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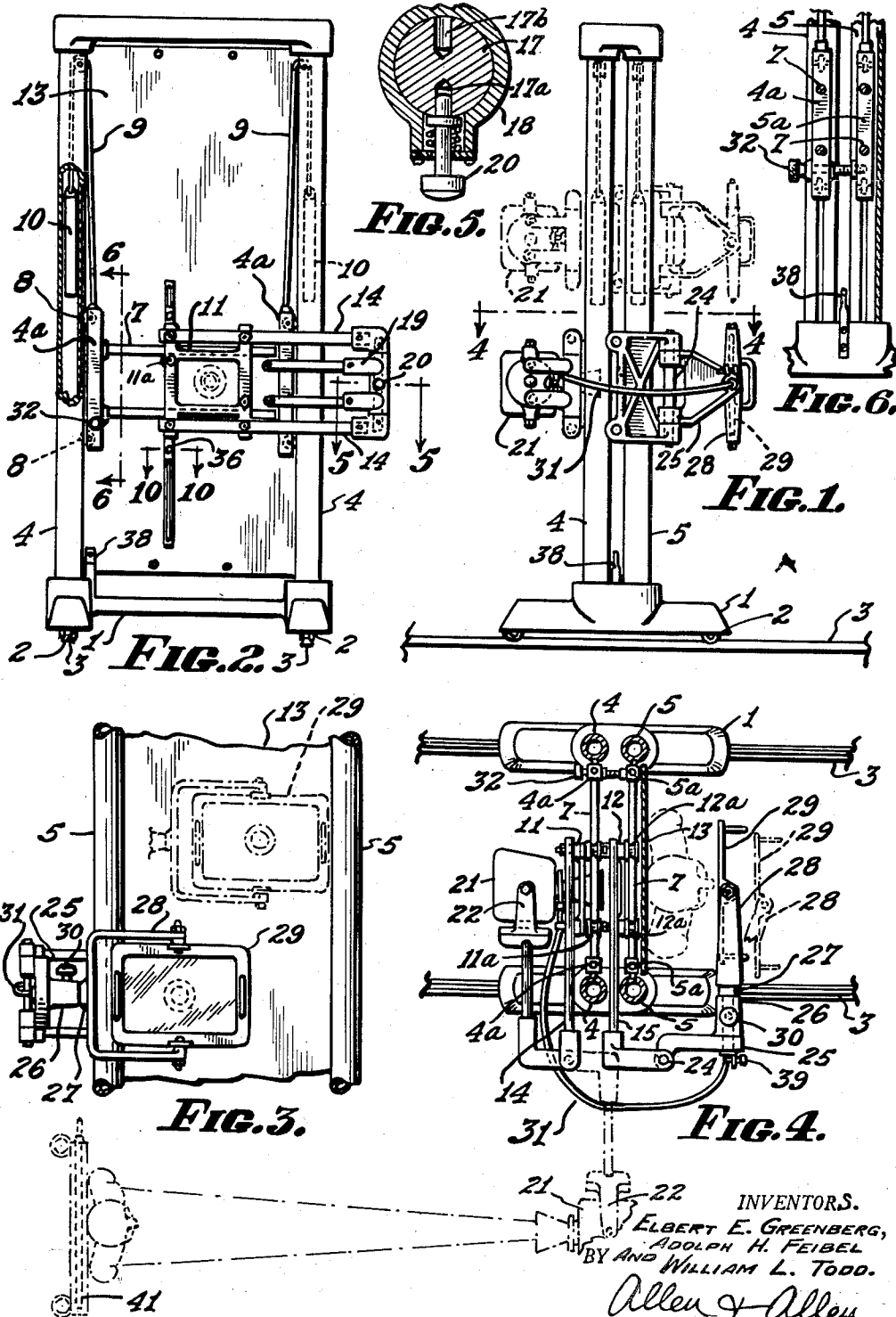
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X-RAY APPARATUS

Filed Sept. 30, 1946

2 SHEETS—SHEET 1



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2 SHEETS—SHEET 2

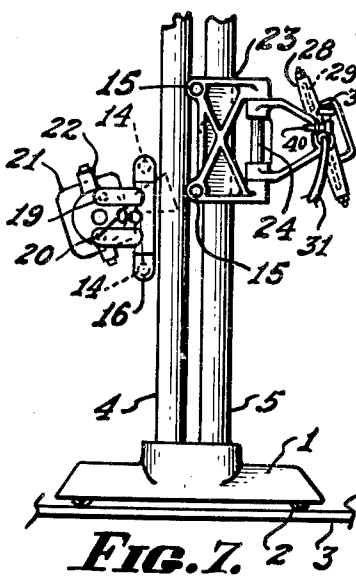


FIG. 7.

