July 30, 1929. I. S. HIRSCH 1,722,573

X-RAY PHOTOGRAPHIC APPARATUS

Filed Nov. 27, 1925 4 Sheets-Sheet 1

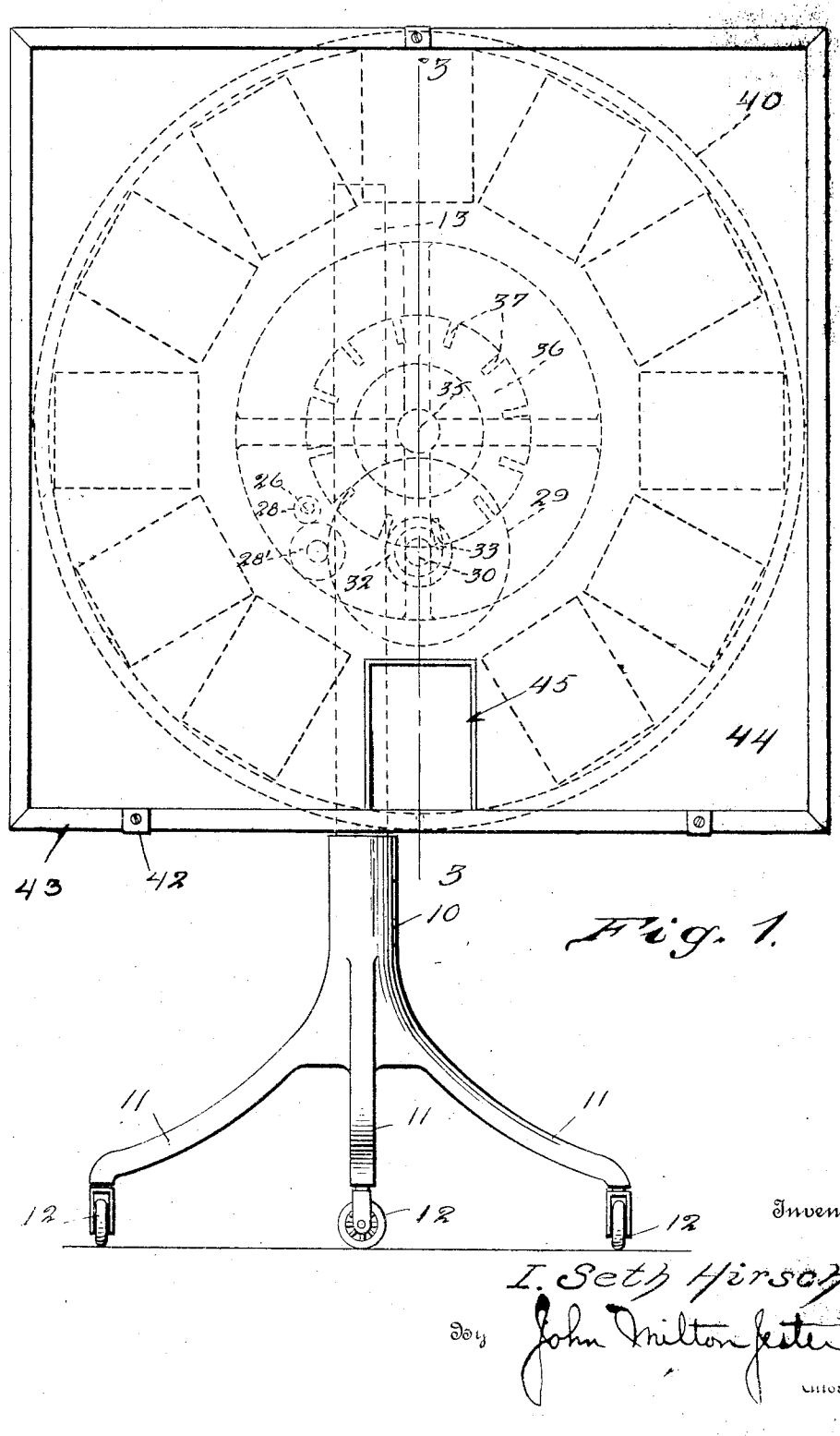


Fig. 1.

