

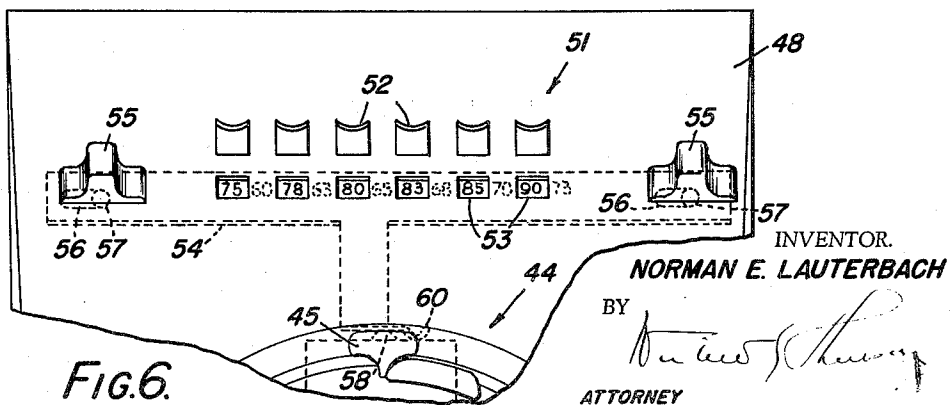
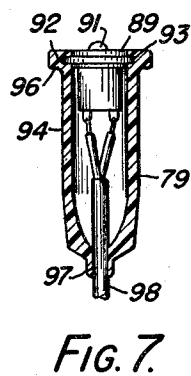
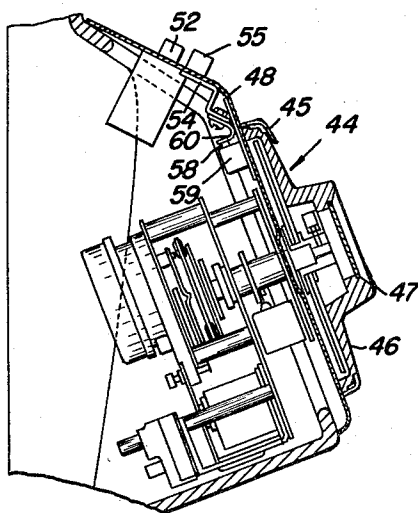
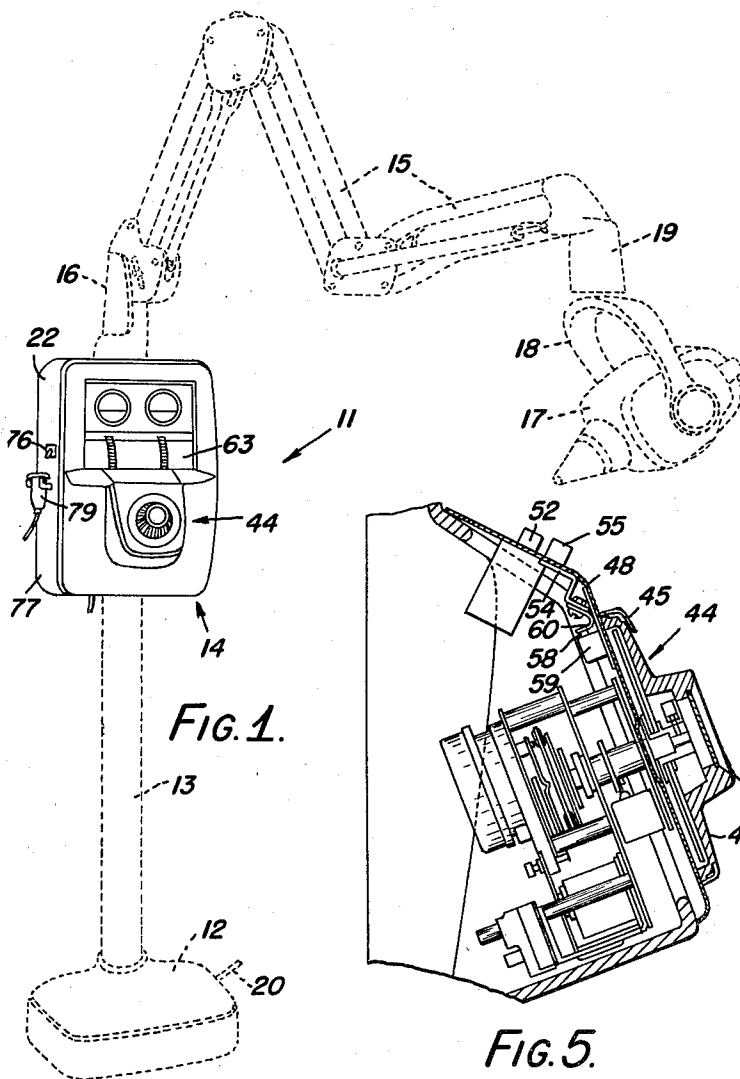
March 13, 1962

