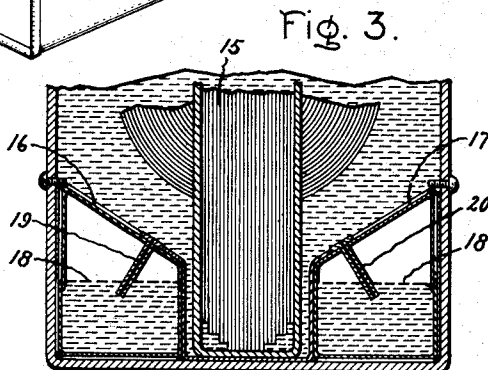
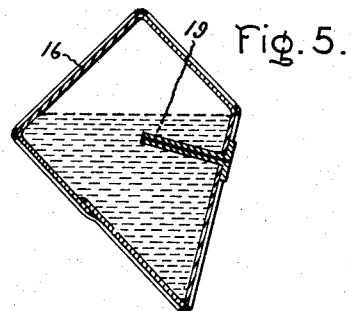
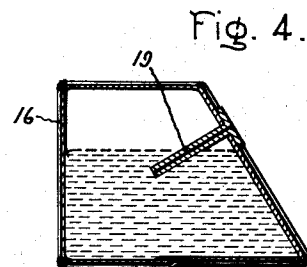
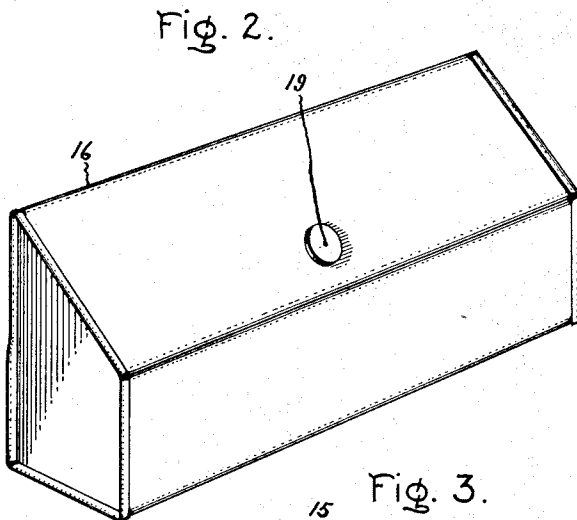
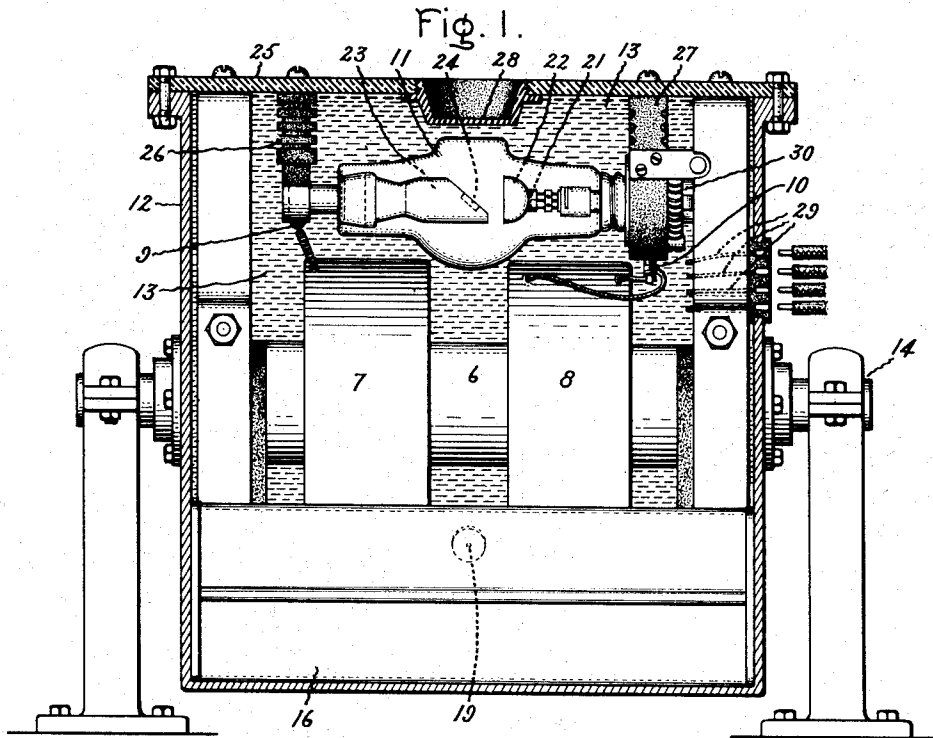


W. D. COOLIDGE.
X-RAY APPARATUS.
APPLICATION FILED OCT. 24, 1919.

1,394,143.

Patented Oct. 18, 1921.



Inventor:
William D. Coolidge,
by *Wm. D. Coolidge*
His Attorney.

