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2,485,340

X-RAY CONTROL SWITCH

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FIG. 1

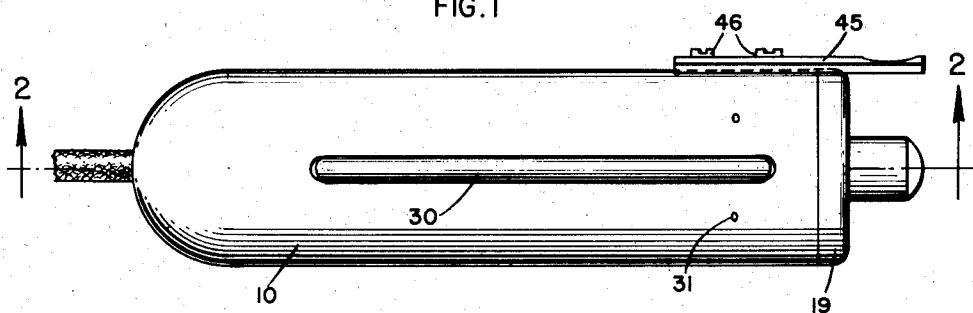


FIG. 2

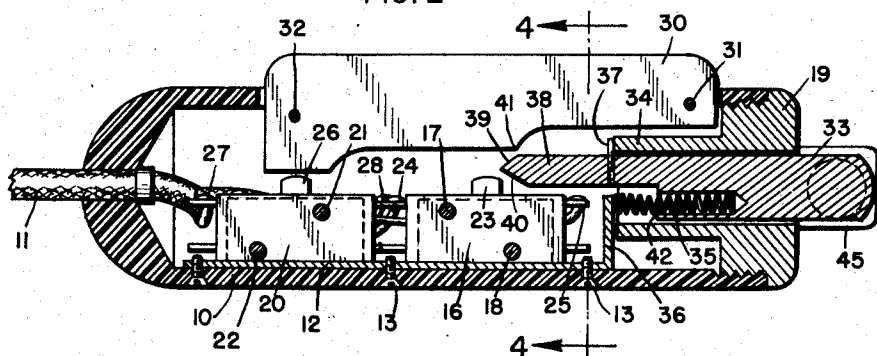


FIG. 3

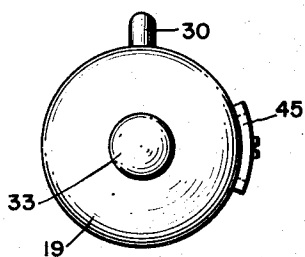
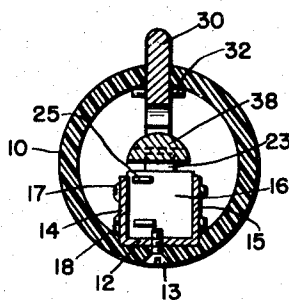


FIG. 4



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X-RAY CONTROL SWITCH

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2 Claims. (Cl. 200—5)

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The present invention relates in general to X-ray control switches and the object of the invention is a new and improved switch of this character.

The invention relates more in particular to a control switch for X-ray apparatus which includes an X-ray tube having a rotating anode. In the operation of a tube of this type it is essential that the anode be undergoing rotation when an exposure is made, in order to avoid damage to the tube. It is customary to provide a protective circuit which theoretically makes it impossible to make an exposure unless the anode is rotating but there is a chance for the circuit to fail and the switch which is the subject matter of the invention has been designed to give additional protection in this situation.

My improved switch comprises a unitary housing enclosing two micro-switches, one for starting the motor which rotates the anode and the other for starting the timer which makes the exposure. There are also two actuating members suitably mounted in the housing, a finger lever for actuating the motor starting micro-switch and a push button plunger for actuating the other micro-switch, and there is a mechanical cooperation between these actuating members as a result of which the operation of the push button plunger is ineffective to operate its associated micro-switch unless the finger lever is in operated position.

The invention will be described more in detail in the ensuing specification, reference being had to the accompanying drawing, in which—

Fig. 1 is a top or plan view of my improved control switch;

Fig. 2 is a section on the line 2—2, Fig. 1;

Fig. 3 is an end view as seen from the right in Fig. 1; and

Fig. 4 is a section on the line 4—4, Fig. 2.

Referring to the drawing, the reference character 10 indicates a tubular housing which may be molded from any suitable plastic material such as Bakelite. The housing is closed at one end except for a small opening for the cord 11. At the other end the housing is open and has internal screw threads for the threaded molded cap 19.

The micro-switch support 12 is made of sheet metal and is secured inside the housing 10 by means of screws such as 13. As best seen in Fig. 4, the support 12 has two integrally formed upright extensions 14 and 15 between which the micro-switch 16 is secured by the screws 17 and 18. The micro-switch 16 is located at the right hand end of the support as seen in Fig. 2. At the left hand end of the support there are two

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additional upright extensions, corresponding to extensions 14 and 15, between which the micro-switch 20 is secured by screws 21 and 22.

