

(No Model.)

E. THOMSON.
REGULATING ROENTGEN RAY TUBES.

No. 591,899.

Patented Oct. 19, 1897.

FIG. 1.

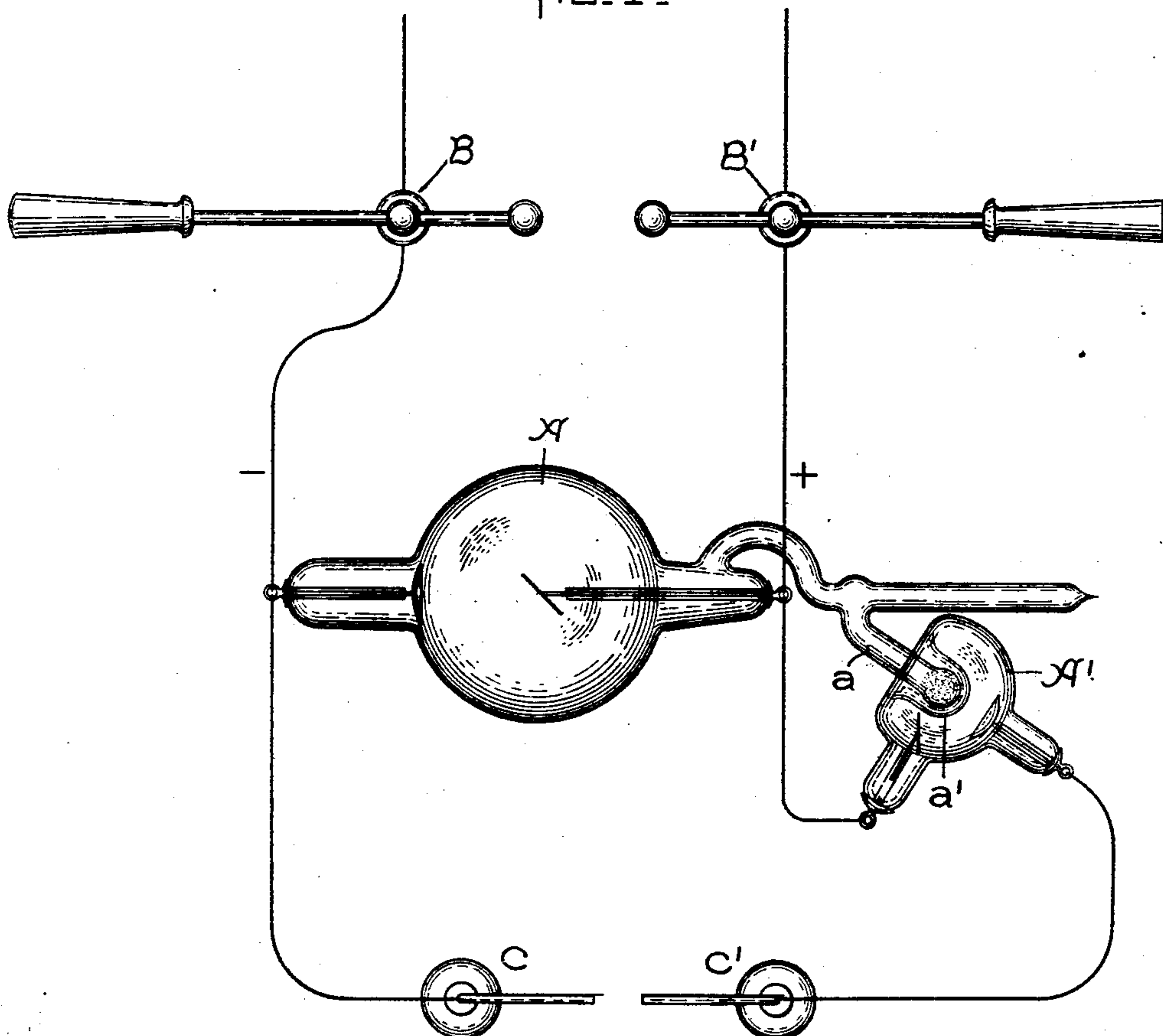
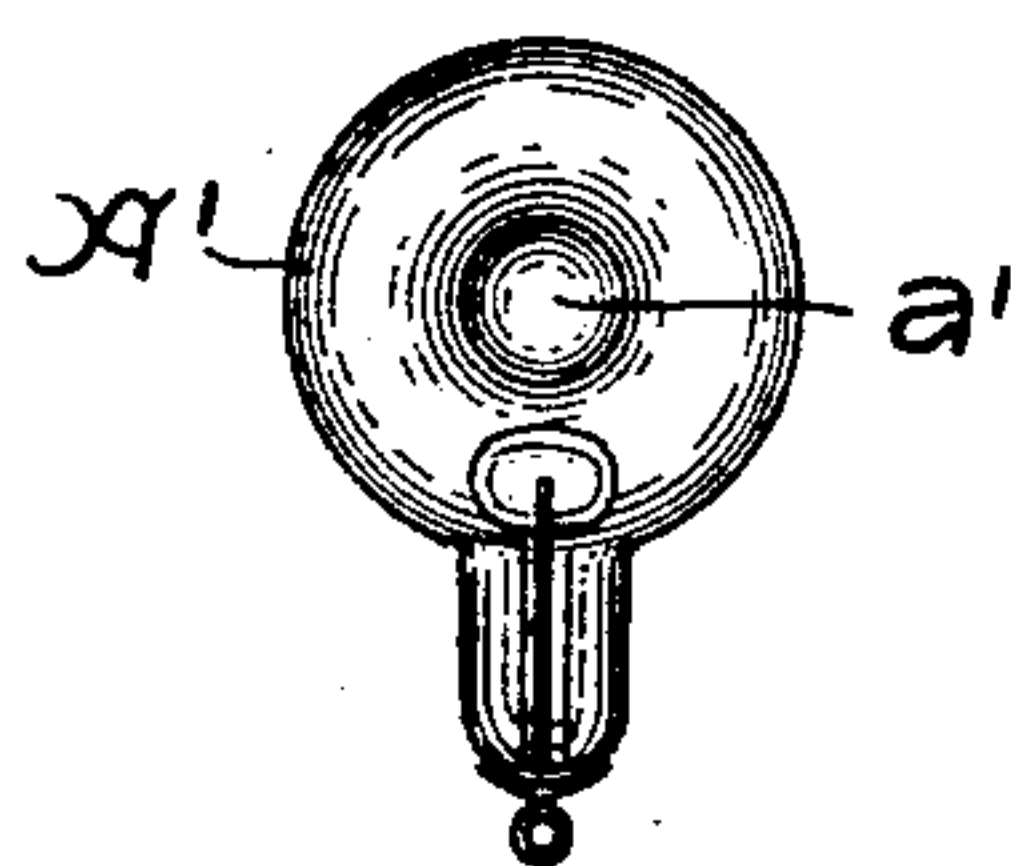


