

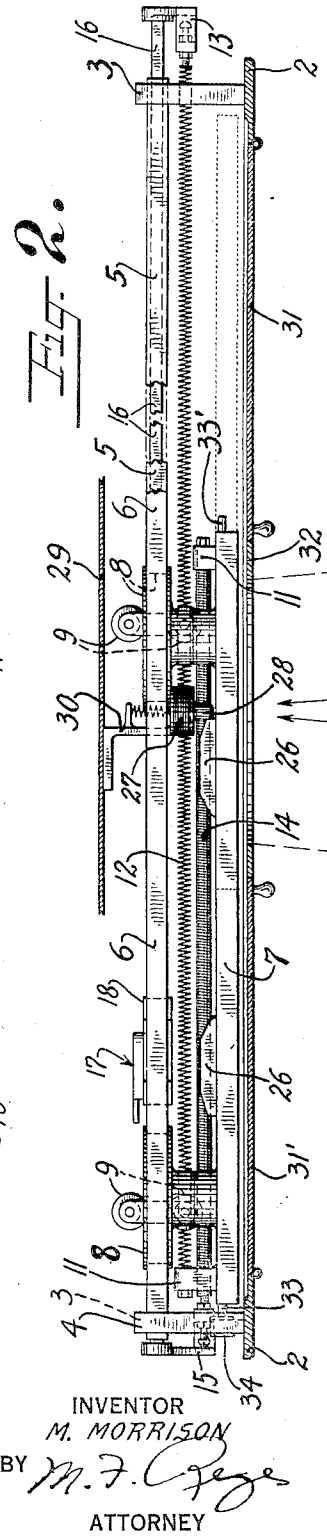
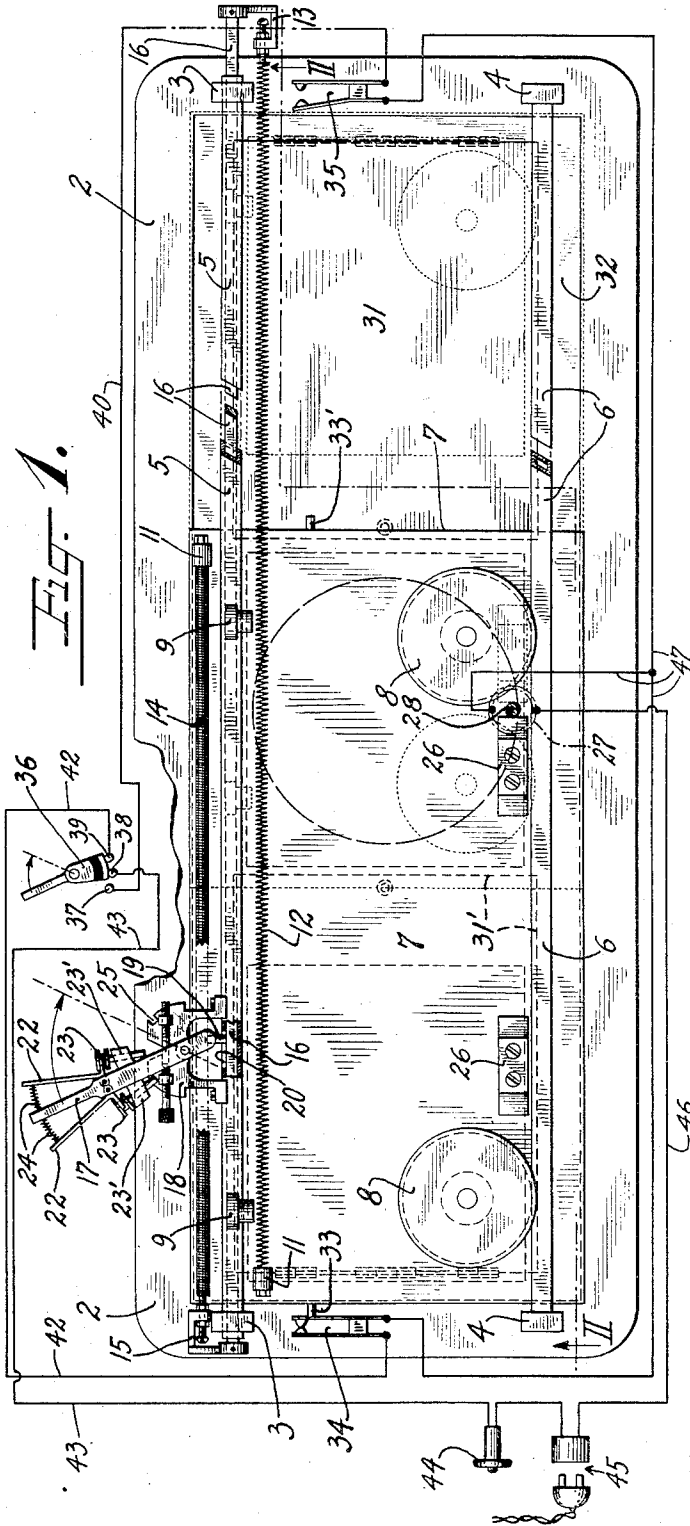
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M. MORRISON