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X-RAY PHOTOGRAPHIC APPARATUS

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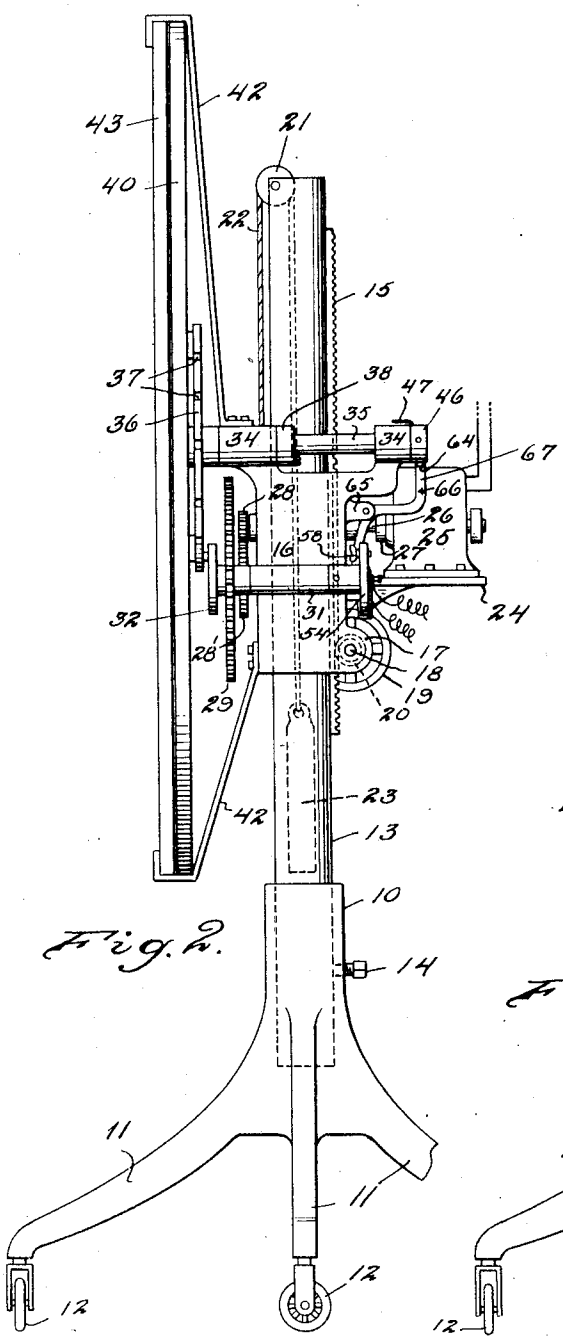


Fig. 2.

