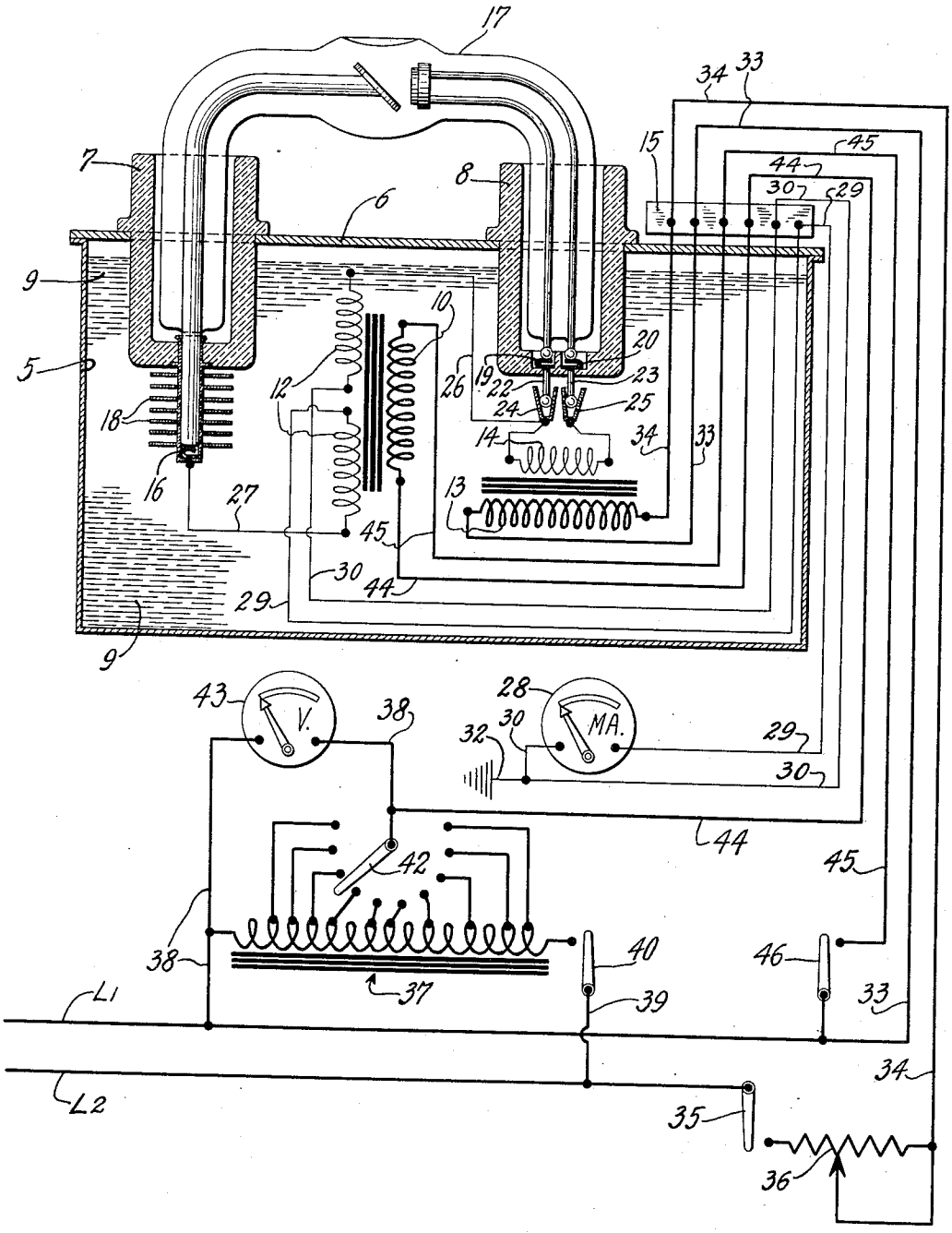
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SHOCKPROOF X-RAY UNIT

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SHOCKPROOF X-RAY UNIT

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My invention relates to X-ray units and more particularly to what is known as shockproof units.

In the construction of shockproof units it is a primary requisite that such units be relatively compact and the possibilities of the operator or patient accidentally contacting the high tension terminals carrying high potential electrical energy must be completely obviated. This greatly increases the degree of safety with which the device may be utilied and enhances the flexibility of operation of the unit for fluoroscopic and radiographic examinations by the Roentgenologist.

It is, therefore, an object of my invention to provide a shockproof X-ray unit in which the high tension electrical terminals are recessed within insulating bushings in such a manner that accidental contact therewith by the operator or patient is prohibited.