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RADIOGRAPHIC PLATE CHANGER

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INVENTOR
M. MORRISON
BY *M. F. Faye*
ATTORNEY

UNITED STATES PATENT OFFICE

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RADIOGRAPHIC PLATE CHANGER

Montford Morrison, Montclair, N. J., assignor to
Westinghouse X-Ray Company, Inc., a corporation of Delaware

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My invention relates to plate changers for radiographic apparatus and are sometimes referred to in the art as serialographs. Devices of this general character are well known in the art for exposing a plurality of sensitized films to X-radiation emanating from an X-ray tube and a device of this character is usually employed in taking stereoscopic radiographic pictures of an object in which the angle between the X-ray tube and the plate changer is changed with the exposure of each film. This latter is usually accomplished by changing the angle of the plate changer or the angle of the X-ray tube relative to the object to be radiographed.

Heretofore the operation of the plate changers have been dependent upon gravity, electric motor or fluid actuated mechanism. These devices are readily susceptible to wear and break down and on the whole are unreliable and cumbersome.

It is, therefore, an object of my invention to provide a plate changer which is entirely automatically actuated by a mechanical device which is not readily susceptible to wear or break down.

Another object of my invention is to provide a plate changer in which each of the individual films assumes a position adjacent a portion of the apparatus which is pervious to X-rays for exposure of each film.

Still further objects of my invention will become apparent to those skilled in the art by reference to the accompanying drawing wherein

Fig. 1 is a rear plan view of my device; and

Fig. 2 is a sectional view taken on line II—II of Fig. 1 with a portion of the apparatus broken away to better illustrate the mechanism.

Referring now to the drawing in detail I have shown a frame member 2 which is provided with a pair of laterally extending lugs 3 and 4 at each end of the frame member. A pair of square tracks 5 and 6 forming a guideway extend longitudinally of the frame member and are secured to these lateral lugs 3—3 and 4—4 respectively. The track member 5 is hollow for a purpose more fully hereinafter explained.

A cassette tray 7, provided with a pair of large rollers 8 and a plurality of pairs of smaller laterally disposed rollers 9, is arranged to move longitudinally of the frame member by the rollers being in engagement with the pair of tracks 5 and 6 respectively. The cassette tray 7 is provided with a pair of laterally extending lugs 11 and a coil spring 12 is secured to one of these lugs and to a bracket member 13. A similar coil spring 14 is secured to the other lug 11 and to a similar

bracket member 15 disposed at the opposite end of the frame member 2.

A square shaft 16 is disposed internally of the hollow track 5 and is arranged to be moved longitudinally of this track member by means of a control handle 17 to be more fully hereinafter described. The bracket members 13 and 15 are secured to the square shaft 16 and the coil springs 12 and 14 are likewise secured to these bracket members as before stated. The coil springs are, however, secured to these bracket members by means of a set screw and lock nut arrangement in a well known manner for increasing or decreasing the tension of these coil springs.

The handle for control lever 17 is pivotally secured to a bracket member 18 which is in turn rigidly secured to one of the surfaces of the track member 5.

