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 INCANDESCENT CATHODE APPARATUS.
 APPLICATION FILED OCT. 24, 1919.

1,394,144.

Patented Oct. 18, 1921.

Fig. 1.

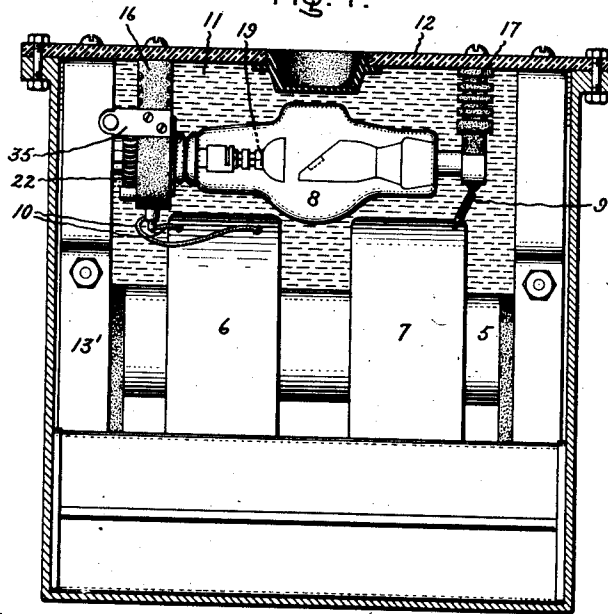


Fig. 2.

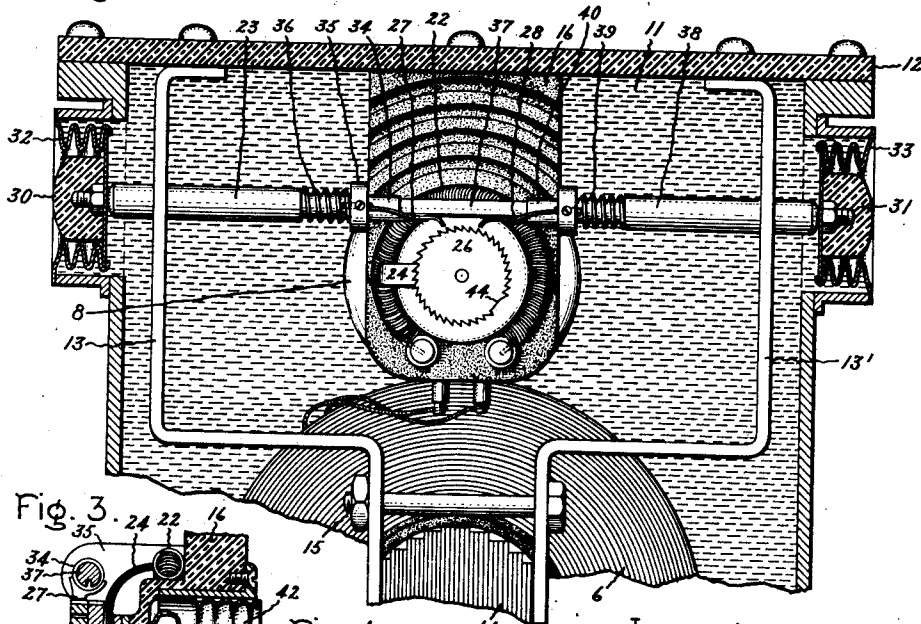


Fig. 3.

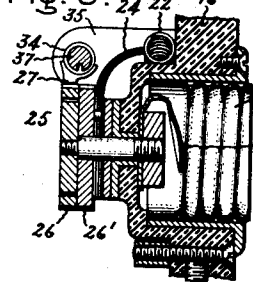
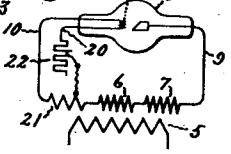


Fig. 4.



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UNITED STATES PATENT OFFICE.

WILLIAM D. COOLIDGE, OF SCHENECTADY, NEW YORK, AND EDWARD A. WAGNER, OF FORT WAYNE, INDIANA, ASSIGNORS TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

INCANDESCENT-CATHODE APPARATUS.

1,394,144.

Specification of Letters Patent.

Patented Oct. 18, 1921.

Application filed October 24, 1919. Serial No. 333,092.

To all whom it may concern:

Be it known that we, WILLIAM D. COOLIDGE, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, and EDWARD A. WAGNER, a citizen of the United States, residing at Fort Wayne, county of Allen, State of Indiana, have invented certain new and useful Improvements in Incandescent-Cathode Apparatus, of which the following is a specification.

The present invention relates to the control of incandescent cathode devices and particularly to devices in which an X-ray tube of the incandescent cathode type and the supply transformer are operated in oil within a metal tank. As all high tension parts are insulated by the oil from the tank and only the low-tension conductors connected to the primary of the supply conductors pass through the walls of the tank, a high degree of safety from electric shock is afforded the operator and the subject in the use of the tube. This high degree of safety would be lost were it necessary to bring any part of the high tension circuit outside of the tank in order to control the current-carrying capacity of the tube.

In accordance with our present invention we have an apparatus having an incandescent cathode tube and a control mechanism located within a tank, the control mechanism being operated externally for varying the cathode heating current and hence the current carrying capacity of the X-ray tube.

The novel features of our invention will be pointed out with particularity in the appended claims. For a complete understanding of our invention reference should be had to the following detailed description taken in connection with the accompanying drawing in which Figure 1 is an elevation of a device embodying our invention, with a wall removed; Fig. 2 is a detailed view taken at right angles to Fig. 1 showing a ratchet mechanism for operating a rheostat in the cathode circuit; Fig. 3 is a sectional detail view of the cathode socket and attached mechanism, and Fig. 4 is a diagram of circuit connections.