FIG. 2.



WITNESSES.

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UNITED STATES PATENT OFFICE.

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REGULATING ROENTGEN-RAY TUBES.

SPECIFICATION forming part of Letters Patent No. 591,899, dated October 19, 1897.

Application filed August 4, 1897. Serial No. 647,035. (No model.)

To all whom it may concern:

Be it known that I, ELIHU THOMSON, a citizen of the United States, residing at Swampscott, county of Essex, Commonwealth of Massachusetts, have invented certain new and useful Improvements in Regulating Roentgen-Ray Tubes, (Case No. 599,) of which the following is a specification.

My invention relates to the vacuum in Roentgen-ray tubes, and has for its object the provision of means for regulating the vacuum automatically if need be, and also it provides that the regulating apparatus shall be in a sense independent of the main ray-tube, so that the regulating apparatus may be applied to various tubes. This is important in case an accident happens to the ray-tube itself without injury to the regulating apparatus, or in case an accident happens to the regulating part of the structure which does not involve the ray-tube. Hitherto the regulating arrangement of the Roentgen-ray tube has been combined in one structure with the tube, which involves the loss of the whole structure—that is, the ray-tube itself and the regulating apparatus—when either are damaged, as by electrical puncture or by accidental breakage. In my invention the automatic regulation is accomplished by means of the production of heat in a vaporizable material, the heating being effected by current passing in the regulating-tube or regulating attachment. The regulating attachment, in my invention, may be applied to existing forms of Roentgen-ray tubes, and may be made and sold as a separate device for use with existing forms of regulating-tubes, such as those containing a side tube having a vaporizable substance from which vapor can be driven off by slight heating in order to counteract the gradual increase of vacuum which takes place in working Roentgen-ray tubes. I apply my arrangement or regulating attachment to the tube generally in a shunted circuit from the main terminals, so that if the resistance to the passage of a discharge increases between the main terminals supplying the Roentgen-ray tube there is a diversion or shunting to the side branch containing the spark-gap and regulating attachment. By making the regulating attachment sepa-

rate from the Roentgen-ray tube I am enabled to standardize both, so that any one of my regulating attachments may be used upon any one of the Roentgen-ray tubes, and the risk of breakage which would exist when both are combined into one structure, as also the loss due to the breakage, would be greatly diminished.