A further object of my invention is the provision of a shockproof X-ray unit in which the high tension electrical terminals are recessed within suitable insulating bushings which prevents accidental contact therewith by the operator or patient and in which the X-ray tube may be placed or withdrawn without disturbing any of the high tension connections.

Still further objects of my invention will become apparent to those skilled in the art by reference to the accompanying drawing wherein the single figure is a sectional view in elevation of my device with a diagrammatical representation of a system for energizing the same.

Referring now to the single figure in detail I have shown an oil tight metallic casing 5 which is provided with a suitable cover plate 6 secured thereto. A pair of high tension insulating bushings 7 and 8 disposed parallel to each other are sealed into the cover plate 6 and form an oil tight joint therewith to prevent leakage of a cooling and an insulating material, such as oil 9, that is contained within the casing 5 and which surrounds the portion of these insulating bushings extending inwardly of the casing 5.

A high tension transformer having a primary winding 10 and a secondary winding 12 is contained in the casing 5 and is immersed in the cooling and insulating material 9. A filament heating transformer provided with a primary winding 13 and a secondary winding 14 is likewise immersed in the cooling and insulating material within the casing 5. The cover plate 6 of the casing is provided with an insulated terminal block 15 having a plurality of binding posts for external connections to various other parts of the system as can be readily appreciated from the figure. This block is provided in order that my unit may be readily connected to a suitable source without disturbing the internal connections.

The insulating bushing 7 is provided in the recessed portion thereof with a high tension electrical terminal 16 extending therethrough into contact with the cooling and insulating material in the casing 5 which is adapted to receive the anode terminal of a suitable X-ray tube, such as shown at 17. This terminal is provided with suitable cooling means such as radiator fins 18, for the purpose of transmitting the heat from the anode of the X-ray tube to the cooling and insulating material.

The insulating bushing 8 is likewise provided with a pair of electrical terminals 19 and 20 which are arranged to establish a contact with the cathode end of the X-ray tube 17. A pair of conductors 22 and 23 extend from the terminals 19 and 20 to a pair of spring clip terminals 24 and 25 carried by the filament heating transformer and connected to the secondary winding 14 thereof. A conductor 26 extends from one end of the secondary winding 12 of the high tension transformer through the cooling and insulating material 9 to the spring clip 24 for the purpose of transmitting high potential energy to the cathode end of X-ray tube 17. A conductor 27 likewise extends from the remaining end of the secondary winding 12 through the cooling and insulating material 9 to the anode end of the X-ray tube for completing the high tension circuit thereto.

A milliampere meter 28 for recording the current flowing in the high tension circuit is disposed exteriorly of the casing 5 in conductors 29 and 30 which extend through the terminal block 15, and a suitable ground connection, such as shown at 32, is provided for safety purposes. A source of alternating current of commercial potential, such as conductors L1 and L2, are connected to the primary winding 13 of the cathode heating transformer by means of a pair of conductors 33 and 34 which are connected through the terminal block 15. A switch 35 is provided in the conductor 34 for the purpose of opening and closing this circuit and a variable rheostat 36 is likewise connected in series with this conductor 34 for varying the energy supplied to the primary winding 13.

An auto transformer 37 is connected to the supply conductors L1, L2, by means of a pair

of conductors 38 and 39 and a switch 40 is provided in the conductor 39 for opening and closing this circuit. The conductor 38 is also connected to the adjusting arm 42 of the auto-transformer and a voltmeter 43 may be connected in this conductor for recording the output voltage of the auto-transformer, if desired. A conductor 44 extends from the adjusting arm 42 of the auto-transformer to one end of the primary winding 10 of the high tension transformer and the remaining end of this primary winding is connected to the supply conductor L1 by means of a conductor 45 for completing a circuit to the primary winding 10. A switch 46 is interposed in this latter conductor 45 for opening and closing the circuit to the primary winding 10 of the high tension transformer.

The X-ray tube 17 is of substantially a U-shaped configuration thus positioning the portion of its electrodes protruding externally thereof substantially parallel with each other which enables the same to establish a contact with the respective terminals recessed within the parallel disposed insulating bushings. The anode conductor, which is subject to intense heat during operation of the tube, is connected to the terminal 16 in such a manner that dissipation of this heat readily occurs due to the transmission thereof to the radiator fins 18 and consequently to the cooling and insulating material 9.

The operation of my system may be described as follows: the switch 35 is closed and the rheostat 36 adjusted to allow the desired heating current to flow to the cathode of the X-ray tube 17.