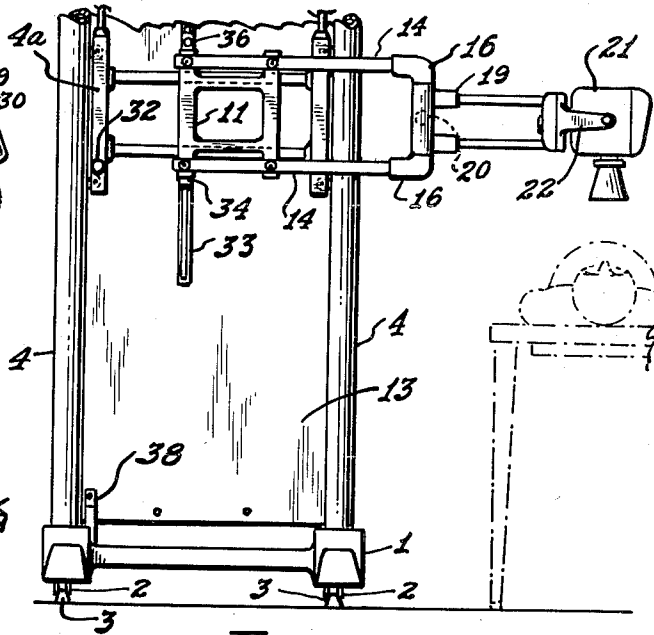


FIG. 9.

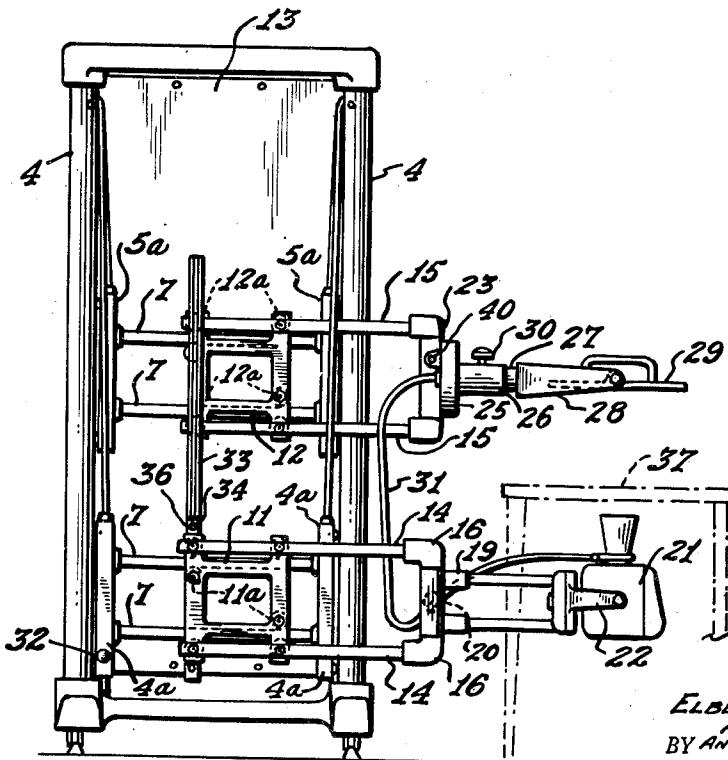


FIG. 8.

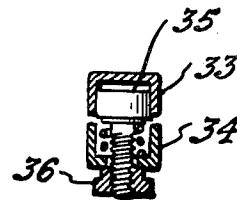


FIG. 10.

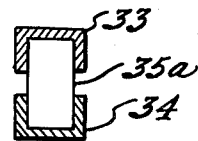


FIG. 10a.