A pin 19 is rigidly secured to the square shaft 16 and extends through an elongated slot 20 provided in the track member 5 and is pivotally secured to the handle of control lever 17. The control lever 17 is provided with a pair of pivoted auxiliary handles 22 which engage a pair of pins 23 slidably mounted in bearings 23' and these handles 22 are biased away from the lever 17 by means of a pair of coil springs 24. The bracket member 18 is provided with notches 25 which are engaged by the respective pins 23 as the control lever is rotated about its pivot.

The cassette tray 7 is provided on its rear surface with a pair of beveled stop plates 26, and a solenoid 27 having a spring pressed plunger 28 is arranged to engage the plates 26, and thus forms a detent to maintain the cassette tray at the respective limits of its travel, with the sensitized films carried by the cassette tray in alignment with a section of the frame member pervious to X-rays.

The frame member is provided with a cover 29 which supports a bracket 30 to which the solenoid 27 is secured and a similar cover 32 is secured to the front of the frame member and is provided with a section thereof pervious to X-rays and the remainder thereof opaque to X-rays. The sections of this cover opaque to X-rays are provided with suitable hinged doors 31 and 31' for loading and unloading the films from the cassette tray.

The cassette tray 7 is provided with a pair of pins 33 and 33' which are positioned to engage a pair of contact members 34 and 35 respectively, disposed at each end of the frame member 2.

A manually operable switch 36 is provided, which in actual practice, is usually mounted upon

the control lever 17. This switch 36 is provided with a contact segment positioned to engage a plurality of contact terminals 37, 38 and 39 respectively. A conductor 40 extends from one of the contact members 35 to the contact terminal 37 and a similar conductor 42 extends from the contact member 34 to the contact terminal 39. A conductor 43 extends from the contact terminal 38 to a push button switch 44 and from this latter switch to a suitable attachment plug 45. A conductor 46 extends from the attachment plug 45 to the solenoid 27 while a conductor 47 interconnects the remaining contact members 34 and 35.

The operation of my device may be best understood by assuming a given operation. Assuming, therefore, it is desired to expose a series of sensitized films to the X-rays radiating from an X-ray tube the cassette tray 7 is initially moved to one of its extremities of travel longitudinally of the frame member 2, such as for example, to the position shown in dotted lines to the right of Fig. 1. One of the sections of the cover 32, which is provided with a door, is open and a sensitized film placed in the cassette tray.

The attachment plug 45 is connected to a suitable source of electrical energy and the switch 36 is moved to the position shown by the arrow establishing contact between the contact terminals 37 and 38. The contact terminals 35 are closed by the pin 33' when the cassette tray is in this position.

The push button switch 44 is then pressed to energize the solenoid 27 thus causing retraction of the spring pressed plunger 28 which disengages one of the stop plates 26 and allows the spring 14 which will be expanded with the cassette tray in the assumed position, to move the same longitudinally of the frame member to the left as shown in full lines in the figure. That section of the plate 32, which is also provided with a door opaque to X-rays, is then opened and a film inserted in this section of the cassette tray. The cassette tray being loaded with unexposed films is now ready for the taking of a radiographic picture. With the cassette tray in the position last mentioned, namely, to the left as shown in full lines in Fig. 1, the right hand section of the cassette tray 7 will be in alignment with the section of the cover 32, of the frame member 2, which is pervious to X-rays with the left hand section of the cassette tray disposed in back of one of the sections opaque to X-rays.

The pin 33 of the cassette tray 7 will be in engagement with one of the pairs of the contact members 34 which will cause the closing of these contact members. The switch 36 is moved in the direction as shown in Fig. 1 which establishes connection between the contact terminals 38 and 39 and the contact members 35 will now be open. With the cassette tray in the position shown, namely to the left as shown in full lines in the figure, the coil spring 12 will be expanded and the coil spring 14 will be contracted.

As these two coil springs are of substantially the same tensile strength upon release of the cassette tray and its movement in response to the potential energy of the coil spring 12 a condition would occur where the potential energy of the respective springs 12 and 14 would tend to equalize each other, which condition would occur before the cassette tray 7 has moved sufficiently to the right, as shown in dotted lines in Figure 1,

for one of the plates 26 to be engaged by the plunger 28 of the solenoid 27.