N. E. LAUTERBACH
CONTROL PANEL FOR X-RAY UNIT

3,025,401

Filed Oct. 28, 1957

4 Sheets-Sheet 1



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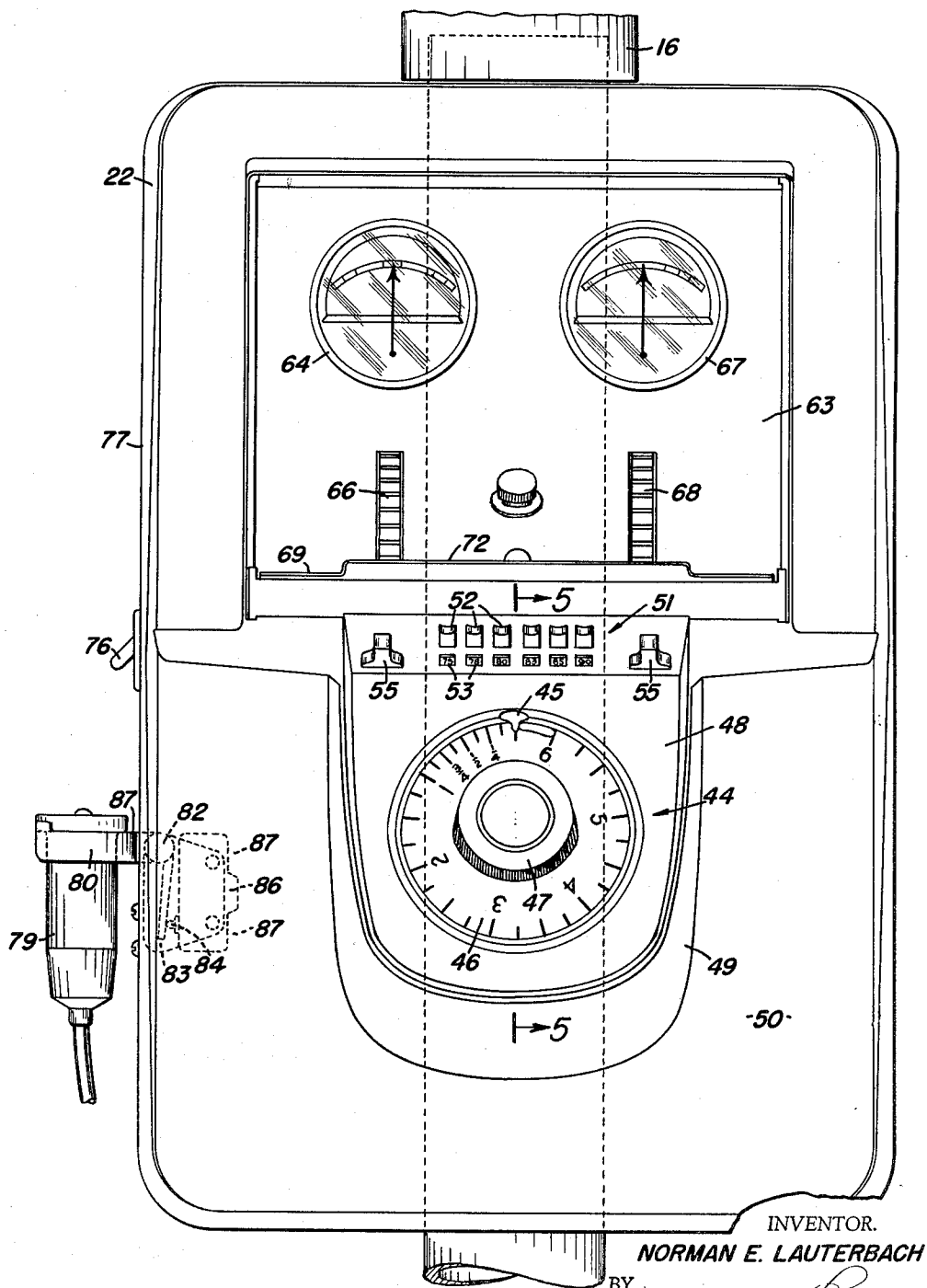


FIG. 2.