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X-RAY APPARATUS

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3 Claims. (Cl. 250-58)

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Our invention relates to devices used for X-ray photography, hereinafter termed radiography, and making fluoroscopic readings, hereinafter termed fluoroscopy.

There have been in the past X-ray machines for radiography and fluoroscopy, but no inexpensive and simple mechanism has been adapted for performing by means of adjustment, all of the required operations required in a physician's office. There are a number of operations required: (1) Vertical fluoroscopy—whereby the patient is examined under a fluoroscopic screen, when standing erect. In such an examination, the X-ray generator and the fluorescing screen should move together both up and down and to and fro, to permit the physician to locate the screen and generator so as to obtain a view of the desired portion of the body of the patient. (2) There is also horizontal fluoroscopy where the patient is lying on a treatment table in which the generator and the screen should again be movable together as a unit in two directions normal to each other, while, as in the first instance, maintaining the correct focal distance between them once this has been determined. One of our objectives is to provide a machine which will perform both of these two services. There is also required provision for (3) horizontal radiography, in which case the machine provides for full adjustability of the generator to direct its beam downwardly through the patient or upwardly through the patient against a sensitive plate placed beneath or upon the patient. (4) There is vertical radiography, in which again the requirement is full adjustability of the generator with the screen out of the way. Our new machine provides quite simply for these operations.

Expressed in another way, it is our object to support on a horizontally movable column, a vertically movable and transversely movable generator and a vertically movable and transversely movable screen, which screen and generator may be moved together both up and down and in and out, and in which the generator and screen supports are movable independently to spaced positions with reference to each other vertically, while still being movable together in and out, in which latter case the conjoint movement of the two in one of the opposite directions is accomplished by moving the entire column, as when the mounting arms for the two devices are swung to positions of location above and below a treatment table.

Other objects are to provide a machine which is strong and simple to operate, fully counter-

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balanced, and simply adjusted to accomplish the various objects noted, and certain other variations of the same. We have illustrated in the drawings, a preferred construction which has been placed into use, and propose by a description of this as an example to illustrate our invention by means of one complete device constructed in accordance therewith. In the claims that follow, we will set forth the novelty in the device.

In the drawings:

Figure 1 is a side elevation of the complete device.

Figure 2 is an elevation taken from the left side of Figure 1.

Figure 3 is a partial elevation taken from the right side of Figure 1.

Figure 4 is a plan view of the device, taken on the section line 4-4 of Figure 1.

Figure 5 is a detail section of the hinged joint for the generator, taken on the line 5-5 of Figure 2.

Figure 6 is a section taken on the line 6-6 of Figure 2.

Figure 7 is a view like Figure 1 showing the arrangement for upwardly slanting fluoroscopy.

Figure 8 is a view corresponding to Figure 2, but with the generator support and screen support moved for horizontal fluoroscopy.

Figure 9 is a view like that of Figure 2 showing the device in use for horizontal radiography.

Figure 10 is a detail section on the line 10-10 of Figure 2 illustrating the relationship between the generator and screen supporting frames at their vertical slide connection.

Figure 10a is a view of an alternative to the structure of Fig. 10.

The device is formed on a base 1, which by means of roller supports 2, slides on ways or a track 3, that is in turn located on the floor of the treatment room. Thus, the entire machine can move along these tracks. The column of the machine consists of two pairs of tubular supports. There are the supports 4-4 for the generator mounting, and supports 5-5, for the screen mounting.

Slide frames are provided for each of these two columns. (See particularly Figures 6 and 9.) These frames consist each of two vertical bars 4a, 4a, and 5a, 5a, for the columnar supports 4 and 5, respectively. The bars are connected by circular bars or tubes 7, and each bar has rollers 8 which engage in grooves in the vertical supports. The frames are counterweighted by means of cables 9 and counterweights 10 located within the columnar supports.

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Each of the frames has located thereon a carriage. There is the carriage 11 for the generator, located on the frame on the supports 4, and the carriage 12 for the screen located on the frame on the supports 5. As shown, the carriages are rectangular frames having rollers 11a and 12a which engage the bars 7 of each frame. The carriages can thus slide to and fro across the column, and the frames can move up and down.