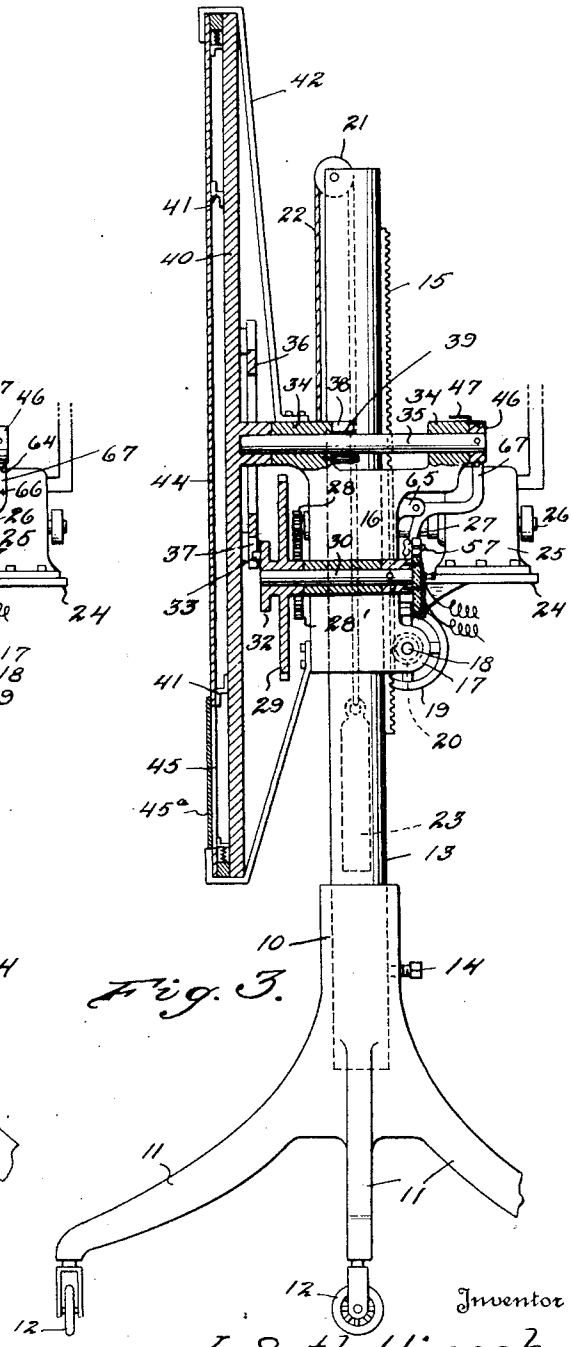


Fig. 3.

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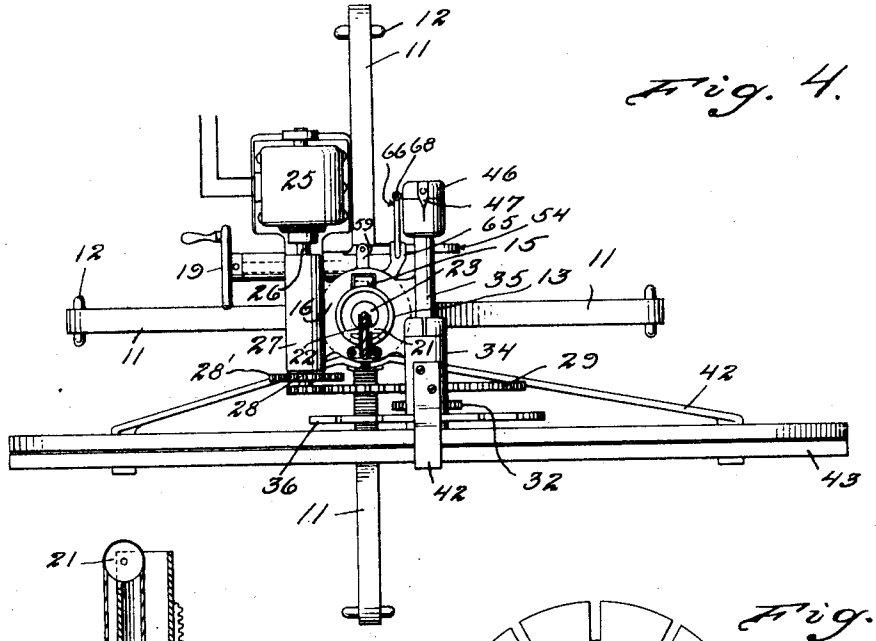
Attorney

July 30, 1929. I. S. HIRSCH 1,722,573

X-RAY PHOTOGRAPHIC APPARATUS

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Fig. 4.



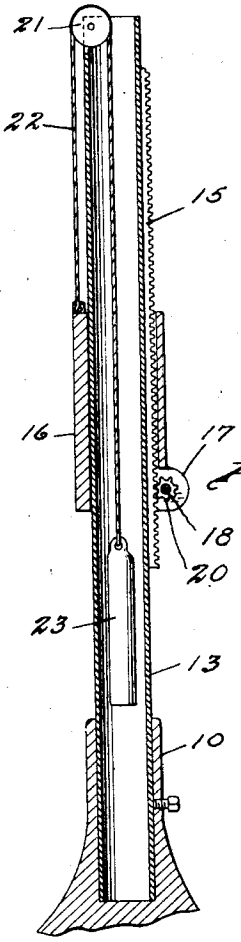
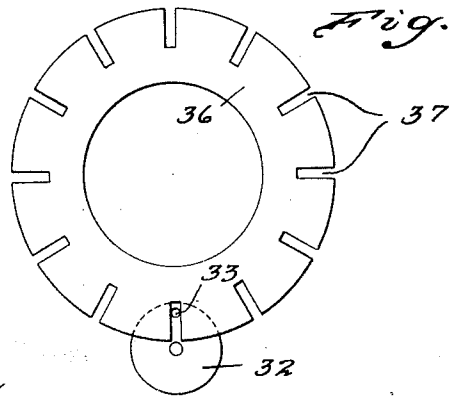


