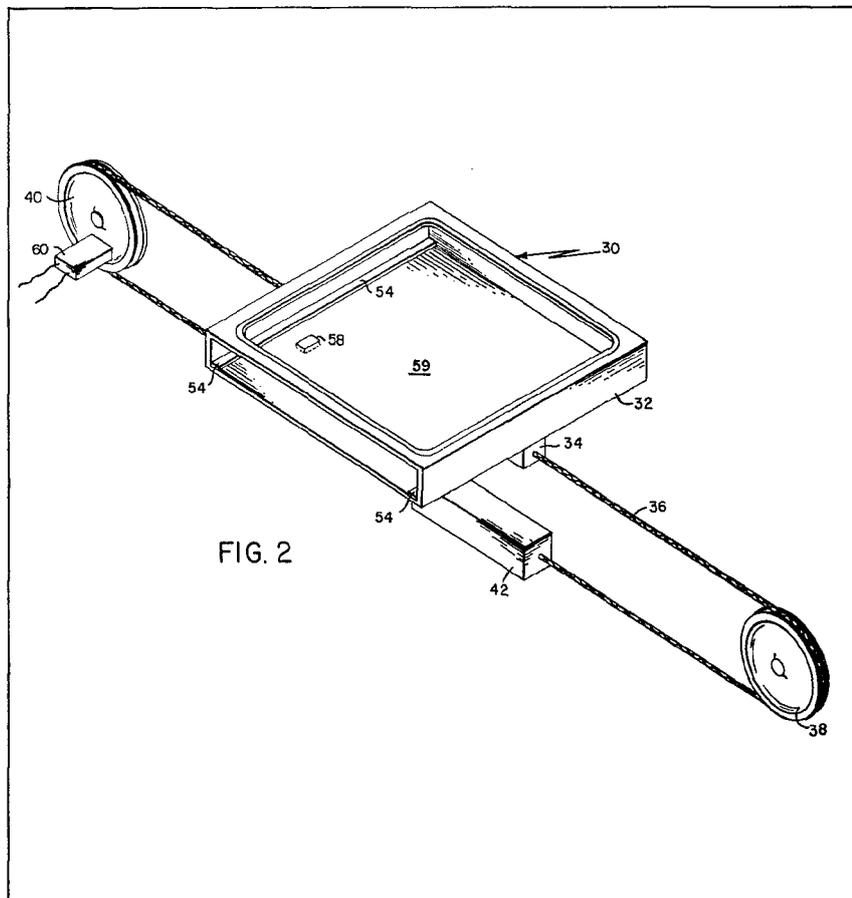


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(54) X-ray table

(57) An X-ray radiographic or fluoroscopic table includes a film holder 30 including a frame 32 attached to a cable 36 running over end pulleys 38 and 40 for positioning the holder longitudinally as desired under the table top. The holder has a front opening for slidably receiving a cassette-supporting tray which can be slid out on tracks 54 to change the cassette and slid in for exposure. A reed switch 58 on the

frame is opened by a permanent magnet on the tray only when the tray is half-way out. When the tray is half-way out, an electromagnet 60 locks the pulley and locks the holder in place. The holder is thus automatically locked in place not only during exposure (tray in) but when the tray is out for changing the cassette. To re-position the holder, the operator pulls the tray half-out and, using the tray itself, pushes the holder along the table, the holder being counterbalanced by a weight 42.