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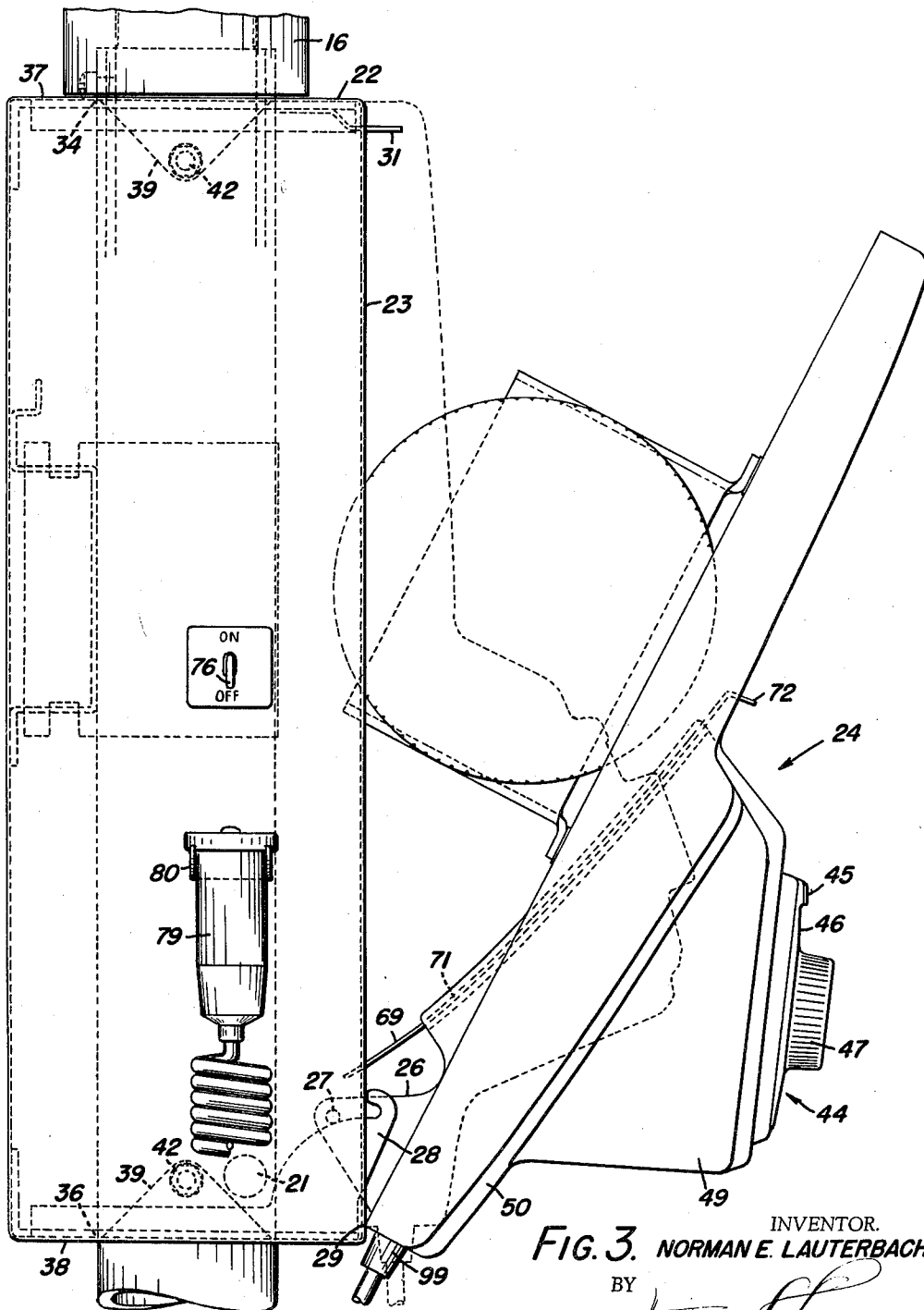
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4 Sheets-Sheet 3



