode made of material having a low atomic weight, and an X-ray emitting portion constituted of material non-absorptive of the softer X-rays, said tube being adapted for
70 operation at sustained low tensions.

GUSTAV BUCKY.