This circuit may be traced as follows: from the source of supply L1, through conductor 33 to primary winding 13 of the cathode heating transformer, thence by means of conductor 34, rheostat 36 and switch 35 to the supply conductor L2. Energization of the primary winding 13 will therefore energize the secondary winding 14 of this transformer and the energy thereof will be conducted to the cathode through the respective spring clip connectors 24, 25, and the conductors 22 and 23, to the cathode terminals 19 and 20.

The switch 40 is then closed to energize the winding of the auto-transformer 37 which is connected to the source L1, L2 by means of the conductors 38 and 39 and the adjustable arm 42 is regulated to give the potential desired as indicated by the voltmeter 43. The switch 46 is then closed completing the circuit to the primary winding 10 of the high tension transformer. This circuit may be traced as follows: from supply conductor L2, through auto transformer 37, then by means of conductor 44 through terminal block 15 to the primary winding 10, thence by means of conductor 45 back to the supply conductor L1 through switch 46. The primary winding 10 thus becomes energized and in turn energizes the secondary winding 12. High potential energy will then flow from this latter winding to the electrodes of the X-ray tube by means of the conductors 26 and 27. The potential of the high tension circuit may be further regulated by movement of the adjustable arm 42 of the auto-transformer and the current of this circuit regulated by means of the rheostat 36.

It can thus be readily seen by those skilled in the art that I have provided a compact shock-proof X-ray unit in which all the parts carrying high potential electrical energy are so disposed that accidental contact therewith by the operator or patient is prohibited. Furthermore, the X-ray tube may be readily inserted or removed from the unit without disturbing the high tension terminals, and the unit due to its compactness enhances the flexibility thereof during operation.

Although I have shown and described one specific embodiment of my invention I do not desire to be limited thereto as various other modifications of the same may be made without departing from the spirit and scope of the appended claims.

What is claimed is:

1. In an X-ray device, an X-ray tube having an envelope with portions thereof angularly disposed relative to the remaining portion of said envelope and provided with electrode terminals carried by the angular disposed portions of said envelope and in parallel relation with each other, a casing containing a volume of cooling and insulating material and supporting said X-ray tube exteriorly thereof, a source of high tension electrical energy housed within said casing and immersed in said cooling and insulating material for energizing said X-ray tube, a pair of parallel insulating bushings extending into said casing surrounded by said cooling and insulating material and having an internal diameter sufficient to enable the angular disposed portions of said envelope to extend inwardly of said bushings, high tension electrical terminals secured to said insulating bushings and extending into said cooling and insulating material, said high tension electrical terminals being connected to said source and adapted to receive the parallel disposed electrode terminals carried by the angular disposed portions of the envelope of said X-ray tube.

2. In an X-ray device, an X-ray tube having an envelope of substantially U-shaped configuration and provided with parallel electrode terminals, a casing containing a volume of cooling and insulating material, a source of high tension electrical energy housed within said casing and immersed in said cooling and insulating material for energizing said X-ray tube, a pair of insulating bushings extending into said casing surrounded by said cooling and insulating material and provided with recessed portions adapted to receive the extremities of said U-shaped envelope inwardly of said bushings, high tension electrical terminals secured to said insulating bushings and extending into said cooling and insulating material, said high tension electrical terminals being connected to said high tension source and adapted to establish contact with the parallel electrode terminals of said X-ray tube.

3. In an X-ray device, an X-ray tube provided with parallel electrode terminals, a casing containing a volume of cooling and insulating material, a source of high tension electrical energy housed within said casing and immersed in said cooling and insulating material for energizing said X-ray tube, a pair of insulating bushings sealed into said casing extending a substantial distance therein and surrounded by said cooling and insulating material, said insulating bushings being provided with recessed portions having high tension electrical terminals connected to said high tension source adapted to receive the parallel electrode terminals of said X-ray tube, and one of said high tension electrical terminals having a cooling radiator immersed in the cooling and insulating material in said casing in heat conducting communication with one of the electrodes of said X-ray tube.

4. In an X-ray device, an X-ray tube of a substantially U-shaped configuration having parallel electrode terminals, a casing containing a volume of cooling and insulating material, a source of high tension electrical energy housed within said casing and immersed in said cooling and insulating material for energizing said X-ray tube, a pair of parallel disposed insulating bushings extending into said casing surrounded by said cooling and insulating material and provided with recessed portions therein, high tension electrical terminals carried by the recessed portions of said insulating bushings adapted to receive the parallel electrode terminals of said X-ray tube, cooling means carried by one of said high tension electrical terminals and immersed in said cooling and insulating material, and high tension electrical conductors passing through the cooling and insulating material to connect said high tension electrical terminals to said high tension source.

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