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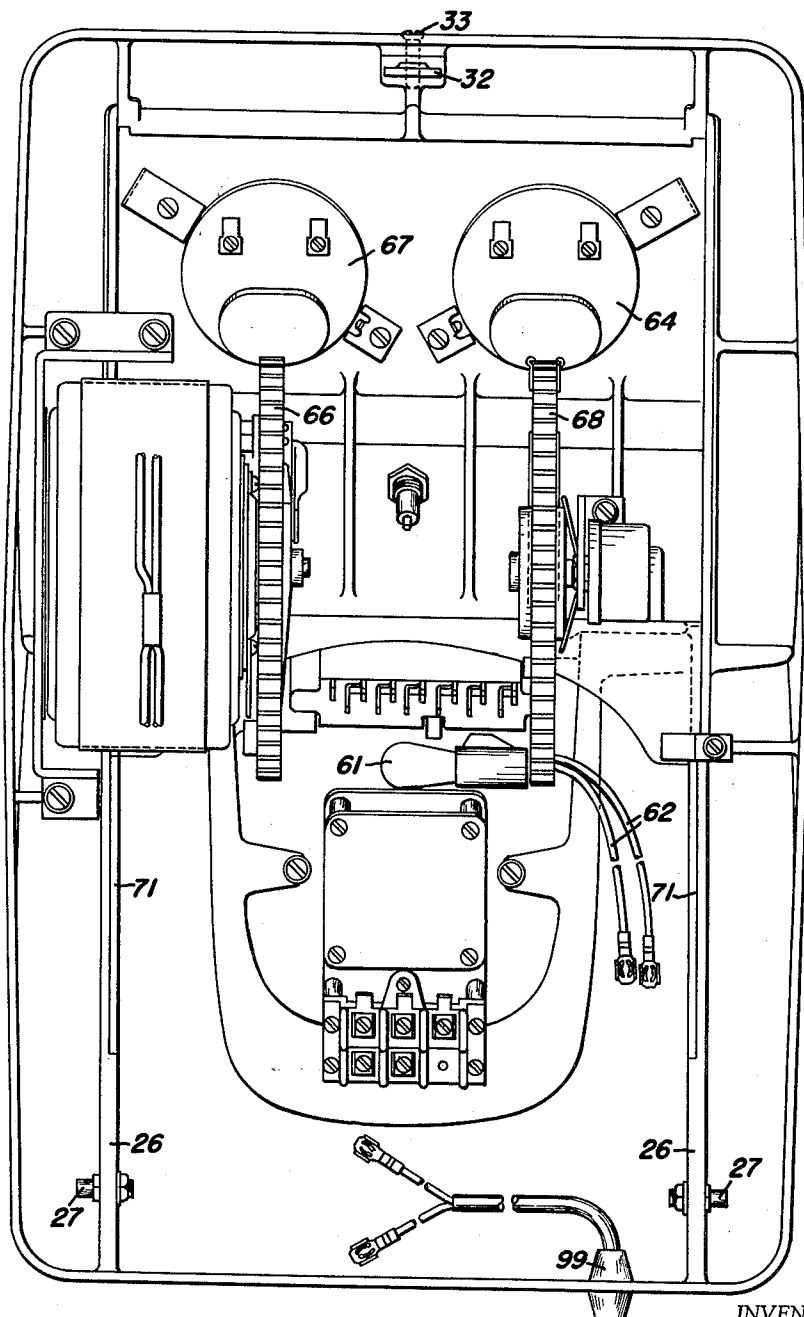
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4 Sheets-Sheet 4



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FIG. 4.

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3,025,401

CONTROL PANEL FOR X-RAY UNIT

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14 Claims. (Cl. 250-93)

This invention relates to X-ray apparatus and more particularly to the construction of an electrical control unit for housing the control instrumentalities used in the operation of an X-ray unit of the type employed primarily in dental radiography.

In the operation of X-ray units of the type used primarily in dental radiography, the calibrating, regulating and actuating control instrumentalities for the unit are generally consolidated in a control unit for convenience and to conserve space. These control units, of necessity, contain a multitude of such instrumentalities as line voltage and current compensators, switches and the like, many of which are required to be manipulated by a relatively skilled operator. The use of only a portion of the control instrumentalities is required during the actual operation of the X-ray unit and, in previous constructions, the infrequently needed components such as the X-ray unit calibrating devices usually requiring adjustment only during the initial installation of the unit, were exposed for possible unnecessary manipulation by a relatively unskilled operator.

With such a multitude of compactly arranged control instrumentalities in the control unit, maintenance was difficult in that the various components were not readily accessible and a great deal of time was expended in locating the source of trouble and replacing defective parts. Furthermore, previous arrangements of the control instrumentalities on the control unit made operation of the X-ray unit by an operator awkward in that many components were not clearly visible or inaccurate settings could be easily made.

Accordingly, a primary object of this invention is to provide a new and novel control unit for use with an X-ray unit of the type employed primarily in dental radiography.

Another object of this invention is to provide a new and novel control unit in which the control instrumentalities employed in calibrating the X-ray unit may be concealed so as to obviate manipulation by a relatively unskilled operator during the operation of the unit.

A still further object of the invention is to provide a new and improved control unit which is relatively simple in construction, inexpensive to manufacture and maintain, presents a pleasing and attractive outer appearance and which may be easily operated without risk of inaccurate settings as a result of the novel arrangement of its components.

Still another object of this invention is to provide a new and novel operating handswitch for the control panel of such an X-ray unit.