Fig. 6.

Fig. 5.



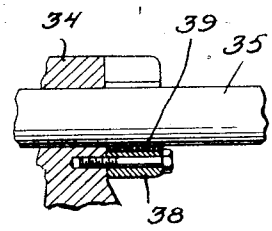


Fig. 7.

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X-RAY PHOTOGRAPHIC APPARATUS

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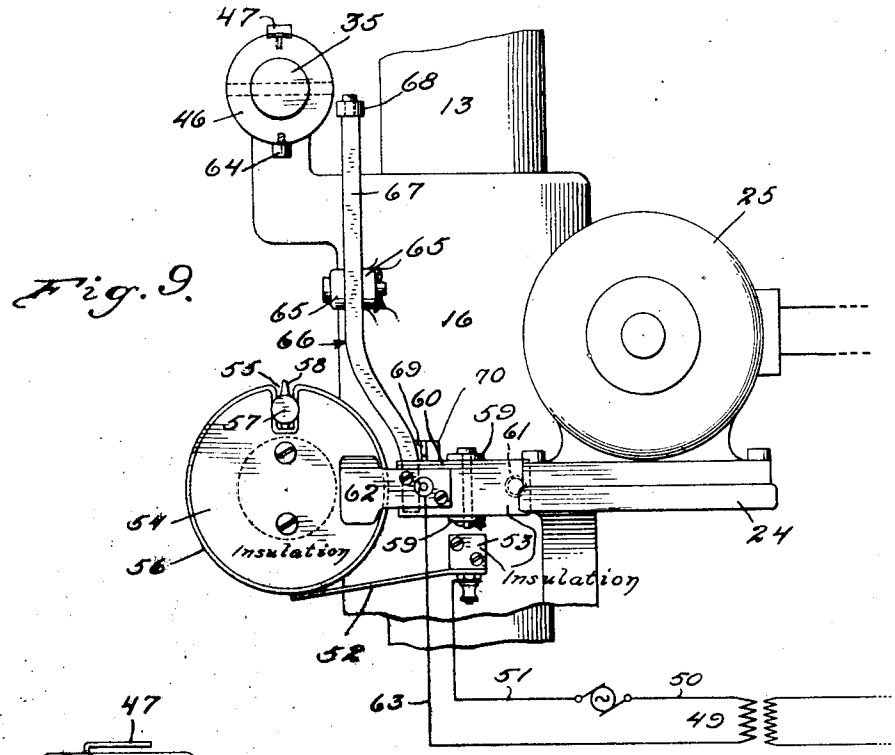


Fig. 9.

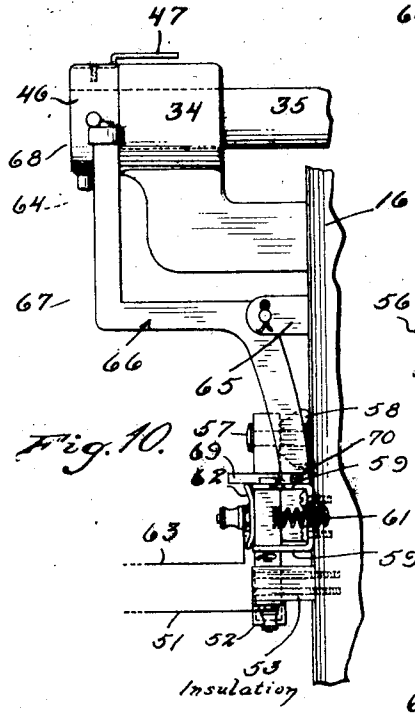


Fig. 10.