UNITED STATES PATENT OFFICE.

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X-RAY APPARATUS.

1,394,143.

Specification of Letters Patent.

Patented Oct. 18, 1921.

Application filed October 24, 1919. Serial No. 333,065.

To all whom it may concern:

Be it known that I, WILLIAM D. COOLIDGE, a citizen of the United States, residing at Schenectady, in the county of Schenectady, State of New York, have invented certain new and useful Improvements in X-Ray Apparatus, of which the following is a specification.

The present invention relates to oil immersed X-ray devices and its object is to provide a device which may be operated in various positions while at the same time maintaining the inclosing tank completely filled with oil.

In the device comprising my present invention the main tank is completely filled with oil and provision is made whereby the oil may expand and contract at different operating temperatures while maintaining the tank substantially full at all times. The object of maintaining the tank filled with oil at all times is to permit the device to be tilted in any position without reducing the thickness of the layer of oil insulation about the high tension conductors or exposing these conductors to air in the tank by a displacement of the oil.

In the specific embodiment of my invention described herein a receptacle is provided within the main tank containing both oil and air, or other gas, and connected by means of a tube with the main body of oil, the tube being so arranged as to prevent escape of the gas into the main chamber, but to enable oil to flow to and from the main chamber into the expansion chamber in accordance with temperature changes of the apparatus.

My invention will be more specifically described in connection with the accompanying drawings in which Figure 1 is an elevation of the complete apparatus with the side wall removed; Figs. 2, 4 and 5, are views of the expansion chamber, and Fig. 3 is a fragmental sectional view taken at right angles to Fig. 1, and showing the arrangement of the expansion chambers within the apparatus.

As shown in Fig. 1, the apparatus consists of a transformer 6 having secondary coils 7 and 8 to the terminals 9 and 10 of which is connected an X-ray tube 11. The transformer and X-ray tube are placed within a tank 12 filled with a body of oil 13. The tank may be adjustably mounted

in any desired manner either on a universal suspension or arranged to be tilted about a single axis, as conventionally indicated by the trunnion 14. On each side of the transformer core 15, as best shown in Fig. 3, are located expansion chambers 16 and 17, each containing a quantity of oil 18 connected with the main body of oil by fine bore tubes 19 and 20.

The X-ray tube shown in the drawing is of the incandescent cathode type having a filamentary cathode 21 adapted to be heated and surrounded by a focusing screen 22. The anode 23 preferably consists of a mass of copper in which is embedded a button consisting of refractory metal such as tungsten. The X-ray tube is preferably supported from a cover plate 25 by means of insulating supports 26, 27; the portion of the cover through which the useful stream of X-rays emerges is preferably dish-shaped, as indicated at 28, in order to decrease the thickness of the oil layer through which the X-rays penetrate. Suitable electrical connections to the primary of the transformer and to a measuring instrument connected between the two sections of the secondary are indicated at 29, but have not been continued in full as they do not relate to the present invention. The heating current of the cathode may be derived from the transformer in series with a rheostat 30, as indicated in Fig. 1. The specific cathode circuit connections have not been illustrated for the sake of simplicity. They form no part of my present invention.

In the operation of the described device all of the heat generated in the transformer and in the X-ray tube is imparted to the oil causing an expansion of the oil. Therefore a flow of oil occurs into the expansion chambers from the main body of oil surrounding the tube and transformer through the tubes 19 and 20 which have an opening at approximately the center of the expansion chambers, thereby compressing the air in these chambers. When the main body of oil cools and contracts an oil flow occurs in the reverse direction from the expansion chamber into the main tank. As will be clear from reference to Figs. 4 and 5, the ends of the tubes 19 and 20 are always sealed by oil in any position and therefore prevent an escape of air from the expansion chamber into the main chamber.

110

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

1. An X-ray apparatus comprising the combination of an inclosed tank, a transformer, a body of oil substantially filling said tank, and means within said tank for permitting said body of oil to change volume at different temperatures in any position of said tank while maintaining said tank substantially filled with oil.

2. An apparatus comprising the combination of an inclosed tank, a device therein evolving heat during operation, a body of oil substantially filling said tank, a receptacle in said tank containing both oil and a gas and a tube, connecting the body of oil within said receptacle with the main body of oil in said tank, said tube ending sub-

stantially at the center of said receptacle, the oil in said receptacle more than half filling the same thereby preventing access of gas to the end of said tube in any position of the device.

3. An electrical apparatus comprising the combination of an inclosed tank, a mounting therefor permitting said tank to be tilted in various positions, a translating device evolving heat located therein, a body of oil substantially filling said tank, and a receptacle in said tank containing both oil and a gas having an opening connecting the main body of oil in said tank with the oil in said receptacle, said opening being arranged to be sealed against passage of gas in any position of said apparatus.

In witness whereof, I have hereunto set my hand this 17th day of October, 1919.

WILLIAM D. COOLIDGE.