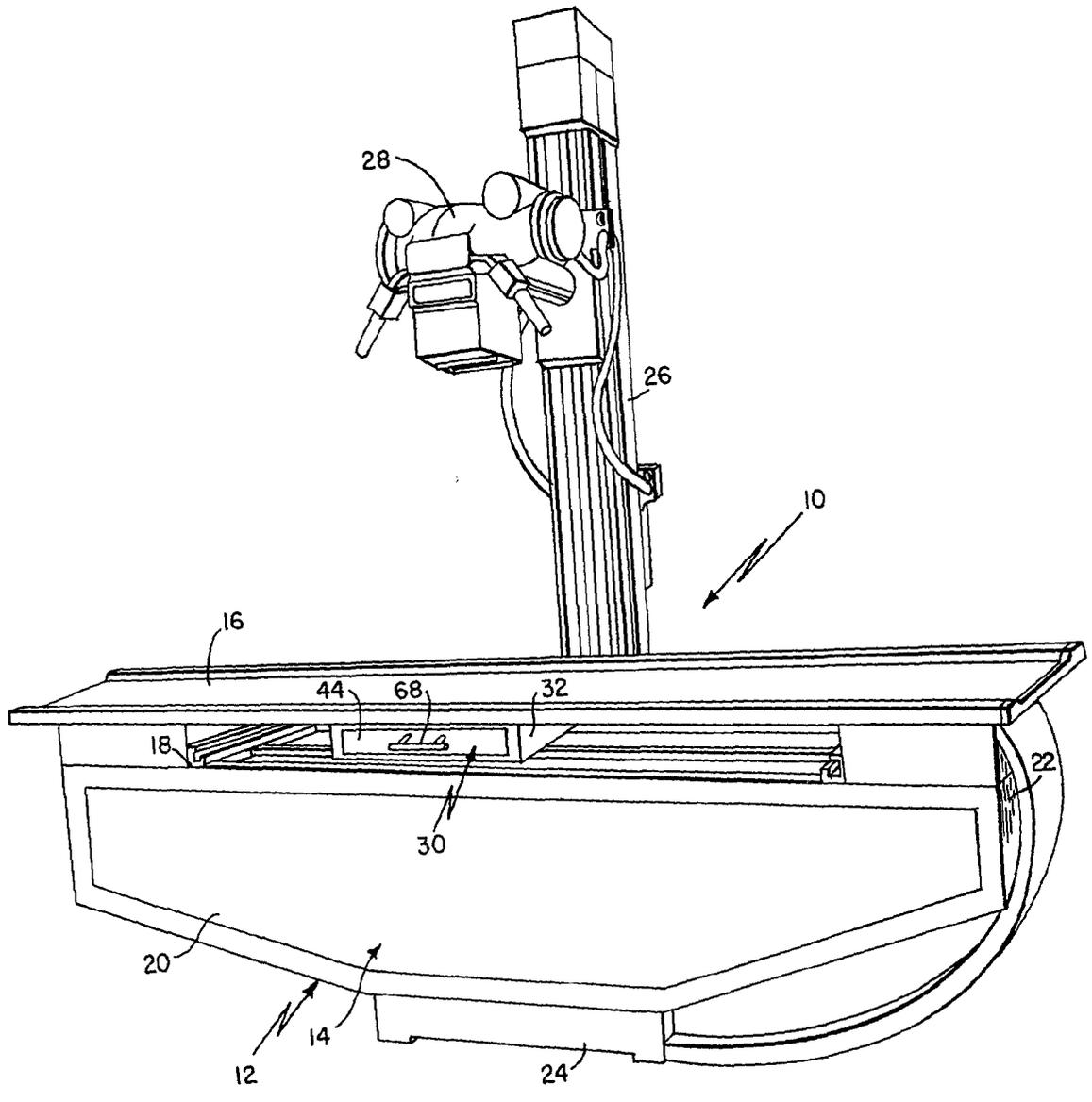


FIG. 1

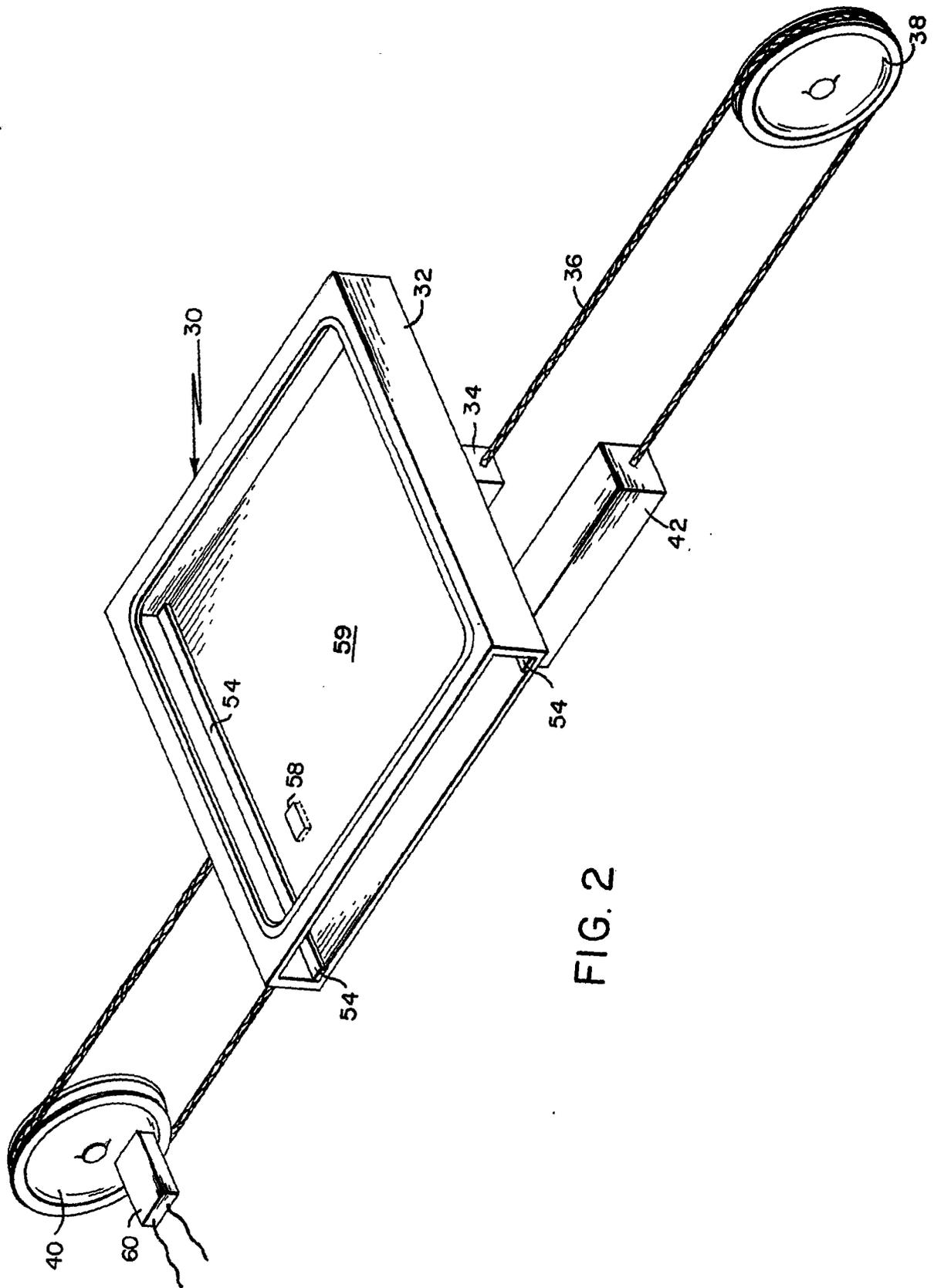


FIG. 2

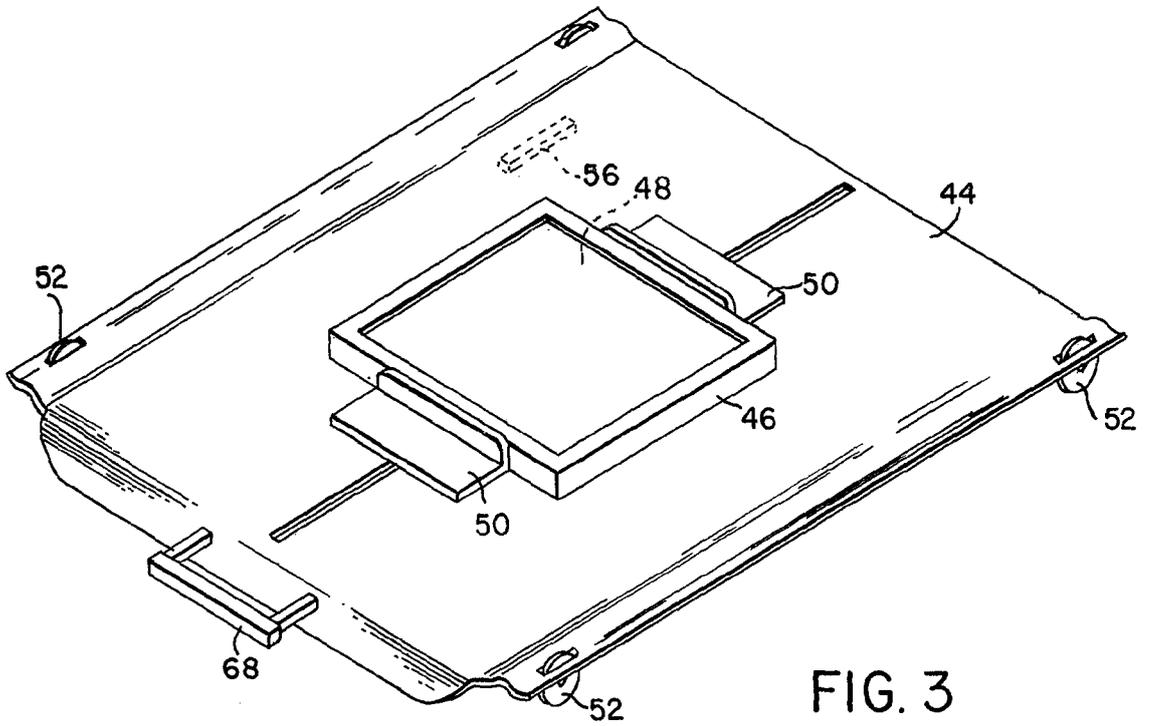


FIG. 3

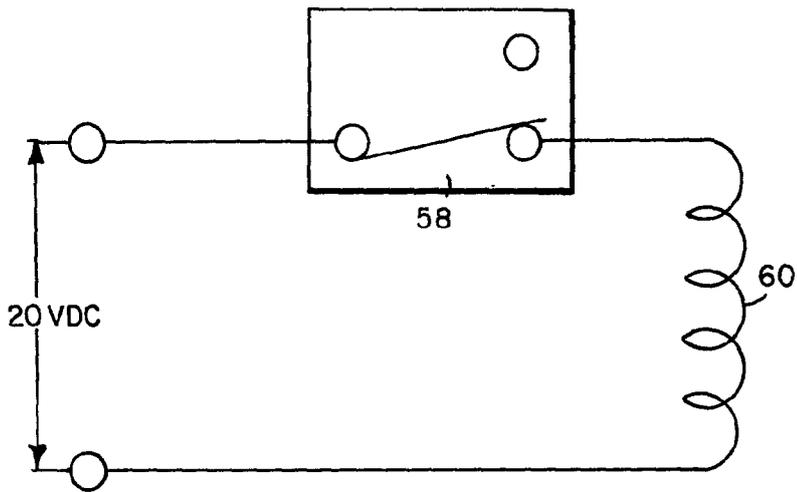


FIG. 8

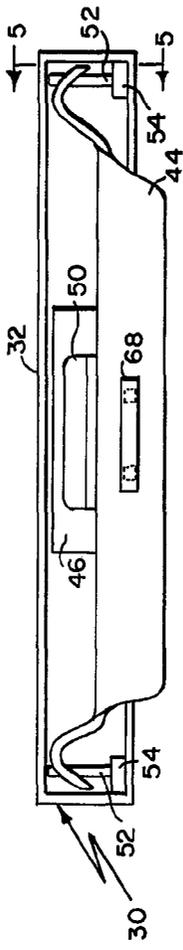


FIG. 4

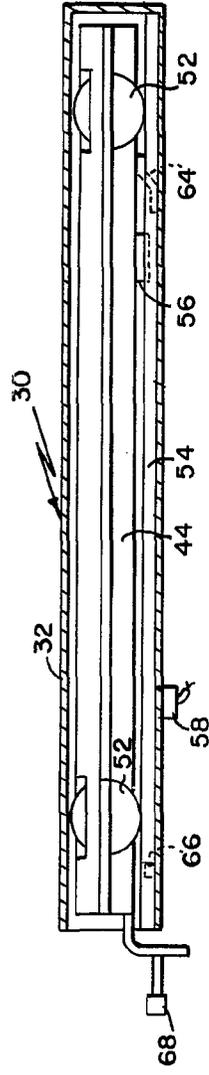


FIG. 5

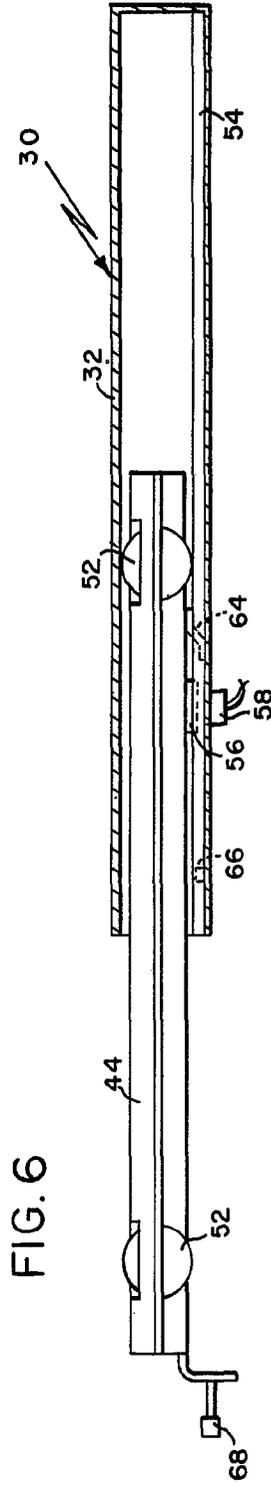


FIG. 6

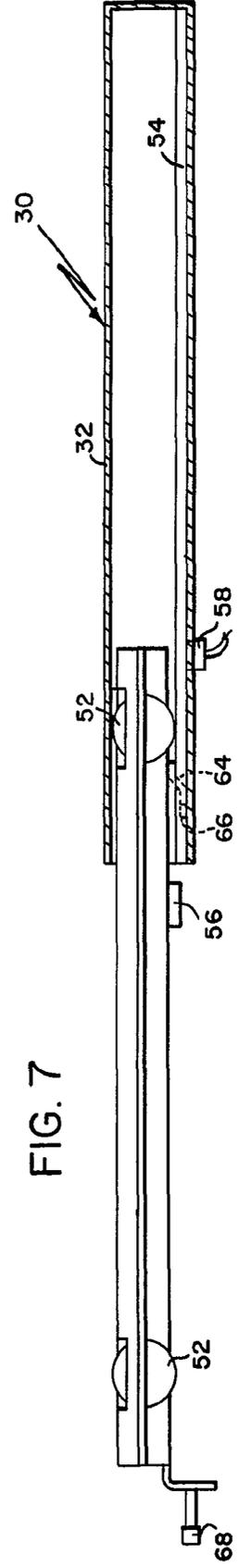


FIG. 7

SPECIFICATION

X-ray table

5 This invention relates to X-ray fluoroscopic tables and has particular reference to such tables which are adapted to support a patient in a position such that X-rays or other similar radiation may be directed through the patient to an image receptor which comprises a radiation-sensitive film for producing a visible image of the irradiated area of the patient.