This invention further contemplates the provision of a new and novel control panel which contains many of the control instrumentalities for an X-ray control unit and which may be easily and quickly replaced by a similar panel if breakdown occurs.

Other objects and advantages of this invention will be particularly set forth in the claims and will be apparent from the following description, when taken in connection with the accompanying drawings, in which:

FIG. 1 is an elevation view of an X-ray unit of the type used in dental radiography which incorporates the invention;

FIG. 2 is an enlarged, front view of the control unit incorporated with the X-ray unit of FIG. 1;

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FIG. 3 is a side view of the control unit of FIG. 2, showing the control panel swung to a partially open position;

FIG. 4 is a rear view of the control panel of FIG. 3;

FIG. 5 is a fragmentary, sectional view taken substantially along line 5-5 of FIG. 2 in the direction of the arrows;

FIG. 6 is an enlarged, fragmentary front view of a portion of the control panel of FIG. 2; and

FIG. 7 is a sectional view of the handswitch associated with the control unit of FIG. 2.

Referring now to FIG. 1, there is shown an X-ray unit of the type primarily employed in dental radiography and designated generally by the numeral 11. The X-ray unit 11 comprises a base 12, a substantially vertical, tubular, supporting post 13, the lower end of which is secured to the base 12, a control unit, constructed in accordance with the invention and designated generally by the numeral 14, a folding bracket 15 secured for limited rotation to the top of the supporting post 13 by means of support 16, and an X-ray head 17 rotatably mounted in a yoke 18 which is also rotatably mounted on the outer end 19 of the folding bracket 15. The head 17 contains an X-ray tube (not shown) which, when energized, directs a beam of radiation toward the subject to be radiographed in the manner well known in the art. It should be understood that in the X-ray unit of FIG. 1, the construction of the bracket 15 and its associated parts permit the head 17 to be moved from a retracted position to a location within a range of operative positions so as to enable the production of X-ray photographs of selected portions of a subject.

The X-ray unit is energized by means of electrical circuit conductors 20 connected to a suitable source of power (not shown), which are preferably carried into the base 12 and upward along the inner bore of post 13 to an opening 21. The conductors are brought through the wall opening 21 and are connected to the appropriate terminals within the control unit 14. It should be understood that, by means of suitable conductors (not shown), a connection is made from the appropriate control unit terminals to the X-ray head 17. Preferably, these conductors are inserted within the post opening 21 so that they may be brought upward through the post 13 and along the folding bracket 15 to the head 17. It should also be understood that, in the present application, the electrical circuitry form no part of the invention and it is the construction of the control unit 14 and the arrangement of the control instrumentalities that the inventor claims as his novel contribution to the art.

Referring now to FIGS. 2, 3, in accordance with the construction of the invention, the control unit 14 comprises a substantially rectangular housing or cabinet 22 open at its front at 23. The housing opening 23 is arranged to be closed by a closure or control panel, designated generally by the numeral 24, which is arranged to pivot at a point adjacent its horizontal lower edge as shown in FIG. 3. The panel 24 is provided with a pair of spaced brackets 26 attached thereto, each of which contain a laterally projecting pin 27 on the outer side thereof. These pins 27 are arranged to engage with correspondingly spaced, hooked brackets 28 on the cabinet 22. The panel 24 may be moved to the open position by pivoting it outwardly until the pins 27 seat within the hooked brackets 28 and the lower edge 29 of the panel contacts the housing 22 in supporting engagement. As can be seen, the control panel may be easily removed from the cabinet 22 by merely lifting the same upwardly so that pins 27 clear brackets 28. The electrical components on the panel are preferably connected to the circuits

in the cabinet by means of detachable connectors, such as a multi-conductor plug, or the like, so that the panel may be completely removed for replacement or repair.

The panel 24 is held in the closed position of FIG. 1 by the locating of the pins 27 at the lower end of brackets 28 and by a tab 31 fixedly mounted on the cabinet (FIG. 3) which is receivable within a recess 32 (FIG. 4) on the panel 24 when the panel is in the closed position. A removable screw 33 may be inserted through the tab 31 when it is seated within recess 32 to securely hold the panel in the closed position.

In order to mount the control unit 14 on the supporting post 13 in the position of FIG. 1, the cabinet 22 is provided with openings 34, 36 in the top and bottom walls 37, 38, respectively. Oppositely disposed brackets 39 are provided on the cabinet adjacent each opening. The supporting post 13 extends through the openings 34, 36 in loose fitting engagement therewith and the panel is secured to brackets 39 by means such as bolts 42 which engage within suitable recesses provided on the post. Thus unit 14 is positioned in a substantially vertical plane, as shown in FIG. 3, and at the proper height on post 13 so as to be easily accessible to the operator. It will be noted that the upper end of the post 13 projects upwardly through the upper panel wall 37 to permit attachment of the folding bracket support 16.