The micro-switch 16 is of known construction, having an actuating button 23 and two terminals 24 and 25. There are two other terminals which are not used. The construction of the switch is such that the terminals 24 and 25 are normally disconnected and are connected together when the button 23 is depressed. That is, the switch is normally open and is closed by operation of button 23.

The micro-switch 20 is similar to the micro-switch 16 and has the actuating button 26 and active terminals 27 and 28. The micro-switch 20 is installed with its terminals to the right of the center line, rather than to the left as in the case of micro-switch 16, see Fig. 4, so that terminal 28 does not interfere with terminal 24. Explaining this further, in Fig. 2, the terminals of micro-switch 16 are in front of the center line whereas the micro-switch 20 is reversed, or rotated 180 degrees, so as to bring its terminals to the rear of the center line.

The micro-switch 20 is operated by means of the finger lever 30, which is located in a slot in the housing 10 and is pivoted on a pin 31. The pin 32 is a stop which retains the finger lever in the housing, as can be seen from Fig. 4.

The micro-switch 16 is operated by means of the push button plunger 33, which is slidably mounted in the cap 19 and extension 34 thereof. The plunger 33 is circular in cross section for the greater portion of its length, but is cut away at the left to form the operating member 38 of semi-circular cross section, having cam surfaces 39 and 40 at the end thereof. The function of these cam surfaces will be explained presently.

The reference character 35 indicates a spring which is compressed between the bottom of a hole drilled in the plunger and the stop 36, the latter being formed as part of the switch support 12, and urges the plunger to the right as seen in Fig. 2. The limit of movement in this direction is determined by the engagement of the pin 37 with the left hand end of the cap extension 34. Movement of the plunger to the left is opposed by the spring 35 and is stopped by the engagement of the shoulder 42 with the stop 36.

The cord 11 extends to the control unit for the X-ray apparatus and may have four conductors. Two of these conductors are included in a circuit for starting the motor which rotates the anode and are connected to the terminals 27 and 28 of micro-switch 20. The other two conductors are included in a circuit extending to the timer

and are connected to the terminals 24 and 25 of micro-switch 16.

The control switch may be provided with a bracket or hanger 45 which is fastened to the housing 10 by screws 46. The projecting end of the hanger 45 has an opening therein adapted to cooperate with a hook on the control unit, so that the control switch may be hung up out of the way when not in use.

The operation of the control switch will now be described. Assuming that the control unit has been set for the correct voltage, current, exposure time, etc., the control switch is removed from the hook by the operator and is grasped in one hand, with the fingers across the finger lever 30 and the thumb on the push button plunger 33. The operator may now press in on the finger lever 30, thereby depressing the button 26 and closing the micro-switch 20. As the result of this operation the motor which rotates the anode in the X-ray tube is started and the anode is set in rotation.

While holding the finger lever 33 in operated position, the operator may now press in the push button plunger 33, moving it to the left as far as it will go. In this movement of the plunger the cam surface 39 on the operating member 38 engages the finger lever at 41 and the operating member is directed downward to a slight extent, so that its upper surface comes into sliding engagement with the lower surface of the finger lever. The movement of the operating member is thus confined to a path such that the engagement of the cam surface 40 with the button 23 causes the depression of the button and the closure of the micro-switch 16. This starts the timer in the control unit and the exposure is made.

It should be explained now that the push button plunger 33 has a rather loose fit in the cap 19, there being enough play so that the operating member 38 has considerable freedom of movement in a vertical plane. It is this construction that makes it necessary to operate the finger lever 33 before the push button plunger can be effectively operated.

If it be assumed now that the push button plunger 33 is accidentally operated prior to operation of the finger lever 30, when the operating member 38 moves to the left the cam surface 40

engages button 23 of the micro-switch 16, but since the finger lever 30 is in its normal position it has no effect in confining or restricting the path of movement of the operating member 38 and the latter merely slides over the button 23 without depressing it and without closing the micro-switch. In this connection it will be noted that there is sufficient space between the finger lever and the button 23 to permit the operating member 38 to pass between them without depressing the button.

It will be seen that the invention provides a very satisfactory control switch for X-ray apparatus of the type described which is convenient to use, and which affords additional protection to the tube, thereby avoiding damage which might otherwise occur.

The invention having been described, that which is believed to be new and for which the protection of Letters Patent is desired will be pointed out in the appended claims.

I claim:

1. In a device of the class described, two switches, an actuating member for one switch which is movable in two paths, movement in one path being effective to operate the associated switch and movement in the other path being ineffective, and an actuating member for the other switch adapted in its operated position to restrict the movement of the first mentioned actuating member to its operative path.

2. In a control device, two switches, a finger lever for operating one switch, a push button for operating the second switch, the operation of said push button being normally ineffective, and means associated with said finger lever in operated position to render the operation of said push button effective.

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The following references are of record in the file of this patent:

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