10 In conventional X-ray systems the X-ray sensitive receptor or film is mounted in a cassette which is supported on a tray, called a bucky tray, adapted to be slid into and out of a support called a bucky frame. The bucky frame is a shallow, boxlike device having an open top and a front opening through which the tray is inserted into the frame whereby X-rays entering the frame through the open top will impinge upon the film supported on the tray. The table has an X-ray transparent top upon which the patient reposes, and the bucky frame is located in the table beneath the top. Since it is undesirable to continually reposition a patient during a series of X-ray exposures, the bucky frame is movably mounted in the table so that it may be adjusted with respect to the patient in a direction longitudinally of the table.

20 The bucky (frame and tray) weighs over 9kg and the cassette weight varies from 0.5 to 3.6kg and may be as large as 43cm square. Therefore, considerable weight is involved when a bucky frame, tray and cassette are to be moved as a unit.

30 Movement of the bucky frame, and consequent adjustment of the position of the film, has been accomplished by attaching the ends of a cable to the frame and mounting the cable on pulleys so that, upon manual manipulation of a crank attached to one of the pulleys, the pulley can be rotated with consequent movement of the cable and frame.

40 In a tilting table the bucky frame is counterbalanced so that the operator can position it easily regardless of the tilt position of the table. However, the counterweight can accommodate only one combination of cassette and bucky weights. Therefore, it was necessary to additionally provide a mechanical lock to immobilize the bucky in its adjusted position.

50 Other prior developments included the provision of a rack and pinion device for moving the bucky and a mechanical clamp for locking it in place. A still later development involves the use of an electric motor with push button operation to move the cable and an electromagnet for rendering a pulley immovable to lock the bucky in adjusted position.