The panel 24 is provided with a group of control instrumentalities by which the X-ray unit may be calibrated and operated. More specifically, the panel 24 contains a timer, designated generally by the numeral 44, provided with a stationary pointer 45 and graduated dial 46 which in the preferred embodiment has a maximum time setting of six seconds. It should be understood that the timer 44 is preferably of the type which enables the operator to set the unit for a predetermined interval of X-ray exposure time by rotating the dial 46 through an operating knob 47 to the appropriate position.

Furthermore, during the timing operation of the timer, the dial rotates until the cycle is complete, whereupon the dial is automatically returned to the original time setting.

The timer 44 is suitably secured to a plate 43 which is formed so as to be appropriately mounted within a raised portion 49 on the forward face 50 of the cover. The timer dial 46 is thus mounted, as shown best in FIG. 5, so as to face slightly upward to facilitate dial reading during the setting of the timing cycle by the operator. The dial pointer 45 is stationary and at the top of the timer dial so as to be easily visible to the operator. Furthermore, in the timer construction, the dial 46 has been greatly enlarged so that an extremely fine time setting may be obtained on the timer.

As it is often necessary to select a predetermined operating voltage for the X-ray unit, a voltage selecting device, designated generally by the numeral 51, is positioned on the panel plate 50 above the timer 44 so as to be readily accessible to the operator. As shown best in FIG. 5, a plurality of push buttons 52, preferably six in the illustrated embodiment, are provided for selecting the unit operating voltage at various voltage levels within two voltage ranges. A window 53 is provided in the plate below each push button through which is visible the particular voltage determined by each push button. These operating voltages are suitably marked on a bar 54 mounted for transverse sliding movement (FIG. 6) between two positions, each of which exposes a range of voltages through the windows 53.

The bar 54 is moved to one of the two positions by means of a pair of slide buttons 55 suitably attached through a plate slot 56 to each end of bar 54 by means of a pin 57. In one position of the bar 54, the contact button 58 of a switch 59 is depressed by means of switch arm 60 connected to the bar 54 to give one range of operating voltages, while a second voltage range is obtainable when the bar is moved to the other position

wherein the button is released by the arm 60. Thus, in each position of bar 54 six operating voltages may be selected for the unit which, in the illustrated embodiment, range from 60 to 73 kilovolts in the "lower" range and from 75 to 90 kilovolts in the "higher" range as shown. If desired, both the timer 44 and voltage selecting device 51 may be illuminated by means of a light 61 suitably connected to the control unit by means of conductors 62 (FIG. 4).

Referring now to FIG. 2, the panel face 49 is also provided with a substantially rectangular, recessed portion or face 63 in which are located the calibrating instrumentalities for the X-ray unit. These calibrating instrumentalities are adjustable for connecting the unit to the proper line current and voltage. More specifically, a current meter 64 such as a milliammeter is suitably mounted on face 63. By means of a control wheel 66 suitably mounted on the panel with a portion projecting outwardly through face 63, the current level at which the unit is to be operated may be preset by manipulation of the wheel 66 in the proper direction while referring to the meter 64. Similarly, a voltmeter 67 is mounted on the panel so as to project a limited extent through the face 63. The input voltage to the unit may be preset using a control wheel 68 as in the case of the current calibrating procedure and the voltmeter will also indicate whether the line voltage drop is excessive when the X-ray unit is operated under load conditions. It should be understood that the control wheels 66, 68 need only project a sufficient distance through face 63 so as to be accessible to the operator. In X-ray units of the type illustrated, satisfactory operating results have been obtained using an operating current of 10 milliamperes.

In everyday practice, it is often necessary that relatively unskilled operators such as dental assistants, hygienists, and the like, be assigned the task of operating the X-ray unit 11 so as to relieve the dentist or skilled operator and permit him to devote his time to other matters while he must handle personally. Generally, the control wheels 66, 68 need not be disturbed once the unit is calibrated, and the operator need only set the voltage selecting device 51 and the timer 44, a relatively simple operation, each time the unit is used. It is highly desirable, therefore, that the control wheels 66, 68 be concealed after the unit is calibrated, so that the unskilled operator will not inadvertently or improperly turn these wheels and upset the unit calibration. Means therefore have been provided to conceal the wheels 66, 68, when desired, so that the wheels are not exposed to the unskilled operator.