Referring to Fig. 1, the apparatus comprises a transformer having a primary winding 5 and secondary coils 6 and 7, to the terminals of which an X-ray tube 8 is con-

nected by the conductors 9 and 10. The transformer, tube and connected parts are immersed in a body of oil 11. The transformer is carried by the cover plate 12 of the apparatus by pairs of metal bands 13 and 13', which, as indicated in Fig. 2, are fastened to the transformer core 14 by bolts, one of which is shown at 15. The X-ray tube 8 is connected by suitable insulating supports 16 and 17 to the cover plate 12. The X-ray tube 8 is of the well-known incandescent cathode type, and therefore will not be described in detail herein. As shown diagrammatically in Fig. 4, the cathode 19 comprising a filament of suitable refractory material, such, for example, as tungsten, is connected by the conductors 10, 20 to the winding 21 of the transformer. Included in this cathode heating circuit, is an adjustable resistance 22, which in Fig. 2 has been indicated as a coiled wire mounted on the insulating support 16.

The finger 24, which makes contact between the resistance 22 and the transformer secondary, may be moved by a double ratchet mechanism to include varied amounts of resistance in the circuit. The two ratchet wheels have teeth pointing in opposite directions, although but one wheel 26 is indicated in Fig. 2 for the sake of clearness. The two ratchet wheels are shown in Fig. 3 as 26, 26'. Engaging respectively with each set of ratchet teeth are pawls 27, 28, operated by rods through buttons 30, 31, set in the walls of the tank.

The buttons are connected to the tank through flexible metal bellows 32, 33, known in the trade as "Sylphon" metal. A pawl 27 is connected to a metal tube 34 which slides through a ring 35 connected to the support 16. The tube 34 is connected at its opposite end to a non-conductive rod 23 which may be moved against the coiled spring 36 by pressure upon the button 30. Sliding within the tube 34 is a rod 37 connected to a non-conductive rod 38 which may be operated by pressure upon the button 31 against a spring 39. The pawl 28 is mounted on a ring 40 which in turn is fastened to the rod 37. The movable contact finger 24 may be moved step by step in one direction by the pawl 27, through the button 30. Pressure upon the button 30 causes the pawl to engage the teeth of the

ratchet and release of the pressure causes the spring 36 to return the button 30 to its original position, thereby disengaging the pawl 27 from the ratchet. In the same manner the contact blade 24 may be moved stepwise in the opposite direction through the button 31.

The cathode conductors 10, 20, are connected to the members of a screw-socket 42, contact from the resistance 22 being made from the spring clip 43 at the base of the socket, and the lead 10 being brought to the socket shell. The X-ray tube 8 is provided at the cathode end with a base such as used in incandescent lamps which engages with the socket 42. Each of the ratchet wheels is provided with a blank space 44 as indicated in Fig. 2 so as to prevent engagement of the respective pawls after the contact blade 24 has reached the limit of its travel.

While we have described one embodiment of our invention, we wish it to be understood that this description is only illustrative of the principle of our invention and that the same may be carried out by other means.

What we claim as new and desire to secure by Letters Patent of the United States, is,—

1. An electric apparatus comprising a high voltage transformer, an incandescent cathode tube connected to the high voltage terminals thereof, a sealed housing for said transformer and tube, a regulator within said housing for varying the current carrying capacity of said tube and means for changing the setting of said regulator from the exterior of said housing.

2. An apparatus comprising a tube having a cathode adapted to operate at incandescence, an inclosing tank, energy supply means within said tank for heating said cathode and for transmitting current through said tube, a device in said tank for varying the heating current supplied to said cathode, and means sealed into said tank for operating said device from the exterior of said tank.

3. An X-ray apparatus comprising an X-ray tube having a cathode adapted to be operated at incandescence, a transformer, circuit connections for supplying the cathode

with heating current from said transformer, an impedance device in said circuit, an inclosing tank for said tube, transformer and impedance device, and means for operating said impedance device from the exterior of said tank.

4. An apparatus comprising the combination of a tube having a cathode adapted to be operated at incandescence, a transformer, circuit connections for both operating said tube and heating said cathode from said transformer, a rheostat in the transformer heating circuit, a tank inclosing said tube, transformer and rheostat, a ratchet mounted in said tank connected to a movable element of said rheostat, a flexible diaphragm in the wall of said tank, and a link connected to said diaphragm for operating said ratchet.

5. An X-ray apparatus comprising an X-ray tube having a cathode adapted to be operated at incandescence, an inclosing tank for said cathode, a rheostat within said tank connected in the cathode circuit of said tube, a flexible bellows mounted in the wall of said tank at opposite points, a ratchet mechanism for adjusting said rheostat mounted in said tank and rods extending from each of said bellows to said ratchet and adapted respectively to operate said ratchet mechanism in order to adjust said rheostat.

6. An apparatus comprising the combination of a tube having a cathode adapted to be operated at incandescence, an inclosing tank for said tube, a body of oil therein, a transformer in said tank for operating said tube, a cathode heating circuit, an impedance device connected in said circuit, a mechanism within said tank for adjusting said impedance device, and a resilient member sealed into said tank for operating said mechanism from the exterior of said tank.

In witness whereof, WILLIAM D. COOLIDGE has hereunto set his hand this 17th day of October, 1919, and EDWARD A. WAGNER has hereunto set his hand this 20th day of October, 1919.

WILLIAM D. COOLIDGE.
EDWARD A. WAGNER.