60 To install a cassette, the operator will pull a tray out of a bucky frame to its maximum "out" position as determined by a mechanical retainer, place the cassette between two clamping bars, and manipulate a lever which sets the bars. The tray is then reinserted in the bucky frame. Since both hands are required to install the cassette, it is a cumbersome and awkward maneuver by the operator to activate and deactivate a separate bucky lock during the loading and unloading procedures. When an operator neglects to operate the lock the bucky may

inadvertently move with consequent damage to the mechanism or disturbance of the patient.

70 In order to overcome these objections, the present invention provides an X-ray table comprising a base, a top positioned on the base, a bucky mounted beneath the top so as to be movable in the longitudinal directional of the table, the bucky comprising a frame having a front opening and a cassette tray slidable into and out of the frame through the opening, and means arranged automatically to immobilize the bucky at at least one position of the tray within the frame.

80 In the preferred embodiment, the bucky is automatically locked both when the tray is in a loading position and when it is in an exposure position and is automatically unlocked when the tray is in an intermediate position. Thus, the bucky frame is movable longitudinally of the table by means of a cable and metal pulleys, with a balance weight being located on the cable for counterbalancing the weight of the bucky frame-tray assembly. The base of the frame carries a switch, such as a magnetically actuated reed switch or axial travel switch which is electrically connected to an electro-magnet located in close proximity to one of the metal pulleys. The switch is adapted to be actuated by a magnet which is carried by the tray whereby when the tray is slid into the frame to an intermediate position the magnet will cause the switch to open the electrical circuit to the electromagnet, freeing the pulley, and allowing the bucky frame and tray assembly to be moved.

90 When the tray is pulled out to load position where a cassette may be positioned on or clamped to the tray, or is pushed in to the home position where an X-ray exposure may be made, the magnet is not located close enough to the switch to cause the switch to be activated. Thus, the switch, which is normally closed, will complete the circuit to the electromagnet, causing the adjacent pulley, and consequently the bucky assembly, to be immobilized.

100 With a table constructed in accordance with this invention, an operator can use both hands to locate a cassette on a tray held by an immobilized bucky frame, and then by adjusting the tray to an intermediate point in the frame he can simply adjust the bucky to a position where the tray is properly aligned in a preselected position, following which he can then push the tray the remainder of the way into the frame to immobilize it and permit an X-ray exposure to be made.

110 The invention will be described in more detail, by way of example, with reference to the accompanying drawings, in which:-

120 *Figure 1* is a perspective view of a fluoroscopic X-ray table embodying the invention;

Figure 2 is an isometric view pictorially illustrating the bucky adjusting system;

125 *Figure 3* is an isometric view of the bucky tray;

Figure 4 is a front elevational view of the bucky including frame and tray;

130 *Figures 5, 6 and 7* are sectional views taken on line 5-5 of *Figure 4* showing the bucky tray in three different positions in the bucky frame; and

Figure 8 is a schematic diagram of the bucky locking circuit.

Figure 1 shows an X-ray machine 10 which includes an X-ray table 12 having a base 14 and a top 16. The top 16 is secured upon a frame or carriage 18 for planar movement in any direction, the means for accomplishing such movement not forming any part of this invention. The base 14 has a depending front panel 20 and end panels 22 which overlie a fixed pedestal 24 upon which the base tiltable, as is well known in the art.

Although not a part of the present invention, the X-ray machine 10 is shown as including a tube stand 26 that supports a vertically adjustable X-ray generator 28 which is normally positioned above the table top 16. Details of the generator and associated mechanism are well known and, therefore, not described herein.

Between the top of the base 14 and the table top 16 is a longitudinally extending space which opens at the front of the table so that a bucky 30 may be inserted and adjusted beneath the top 16 so as to be properly positioned with respect to the X-ray generator 28. Thus, when the generator 28 and the bucky 30 are properly related, X-rays from the generator 28 will pass through a patient lying on top 16 and through the top to a film which is carried within the bucky.

The bucky 30 includes a bucky frame 32 which is better shown in Figure 2. The frame 32 carries a fixed clamp or block 34 on its underside to opposite ends of which are attached the two ends of a cable 36. The cable 36 runs over spaced pulleys 38 and 40 which are rotatably mounted in respective end portions of the table base 14. Thus, the bucky frame 30 may be easily slid longitudinally off the table within the space beneath the top 16. A weight 42 is carried by the cable 36 to counterbalance the weight of the bucky frame 30 and a bucky tray and cassette carried by the frame.