More specifically, there has been provided as shown in FIGS. 2, 3, a partition or door 69 composed of thin, slightly flexible material such as sheet metal or plastic which is vertically slidable on shoulders 71 arranged along each inner side edge of the panel 24 (FIG. 4). The door 69 may be manipulated by means of a flange 72 along its upper edge and is arranged to move between a retracted position wherein the control wheels 66, 68 and indicators 64, 67 are exposed and a closed position in which the face 63 together with the control wheels 66, 68 and indicators are concealed. In FIG. 1, the door 69 is shown in an open position.

In order to energize the electrical system in the unit, a main switch 76 is mounted on the side wall 77 of the cabinet 22 and is appropriately connected to the control unit terminals so as to be switched between an "off" position wherein the X-ray unit is completely de-energized and an "on" position wherein the components of the control unit are connected to a source of power for subsequent operation of the unit.

In order to control the activation of the X-ray tube (not shown) which generates the projected beam of X-rays, a handswitch 79 is arranged to be hung from the arms 80 of a "telephone" type hook pivotally attached at 82 to the cabinet sidewall 77. The hook 81 has a down-

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wardly depending leg 83 within the cabinet engageable with an outwardly urged, contact button 84 of a micro-switch 86 suitably mounted in the cabinet and appropriately connected from its terminals 87 to the filament of the X-ray tube in head 17. Thus, downward movement of the hook arms 80 will pivot arm 83 and depress contact button 84. This tube filament, which is normally energized when the button 84 is released, is thus de-energized. In the embodiment illustrated, the weight of hand-switch 79 is sufficient to pivot "hook" switch 81 and depress the contact button 84.

Referring now to FIG. 7, the handswitch 79 comprises push-button switch 89 having a manually operable button 91. The switch 89 is provided with a flange 92 which is resiliently accommodated within groove 93 at the upper end of a tubular casing 94. The casing 94 is preferably composed of a resilient material such as rubber and contains a peripheral flange 96 and an opening 97 through which extends conductors 98, suitably connected to switch 89. At the opposite end, the conductors 98 extend through a panel fitting 99 (FIG. 4) and are connected to the appropriate terminals on the control unit. As shown, the conductors are preferably of the sheathed "coiled cord" type so that they may be extended in length from the retracted condition shown in FIG. 4.

The push-button switch 89 is appropriately connected to energize the X-ray tube when its button 91 is depressed by the operator and deliver the necessary radiation to the subject. The push button 91 simultaneously initiates the operation of the timer 44 so that when a time interval has been preset by means of the timer knob 47, depression of the push button 91 causes the timer to rotate during the energization of the X-ray tube. The timer, of course, will de-energize the tube at the end of the time cycle. It should be understood that the operation of the various control instrumentalities in the control panel 14 and X-ray unit 11 have been described primarily to illustrate their novel arrangement and no circuitry has been shown as it forms no part of this invention.

One of the outstanding features of the invention is the arrangement of the major portion of the control instrumentalities in the panel 24. As described, the panel contains such devices as the handswitch 79, the calibrating instruments 64, 67 and wheels 66, 68, the timer 44, and voltage selecting device 51. In the event of breakdown in any of these devices, the panel may be simply removed without disconnecting the electrical connection to cabinet 22 and replaced until repairs can be made so that interruption of the unit operation is kept to a minimum.

In the operation of the X-ray unit 11 after it has been assembled and installed as described above, the unit is adjusted for the proper input current and voltage by means of the control wheels 66, 68 with the door 69 in the retracted position of FIG. 2. The door is then pulled upwardly to conceal the face 63 in the front of panel 24 and thus concealing both the indicators and the control wheels. The only control devices exposed now are the voltage selecting device 51 and the timer 44. When the unit is to be used for dental radiography of a subject, the proper operating voltage is established by means of the sliding buttons 55 and push buttons 52. The time for the operating cycle may be preset by rotating the manual operating knob 47 until the timer is indexed at the proper time setting. The main switch 76 is now moved to the "on" position and the operator may lift the switch 79 from the hook 81 permitting the microswitch button 84 to move outwardly energizing the filament of the X-ray tube. It should be understood that the filament is preferably of the type which when energized will warm the X-ray tube to operating temperature in less than one second. The unit is now ready for operation and when the push button 91 on switch 89 is depressed, the unit radiates and the timer rotates to de-energize the unit at the end of the predetermined cycle and return automatically to the original time setting.

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While there has been shown and described the preferred forms of mechanisms of the invention, it will be apparent that various changes and modifications may be made therein, particularly in the form and relation of parts, without departing from the spirit of the invention as set forth in the appended claims.

I claim:

1. A control unit for electrical apparatus comprising, in combination, a cabinet having an access opening, a frontpanel movably mounted on said cabinet and arranged to close said opening, X-ray unit calibrating, control and timing means for said apparatus mounted on said panel so as to be accessible by an operator, and switch means associated with said unit for actuating said apparatus.