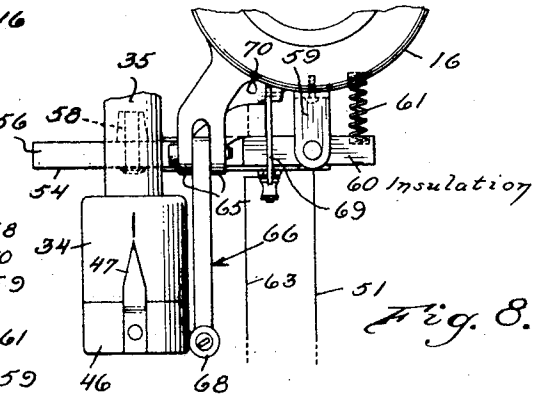


Fig. 8.

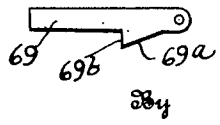


Fig. 11.

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Patented July 30, 1929. 1,722,573

UNITED STATES PATENT OFFICE.

ISAAC SETH HIRSCH, OF NEW YORK, N. Y.

X-RAY PHOTOGRAPHIC APPARATUS.

Application filed November 27, 1925. Serial No. 71,862.

This invention relates to what is commonly called X-ray photography and has special reference to an apparatus for taking successive photographs of various portions of the body such as the heart, stomach or other organs.

The principal object of the invention is to improve the general construction of devices of this character.

A second object of the invention is to provide an improved means whereby a succession of photographic plates or films may be exposed to the influence of the rays from an X-ray tube at suitable timed intervals.

A third object of the invention is to provide an improved means for regulating the length of exposure or lighting of the successively exposed plates.

A fourth object of the invention is to provide an improved means for breaking the circuit when all the plates designed to be acted upon by the X-ray shall have been exposed.

With the above and other objects in view, as will be hereinafter apparent, the invention consists in general of certain novel features of construction, combinations of parts and arrangements of elements hereinafter fully described, illustrated in the accompany drawings and specifically claimed.

In the accompanying drawings like characters of reference indicate like parts in the several views, and:—

Figure 1 is a front elevation of a machine equipped and constructed in accordance with this invention,

Figure 2 is a side elevation of the same,

Figure 3 is a section on the line 3—3 of Figure 1,

Figure 4 is a plan view of the device,

Figure 5 is an enlarged detail of an intermittent rotary movement used therewith.

Figure 6 is a section through the support showing the counterbalance arrangement,

Figure 7 is a detail of a certain friction check used herewith,

Figure 8 is a plan of certain circuit closers used herewith,

Figure 9 is a side elevation thereof,

Figure 10 is a rear elevation thereof.

Figure 11 is a detail elevation of the latch.

In the present embodiment of the invention there is provided a stand consisting of a vertical tubular member 10 having legs 11 provided with casters 12, the latter being preferably rubber tired.

Mounted in the member 10 is an upright 13 consisting of a tube of suitable size and this tube is held in position in the member 10 by means of set screws 14. On the upright 13 is a longitudinally disposed rack 15 and surrounding the upright is a sleeve 16 which is provided with bearings 17 wherethrough passes a shaft 18 having on one end a hand wheel 19. On this shaft is also fixed a pinion 20 which meshes with the rack 15. At the upper end of the upright 13 there is provided a pulley 21 over which is trained a cord or the like as at 22. One end of this cord is fastened to the sleeve 16 while the other end thereof is secured to a counterweight 23 movable in the upright 13.

Carried on the sleeve 16 is a bracket 24 whereon is mounted a suitable motor 25. This motor is provided with the usual shaft 26 carried in bearings 27 and on this shaft is a pinion 28 which meshes with reduced gearing 28′, the latter engaging a gear 29 mounted on a shaft 30 carried in bearings 31 on the sleeve 16.