The set of columns 5, are normally used to mount a panel 13 of wood or plastic which forms a rest for a vertical panel, and when in use the generator will be on one side of this panel and the screen on the other.

The carriages mount horizontal bars 14, for the generator device and 15 for the screen. The bars 14 are secured to headers 16 between which is a hinge pin 17. The sleeve 18 of the generator arm 19 is swivelled on this pin and (see Figure 5) preferably has a locating pin 20 which will hold the arm in position aimed directly parallel with the panel 13 or aimed directly at 180 degrees from the first position, when in engagement with holes 17a, 17b in the pin 17. The first of these positions is for work on a vertical patient and the latter for work on a horizontal patient. The generator 21 is secured pivotally on a yoke 22, on the end of the generator arm for pivotal movement at right angles to the swivel mounting of the arm.

The bars 15 mount a single header 23 which extends normally to the panel 13 (Figures 14 and 7) and provides for a hinge pin 24, on which is pivoted the fluoroscopic screen arm 25. This arm has a right angle bend in it, as shown and terminates in a sleeve or boss 26. In this sleeve or boss is pivotally secured the mounting post 27 for the screen yoke 28. The screen 29 is pivotally mounted in this yoke.

Conveniently located on the screen arm, say on the boss portion 26 is a control dial 30 connected by a flexible cable 31 with the X-ray generator. This is in order that the generator shutter can be controlled from a position where the screen is being manipulated in front of a patient or above the patient, as the case may be. When the screen arm is swung as far as it will go on its pivot, and the generator arm is moved to its position parallel with the panel 13, the spacing of the generator from a patient standing against the panel normally will be correct, and the screen will be in front of the patient. If at this adjustment the patient is too thick to be back of the screen, the arm 25 may be swung on its pivot 24, and the screen itself moved to parallel position with the panel (see dotted lines Figure 4).

Referring back to the frames 4a and 5a, we provide an interlock pin 32, which may be located in one or both of the frame bars 4a and which when the two frames are at a level with each other can be used to engage in a hole or holes, as the case may be, in the frame bars 5a (Figure 6). When the frames are interlocked in this manner, a force applied either to the generator or the screen will move them up and down on the columnar supports together.

To engage the carriages so that they will slide to and fro together, a preferred arrangement is as follows: a channel bar 33 (Figures 2, 8, 9 and 10) is secured to the carriage 12, and a bar 34 is secured to the inside of the carriage 11. The bar 34 has a series of rollers 35 secured thereto by screw studs 36 or the like which slide in the channel of bar 33. Thus, the two carriages, when the frames are unlocked from each other by removal

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of the pin 32 can slide vertically with relation to each other. However, a force tending to slide either of the carriages crosswise on the frame bars 7, will result in sliding the other carriage along with it. With two channel bars as 33 and 34, having the channels closed at the ends, it will be practical merely to insert a slide block as at 35a between the two channels when assembling the machine (see Fig. 10a). The advantage of the construction first shown is that the rollers 35 may be pulled outwardly to release the carriages from each other, should this be desired.

In vertical fluoroscopy, with the parts in the position of Figure 1 or Figure 4, the operator standing at the front of the patient and manipulating the screen, can move the screen and generator up and down together, so long as their frames are locked to each other, and move the generator and screen together horizontally. This movement alone is provided for by previous machines.

In the present machine, however, referring to Figure 8, a patient can be placed on the treatment table, as indicated at 37. The generator frame may be unpinned from the screen frame, and moved downwardly on the columns 4. At the lower position of the generator an ear 38 is provided with an aperture in it for reception of the locking pin 32. The arm is then released from the position of being locked by its hinge pin (as in Figure 5) and swung through 180 degrees. The generator is then turned with the discharge cone upwardly. In this position it is beneath the table. The screen frame is then moved to a position which will bring the screen to the right height from the table to fit the thickness of the patient, and the screen arm is swung on its pivot mounting, already described.