To these ends I have devised my present invention, which consists of an outer separate tube or exhausted bulb, so shaped that it may be applied directly to the small tube or extension containing the volatilizable compound. This bulb is contained in a shunt around the ray-tube and contains a cathode-terminal of the usual concave disk form, preferably, and a suitable anode-terminal placed at any convenient place within the bulb. I prefer to so shape the bulb that it will readily maintain itself in position.

The drawings annexed show an embodiment of my invention, Figure 1 showing the tube and auxiliary bulb referred to, with their connections, and Fig. 2 showing an end view of the bulb alone.

A is the Crookes tube, of now well-known form; B B', the terminals of the exciting apparatus, such as an induction-coil.

C C' are the terminals of the shunt or regulating spark-gap.

The tube A is provided with the tubular extension α , in which is the volatilizable compound, such as potassium hydrate.

A' is the auxiliary bulb or tube, of such shape as may be preferred. That shown is a desirable one. It is provided with an exterior cap or depression α' , within which may be seated the tubular extension α of the Crookes tube, and with which it is designed to register. To facilitate the transmission of heat to the material in the extension α , a little oil may be placed, if desired, in the cup. The bulb A' has the cup or cathode-terminal opposite the cup, the discharge passing from such terminal to the anode-terminal within the same tube. Each terminal is connected, respectively, to the terminals of the main tube A, as shown. It is to be understood that the spark-gap C C', which is the regulating spark-gap, is shorter than the spark-gap between B B', or the terminals of the exciting apparatus,

and of such length as to only allow a spark to pass when the opposition to the discharge in the main tube has risen to that point which causes it to cease to be effective for the particular kind of Roentgen rays to be obtained from it. Also, the spark-gap C C' may evidently be put in any part of the circuit or connection leading from the cathode to the anode terminal through the regulating-bulb A'.

10 The operation is as follows: Supposing the tube A' to be in working condition and the spark-gap C C' adjusted, as indicated, with the parts in place, as shown in the figures, then if the vacuum in the tube A, due to the

15 continued use of the tube, rises, as it generally does, it may reach that point which will force the discharge to pass over the spark-gap C C'—that is, it will so fail to shunt the terminals of the exciting apparatus as to

20 cause an increased potential to be exhibited between those terminals. The side circuit including the spark-gap C C' includes also the regulating-bulb A', and the bombardment from its cathode-rays hits the cup in contact

25 with which, or close to which, is placed the regulating-tube A', containing the volatile compound. The heat so developed volatilizes a portion of the compound, or decomposes a portion thereof, giving out gas which lowers

30 the vacuum in the main bulb A, and restores its condition of working. Of course it is understood that the exciting apparatus whose terminals are at B B' is not to be such as would maintain a constant potential between

35 the terminals, but is to be similar to a Ruhmkorff induction-coil in its nature. It is also to be understood that the spark-gap C C' might be replaced by an extremely-high resistance—such as a small glass tube filled

40 with water or other fluid, the leakage through which would be determined by the resistance. It will also be understood that where the discharges are of high frequency, and alternating

in direction, electrodeless tubes may be used in place of A, in the usual manner, and also so may electrodeless bulbs, suitably modified in well-known ways, be substituted for the bulb A'.

Fig. 2 simply shows an end view of the bulb A', with the cup *a* in the center.

Having thus described my invention, what I claim is—

1. As a new article of manufacture, for use with Crookes tubes having an extension containing a volatilizable substance or compound, a separable vacuum-adjuster consisting of an exhausted auxiliary bulb having a portion fitted to the main tube for the transfer of heat thereto, and containing terminals for the passage of electric discharges.

2. The combination with a Crookes tube to be maintained at a critical vacuum for the production of Roentgen rays, of an extension from the main tube containing a salt or substance volatilizable by heat, and a separate exhausted bulb registering with the extension and included in a shunt around the main tube.

3. The combination with a Crookes tube having an extension containing a volatilizable salt or compound, of an auxiliary bulb fitted to or registering with said extension and provided with terminals, whereby it may be included in a shunt around the main tube, with a regulating spark-gap or high resistance in the shunt-circuit.

4. As a new article of manufacture, an exhausted bulb having a depression or recessed portion adjusted or placed within the range of bombardment of cathode-rays within the said bulb by the passage of electric discharges through the same, for the purpose specified.

Lynn, Massachusetts, August 2, 1897.

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Witnesses:

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