In order to increase the potential energy of the expanded spring 1 I provide the control lever 17. This lever is provided with a pin 19 engaging the square shaft 16 and upon movement of the lever the square shaft 16 is moved internally of the track member 5. The bracket members 13 and 15 being secured to the respective springs 12 and 14 and to each end of the square shaft 16 causes further expansion of the coil spring 12 as the square shaft 16 is moved to the right. This further expansion of the coil spring increases the potential energy of the spring to an amount sufficient to overcome the potential energy of the spring 14 as the same tends to become effective during movement of the cassette tray, and allows the latter to move the additional required amount to permit the plunger of the solenoid to engage the stop plate 26 and maintain the cassette tray in its other extremity of travel.

Upon closing of the switch 44 the circuit will be completed to the solenoid 27, which extends from one side of the plug 45 through conductor 46, solenoid 27, conductor 47 through the contact members 34, conductor 42 to the contact terminal 39, through the switch 36 to the terminal 38, thence by means of conductor 43 through the switch 44 back to the other side of the plug 45. This allows the solenoid 27 to retract the plunger 28 and disengage the stop plate 26.

The coil spring 12 will then cause movement of the cassette tray 7 to the right, which due to the increased potential energy given the spring 12 by the control handle 17 will enable the spring pressed plunger 28 to engage the other plate 26 and maintain the cassette tray in a position shown in dotted lines.

As the cassette tray moves to this position the pin 33' will immediately cause the closing of the contact members 35, which would immediately cause the solenoid to become energized, should the operator still have the switch 44 closed, were it not for the fact that the switch 36 has the circuit to the solenoid open, as well as the fact, that the pin 33 has opened the contact members 34 in moving to the right.

When it is desired to again have the cassette tray move to the left as shown in full lines, the switch 36 must be moved to the position shown by the arrow to establish a contact between the terminals 37 and 38 to partially complete the circuit to the solenoid. The control lever 17 must likewise be moved to the position as shown, as indicated by the arrow to move the square shaft 16 to the left and increase the potential energy of the spring 14 which would now be expanded. Immediately upon closure of the circuit by the operator actuating the switch 44 the cassette tray will be again released by the solenoid 27 and it will move from the position indicated in dotted lines to that shown in full lines.

It can thus be seen that once the cassette tray is moved to either of its positions and either of the respective springs 12 and 14 initially tensioned the operation of the device is entirely automatic.

Upon movement of the tray to one position, one of the springs becomes tensioned, while the other is contracted and upon movement of the cassette tray to the opposite position the inverse condition of the springs results. This enables each of the springs to alternately act as shock absorbers for the cassette tray while at the same time per-

mitting the potential energy of the tensioned spring to move the tray to its limits of travel.

It is, therefore, obvious that the mechanism utilized for actuating the device is susceptible to very little wear, is simple in construction and positive in its operation.

Although I have shown one specific embodiment of my invention I do not desire to be limited thereto as various other modifications of the same may be made without departing from the spirit and scope of the appended claims.

What is claimed is:

1. In an automatic plate changer for X-ray photography the combination of a guideway, a cassette tray movable longitudinally along said guideway, tensioning means connected at one end with said cassette tray, a portion of said tensioning means serving to move the tray in one direction and the remaining portion thereof serving to move the tray in an opposite direction, means connected with the other end of said tensioning means for increasing the tension of either of said portions thereof, and releasable means cooperating with said cassette tray for holding the same stationary at predetermined points in its path of movement.