We preferably provide a small lock pin 39 for the screen pivot, which when the screen arm 25 is swung through 180 degrees will engage in a hole 40 in the screen mounting header 23. This will hold the screen arm in a horizontal position, in parallel with the generator arm. The operator then has a set up for horizontal fluoroscopy, and can manipulate the generator and screen in and out together. For moving the screen and generator along the patient's body, the entire base will move on its track with the slight pressure. As before the generator can be controlled from a position of manipulating the screen.

For upwardly slanting fluoroscopy, the generator frame and screen frame are disconnected and spaced (see Figure 7) so that the screen frame is higher than the generator, and the generator is tipped on its mounting fork to an upwardly slant. The screen mounting yoke can then be rotated somewhat on its mounting pin in the screen arm boss and a condition of slantwise reading on the screen is set up.

For radiography, the generator frame can be freed from the screen frame, for desired up and down position of the former, and the screen left in position as for vertical fluoroscopy. As indicated in dotted lines in Figure 4, the patient may be located either vertically or horizontally, and the film or plate 41 placed as desired on the opposite side of the patient from the generator.

It will be evident that there are other equivalent mechanical devices which can readily be substituted for those which have been described. The particular generator and screen arms with universal movement, as described may follow any standard arrangement in such machines. The particular point of the invention is the arrange-

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ment for the screen frames and carriage and the generator frame and carriage with reference to the machine base and supports and with reference to each other, so as to permit any desired type of photographic or screen reading, with mutual adjustment, and by moving either the screen or the generator to shift the two as a unit with reference to the patient.

Having thus described our invention, what we claim as new and desire to secure by Letters Patent is:

1. In an X-ray radiography and fluoroscopy machine the combination of a base, spaced pairs of fixed vertical supporting members mounted on said base, there being two pairs of said members lying in parallel planes, a movable frame mounted between each of said pairs of supporting members and adapted to move vertically therealong, said frames paralleling the planes of said supporting members and movable independently of each other, a movable carriage mounted on each of said frames and adapted to move horizontally along said frames, said carriages also paralleling the planes of said supporting members and movable independently of each other, a generator arm carried on one of said carriages, a screen arm carried on the other of said carriages, and interconnecting means for said carriages to connect them together for joint horizontal movement at various relative vertical positions of said frames, said interconnecting means comprising a vertically extending slide on one of said carriages, and a member on the other of said carriages slidably engaging said vertically extending slide for movement therealong.

2. In an X-ray radiography and fluoroscopy machine the combination of a base, spaced pairs of fixed vertical supporting members mounted on said base, there being two pairs of said members lying in parallel planes, a movable frame mounted between each of said pairs of supporting members and adapted to move vertically therealong, said frames paralleling the planes of said supporting members and movable independently of each other, a movable carriage mounted on each of said frames and adapted to move horizontally along said frames, said carriages also paralleling the planes of said supporting members and movable independently of each other, a generator arm carried on one of said carriages, a screen arm carried on the other of said carriages, and interconnecting means for said carriages to connect them together for joint horizontal movement at various relative vertical positions of said frames, said interconnecting means comprising a vertically extending slide on one of said carriages, and a member on the other of said carriages slidably engaging said vertically extending slide for movement there-

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along each of said arms being mounted on a vertical pivot carried by its carriage, and locking means for each arm to prevent pivotal movement when each arm is swung on its pivot so as to extend away from the direction of the vertical supporting members with the arms in parallel relation to each other.

3. In an X-ray radiography and fluoroscopy machine the combination of a base, spaced pairs of fixed vertical supporting members mounted on said base, there being two pairs of said members lying in parallel planes, a movable frame mounted between each of said pairs of supporting members and adapted to move vertically therealong, said frames paralleling the planes of said supporting members and movable independently of each other, a movable carriage mounted on each of said frames and adapted to move horizontally along said frames, said carriages also paralleling the planes of said supporting members and movable independently of each other, a generator arm carried on one of said carriages, a screen arm carried on the other of said carriages, an interconnecting means for said carriages to connect them together for joint horizontal movement at the various relative vertical positions of said frames, said interconnecting means comprising a vertically extending slide on one of said carriages, and a member on the other of said carriages slidably engaging said vertically extending slide for movement therealong, said vertically extending slide and last mentioned member being in releasable engagement, whereby said carriages may be released from each other for independent horizontal movement.

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