On the shaft 30 is also fixed a disk 32 from which projects a pin 33. On the sleeve 16 are provided bearings 34 wherein is mounted a shaft 35 carrying a disk 36 provided around its periphery with a series of notches 37. The disk 36 overlaps the disk 32 in such a manner that the pin 33 enters successive notches 37 and rotates the disk 36 in a step by step movement. In order to check the movement of the disk 36 after release from the pin 33 there is provided on the shaft 35 a split collar 38 which is secured to one of the bearings 34 and within this collar is a leather friction strap 39 as clearly shown in Figure 7. Mounted on the shaft 35 is a large disk 40 whereon are a series of holders 41 adapted to receive photographic plates or films which are suitably covered. It will be obvious that the number of holders 41 must be equal to the number of notches 37 as will be hereinafter set forth and in the present instance twelve of each have been shown although the number may be varied at will.

Carried on suitable brackets 42 attached to the sleeve 16 is a frame 43 wherein is mounted a screen 44 of material impervious to the rays from an X-ray tube, the screen being preferably of lead. In this screen is a window 45 covered with a plate of aluminum or other material pervious to the ray, the window corresponding in size with

the plate or film to be exposed therethrough.

In order to indicate the proper position for starting, the shaft 35 carries a collar 46 whereon is provided a pointer 47 which travels around on the bearing 34, the latter being provided with a suitable index line.

The gearing above described and the motor speed are preferably such as keep the plate stationary for one second, the movement consuming somewhat less time. Provision is now made for the control of the passage of the current through the X-ray tube by the insertion of a circuit maker and breaker in the primary circuit, so arranged that the circuit may be made and broken during the time that the plate is stationary, the actual make of the circuit being only a very small fraction of a second. To this end one lead from the current supply is connected direct to said primary of the usual transformer 49 by means of a wire 50 while the other lead from the supply is connected by a wire 51 with a spring contact 52 supported on an insulating block 53 secured to the sleeve 16. On the shaft 30 is fixed a disk 54 of suitable insulating material and this disk is provided with a slot 55. Extending around the entire periphery of the disk is a metal band 56 wherewith the member 52 engages. In the slot 55 is held a contact button 57, the position thereof being regulated by a butterfly nut 58.

On the sleeve 16 are spaced ears 59 between which is pivotally mounted a strip of insulating material 60. This strip 60 is normally urged in one direction by a suitable spring 61. On the strip 60 is mounted a contact strip 62 which projects from one end of the member 60 and has its free end in the path of the contact button. This strip has its free end widened so that the button 57 when moved inward in the slot 55 will take a longer time to cross the strip. Leading from the strip 62 is a wire 63 which is connected to the remaining end of the primary coil. The ends of the secondary are of course connected to a suitable X-ray tube, the latter not being deemed necessary to be shown.

In order to stop the exposure when a cycle has been completed there is provided on the collar 46 a pin 64 and on the sleeve 16 is provided a pair of ears 65 between which is pivoted a bell crank lever 66 one end whereof is bent upward as at 67 and provided with a roller 68 against which the pin 64 strikes when a complete revolution of the disk 40 has been made. The other arm of this lever is positioned over the end of the member 60 opposite the strip 62 so that when actuated by the pin 64 the member 60 is moved against the action of the spring 61 and forced outwardly. As this movement occurs, the member 60 rides under a latch 69 which is pivoted between ears 70 on the sleeve 16. This latch is shown as having its lower portion formed with an inclined surface 69^a leading to a shoulder 69^b. When the member 60 swings outwardly to a certain extent it rides out from under the lower portion of the latch, permitting the latch to drop down with the shoulder 69^b engaging behind the member 60 so that the contact member 62 will be positively held out of the path of movement of the contact button 57. From this position the member 60 may be released by lifting the latch by hand.

There has thus been provided a simple and efficient device of the kind described and for the purpose specified.

Having thus described the invention, I claim:

1. In an apparatus of the class described, a frame adapted to hold a plurality of photograpic plates, a screen of material impervious to X-rays disposed between said frame and a source of X-rays and provided with a window pervious to X-rays, mechanically operated means for moving said frame to bring said plates successively in line with said window, and means for regulating the energization of the X-ray producing device, said regulating means being automatically operated by said means for moving said frame, and comprising a rotating contact and a relatively fixed yieldable contact disposed in the path of movement thereof.