2. A control unit for an X-ray unit comprising, in combination, a cabinet having an access opening, a front panel pivotally mounted on said cabinet and arranged to close said opening, X-ray unit calibrating, control and timing means for said X-ray unit mounted on said panel so as to be accessible by an operator, and switch means associated with said panel for actuating said X-ray unit.

3. A control unit in accordance with claim 1 wherein said switch means includes a handswitch removably mounted on said cabinet to enable the operator to actuate said apparatus at a removed position from the control unit.

4. A control unit in accordance with claim 2 wherein said panel with its associated calibration, control and timing means is detachably mounted on said cabinet for removal as a unit for replacement or repair.

5. A control unit in accordance with claim 2 including an upstanding post for supporting said unit, said post arranged to extend through said cabinet in supporting relationship therewith, said post being adapted to enclose first circuit conductors extending from a source of power through said post to said control unit and enclose second circuit conductors extending from said control unit to an X-ray head.

6. A control unit for an X-ray unit comprising, in combination, a cabinet having an access opening, a front panel movably mounted on said cabinet and arranged to close said opening, X-ray unit calibrating, control and timing means for said X-ray unit mounted on said panel so as to be accessible by an operator, door means in said panel movable from a retracted position to a position for concealing said calibrating means, and switch means associated with said unit for actuating said X-ray unit.

7. A control unit in accordance with claim 6 wherein said door means comprises a sheet of flexible material mounted on said cover for substantially vertical reciprocating movement.

8. A control unit for an X-ray unit comprising, in combination, a cabinet having an access opening, a detachable front panel movably mounted on said cabinet arranged to close said opening, timer, control and calibrating means for said X-ray unit mounted on said panel so as to be accessible by an operator, said calibrating means comprising current and voltage standardization means, a door on said panel slidably movable between a retracted position to a position for concealing said current and voltage standardization means, and switch means associated with said control unit for actuating said X-ray unit.

9. A control unit in accordance with claim 8 wherein said switch means includes a handswitch removably mounted on said cabinet to enable the operator to actuate said apparatus at a removed position from the control unit.

10. A control unit in accordance with claim 8 wherein said control means includes voltage selecting means for said unit on said panel accessible to an operator, said voltage selecting means comprising a plurality of push-

button switches for selecting a unit operating voltage within a voltage range.

11. A control unit in accordance with claim 8 wherein said control means includes voltage selecting means for said unit on said panel accessible to an operator, said voltage selecting means comprising a plurality of push-button switches for selecting a unit operating voltage within a voltage range and a selector switch for determining the voltage range from which said operating voltage is selected by said push buttons.

12. A control panel in accordance with claim 8 in combination with an X-ray tube, means for preheating and means for energizing said X-ray tube, and wherein said switch means includes a weight operated switch for actuating said preheating means and a handswitch for actuating said tube energizing means, said handswitch being arranged to be hung on said weight operated switch and de-activate said preheating means.

13. A control unit for an X-ray unit comprising, in combination, a cabinet having an access opening, a detachable front panel mounted on said cabinet arranged to close said opening, timer, control and calibrating means for said X-ray unit mounted on said panel so as to be accessible by an operator, said panel with its associated calibration, control and timing means being detachably mounted on said cabinet for removal as a unit for replacement or repair, said calibrating means comprising current and voltage standardization means, a door on said panel slidably movable between a retracted position to a position for concealing said current and voltage standardization means, said control means including voltage selecting means for said unit on said panel ac-

cessible to an operator, and switch means associated with said control unit for actuating said X-ray unit.

14. A control unit for an X-ray unit comprising, in combination, a cabinet having an access opening, a detachable front panel pivotally mounted on said cabinet arranged to close said opening, a timer, a control and a calibrating means for said X-ray unit mounted on said panel so as to be accessible by an operator, said panel with its associated calibrating, control and timer means being detachably mounted on said cabinet for removal as a unit for replacement or repair, said calibrating means comprising current and voltage standardization means, said control means including voltage selecting means for said unit on said panel accessible to an operator, said voltage selecting means comprising a plurality of push-button switches for selecting a unit operating voltage within a voltage range and a selector switch for determining the voltage range from which said operating voltage is selected by said push-buttons, means for preheating an X-ray tube, means for energizing an X-ray tube, said preheating means including a weight operated switch for actuating said means and a handswitch for actuating said tube energizing means, said handswitch being arranged to be hung on said weight operated switch and thereby de-activate said preheating means, said weight operated switch being pivotally connected to said cabinet.

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