The bucky frame 30 is open at the top and has a front opening through which a bucky tray 44 (Figures 1 and 3) may be inserted into the frame. The tray 44 supports a cassette 46 which carries an X-ray sensitive film 48. The cassette 46 is centered on the tray 44 between adjustable clamps 50 and can be aligned with the X-ray generator 28 in the known manner.

The sides of the tray 44 are provided with rollers 52 which ride along track portions 54 of the frame 32 when the tray is being inserted into or withdrawn from the frame. The under side of the tray 44 has attached to it near one side a magnet 56, preferably a bar magnet, which is positioned in proximity to a switch 58 carried by the bottom 59 of the frame 32 when the tray is withdrawn half-way out of the frame. When the tray 44 is located in the half-way position illustrated in Figure 6, the magnet 56 will be located immediately above the switch 58.

The switch 58, which may be a reed switch or an axial travel switch, is a normally closed single pole switch connected at one side to a suitable source of power (see Figure 8) such as 20 or 24 volts DC at the opposite side to an electromagnet 60 which is located closely adjacent the face of one of the

pulleys 40, as shown in Figure 2. Since the switch 58 is normally closed, the electromagnet 60 will normally be energized. This will immobilize the pulley 40 and consequently the cable 36 and bucky 30 cannot be normally moved.

When a cassette 46 is to be loaded onto a tray 44, the tray is pulled out of the bucky frame 32 to the fullest extent possible without removing it entirely, this being controlled by a spring member 64 (Figure 7) which is fixed to the under side of the tray 44 in a position where it will engage a stop 66 on the bucky frame 32. Thus, when the tray is pulled out of the frame to the point where the spring member 64 engages the stop 66, as shown in Figure 7, the magnet 56 is sufficiently far enough away from the switch 58 that its magnetic field will not cause the switch to open. Thus, the bucky is immobilized and the operator can use both hands to load a cassette 46 on the tray 44.

When the tray 44 is pushed into the frame 32 to approximately the midpoint, as shown in Figure 6, the magnet 56 will open the switch 58, deenergizing the electromagnet 60, and allowing the bucky 30 to be adjusted longitudinally to the table. This can be done by the operator very easily by merely grasping the handle 68 on the tray and applying pressure in the direction in which the bucky is to be moved.

When the bucky 30 has been suitably adjusted, the tray 44 will then be pushed all the way in to the home position as shown in Figure 5. When in its home position an X-ray exposure may be taken and, therefore, it is important that the bucky be stationary. To permit this the magnet 56 is again remote from the switch 58. Thus, the switch is in its normally closed condition and the electromagnet 60 is energized to immobilize the bucky.

CLAIMS

1. An X-ray table comprising a base, a top positioned on the base, a bucky mounted beneath the top so as to be movable in the longitudinal direction of the table, the bucky comprising a frame having a front opening and a cassette tray slidable into and out of the frame through the opening, and means arranged automatically to immobilize the bucky at at least one position of the tray within the frame.
2. An X-ray table according to claim 1, wherein the bucky is immobilized when the tray is in the frame.
3. An X-ray table according to claim 2, wherein the bucky is also immobilized when the tray is out of the frame and is only free to be moved longitudinally when the tray is at an intermediate position.
4. An X-ray table according to claim 1, 2 or 3, wherein the immobilization of the bucky is effected by an electrically-activated device controlled by a switch arrangement responsive to the position of the tray.
5. An X-ray table according to claim 4, wherein the switch arrangement comprises a switch and switch actuator carried respectively by one and the other of the frame and tray at locations such that the switch is in the state freeing the bucky only when the

tray is at an intermediate position.

6. An X-ray table according to claim 5, wherein the switch is a magnetically actuated switch and the actuator is a permanent magnet.

5 7. An X-ray table according to claim 4, 5 or 6, wherein the electrically-actuated device is an electromagnet.

8. An X-ray table according to claim 7, wherein the bucky is attached to a cable passing round
10 pulleys at the ends of the table, the electromagnet being positioned to hook one of the pulleys when energised.

9. An X-ray table substantially as hereinbefore described with reference to and as illustrated in the
15 accompanying drawings.

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