2. In an apparatus of the class described, a frame adapted to hold a plurality of photographic plates, a screen of material impervious to X-rays disposed between said frame and a source of X-rays and provided with a window pervious to X-rays, mechanically operated means for rotating said frame to bring said plates successively in line with said window, and means for regulating the energization of the X-ray producing device, said regulating means being automatically operated by said means for rotating said frame.

3. In an apparatus of the class described, a frame adapted to carry a plurality of photographic plates, a stationary shield of material impervious to X-rays disposed between said frame and a source of X-rays and provided with a window pervious to X-rays, motor operated means for automatically intermittently rotating said frame to bring the plates carried thereby successively in line with said window, and adjustable means for controlling the energization of the X-ray producing device, said controlling means being automatically operated by the means for rotating said frame, said adjustable means embodying a rotatable disk, a contact radially adjustable thereon, and a relatively fixed yieldable contact disposed in the path of travel of the first named contact and of varying width.

4. In an apparatus of the class described,

a frame adapted to carry a plurality of photographic plates, a screen of material impervious to X-rays interposed between said frame and an X-ray producing device and provided with a window pervious to X-rays, means for rotating said frame to bring said plates successively in line with said window, and means for preventing further exposure of a plate after all the plates have been exposed, said last named means being automatically operated by said means for rotating said frame.

5. In an apparatus of the class described, a frame adapted to carry a plurality of photographic plates, a stationary shield of material impervious to X-rays disposed between said frame and a source of X-rays and provided with a window pervious to X-rays, motor operated means for automatically intermittently rotating said frame to bring the plates carried thereby successively in line with said window, adjustable means for controlling the energization of the X-ray producing device, said controlling means being automatically operated by the means for rotating said frame, and means for preventing further exposure of a plate after all the plates have been exposed, said last named means being automatically operated by the means for rotating the frame.

6. In an apparatus of the class described, a frame adapted to hold a plurality of photographic plates, means for moving said frame to bring said plates successively in position to be acted upon by rays from an X-ray producing device, said movement ceasing for an interval as each plate arrives in position to be acted upon, means for energizing X-ray producing devices synchroniously with the stopping of each plate and for the deenergization thereof when the movement is continued, and an automatic circuit breaker actuated after predetermined movement of the frame.

7. In an apparatus of the class described, a screen impervious to X-rays provided with a window wherethrough X-rays may pass, an X-ray producing device in front of said screen, a disk in the rear of said screen provided with a series of plate holders, said disk being revoluble with respect to the screen, means to revolve the disk, and means to prevent further exposure of a plate in the plate holding disk when all the plates held thereby have been exposed, the last mentioned means including a circuit breaker arranged to break an operative circuit upon the completion of a desired cycle of movements of the device.

8. In an apparatus of the class described, a standard, a screen of material impervious to X-rays vertically adjustably mounted on said standard, a plate holding frame revolubly mounted in relation to and behind said screen and secured upon a shaft, motor actuated transmission for revolving said shaft to bring the plates on said frame behind a pervious window in said screen, a circuit breaker operated by said transmission for making and breaking the circuit as each plate is brought before said window, and means carried by said shaft for disengaging the elements of said circuit breaker when the frame has made a complete revolution.

9. In an apparatus of the class described, a standard, a screen of material impervious to X-rays vertically adjustably mounted on said standard, a plate holding frame revolubly mounted in relation to and behind said screen and secured upon a shaft, motor actuated transmission for revolving said shaft to bring the plates on said frame behind a pervious window in said screen, a circuit breaker operated by said transmission for making and breaking the circuit as each plate is brought before said window, and means for automatically disengaging the elements of said circuit breaker when the frame has made a complete revolution, part of said means maintaining said elements in their disengaged position and being manually releasable to allow said elements to reengage each other.

In testimony whereof I affix my signature.

ISAAC SETH HIRSCH.