2. In an automatic plate changer for X-ray photography the combination of a frame member provided with a guideway, a cassette tray carried by said frame member and movable substantially the entire length thereof along said guideway, tensioning means connected to said cassette tray and operable to cause movement of the latter along said guideway in one direction, tensioning means connected to said cassette tray and operable to cause movement of the latter along said guideway in an opposite direction, said tensioning means being connected to said cassette tray in opposition with respect to each other, means connected with both of said tensioning means and operable to increase the potential energy of either of said tensioning means sufficiently to cause said tensioning means having increased potential energy to cause movement of said cassette tray substantially the entire length of said frame member against the potential energy of said opposed tensioning means as the latter becomes effective during movement of said cassette tray longitudinally of said frame member, and releasable means carried by said frame member and engageable with said cassette tray to maintain the latter at its extremities of travel against the potential energy of either of said tensioning means.

3. In an automatic plate changer for X-ray photography the combination of a frame member provided with a guideway, a cassette tray carried by said frame member and movable substantially the entire length thereof along said guideway, tensioning means connected to said cassette tray and operable to cause movement of the latter along said guideway in one direction, tensioning means connected to said cassette tray and operable to cause movement of the latter along said guideway in an opposite direction, said tensioning means being connected to said cassette tray in opposition with respect to each other, a detent carried by said frame member and engageable with said cassette tray for maintaining the latter at either of its extremities of travel, means connected with both of said tensioning means and operable to increase the potential energy of either of said tensioning means sufficiently to cause said tensioning means having increased potential energy to move said cassette tray to an engaging

position with said detent against the potential energy of said opposed tensioning means as the latter becomes effective during movement of said cassette tray longitudinally of said frame, and means carried by said frame member and responsive to actuation by an operator for releasing said detent and causing said tensioning means having increased potential energy to move said cassette tray.

4. In an automatic plate changer for X-ray photography the combination of a frame member provided with a portion pervious to X-rays and the remainder thereof opaque to X-rays, a guideway in said frame member and extending longitudinally thereof, a cassette tray for encasing a plurality of sensitized films disposed in said frame member and arranged to be automatically moved along said guideway longitudinally of said frame member, spring tensioning means connected to said cassette tray and operable to cause movement of the latter within said frame along said guideway in one direction of travel, spring tensioning means connected to said cassette tray and operable to cause movement of the latter within said frame along said guideway in an opposite direction of travel, a detent carried by said frame member and engageable with said cassette tray to maintain the latter in various positions during its movement to cause at least one of said films to be always in a position relative to the portion of said frame member pervious to X-rays, manually operable means connected to both of said spring tensioning means and operable to increase the tension of either of said spring tensioning means, and electrically operated means carried by said frame member and operable to release said detent and render said spring tensioning means having increased tension effective to move said cassette tray longitudinally of said frame member along said guideway.

5. In an automatic plate changer for X-ray photography the combination of a frame member provided with a guideway, a cover for said frame member provided with a portion pervious to X-rays and the remainder thereof opaque to X-rays, a cassette tray for encasing a plurality of sensitized films disposed in said frame member and movable longitudinally thereof along said guideway, a pair of coil springs of substantially equal potential energy connected to said cassette tray, one of said coil springs being effective to cause movement of said cassette tray in one direction and the other of said springs being effective to cause movement of said cassette tray in the other direction, a detent carried by said frame member and engageable with said cassette tray to maintain the latter at either of its extremities of travel against the tension of one or the other of said springs, manually operable means connected to both of said coil springs to increase the potential energy of the spring under tension when said cassette tray is at one extremity of travel, and electrically operated means carried by said frame member to cause said detent to disengage said cassette tray and cause the spring under tension to move said cassette tray longitudinally of said frame member along said guideway.

6. In an automatic plate changer for X-ray photography the combination of a frame member provided with a guideway, a cassette tray carried by said frame member and movable longitudinally thereof substantially the entire length of said guideway, a coil spring connected to said cassette tray and operable to move the latter in one direction along said guideway, a coil

spring connected to said cassette tray and operable to move the latter along said guideway in an opposite direction, mechanism connected to both of said coil springs provided with an actuating lever and operable to increase the potential energy of each of said coil springs as the respective springs are tensioned by movement of said cassette tray, a solenoid carried by said frame member and provided with a plunger engageable with said cassette tray to maintain the latter in a fixed position relative to said frame member, and manually operable means electrically connected to said solenoid to cause disengagement of the plunger relative to said cassette tray to render the respective spring under tension effective to move said cassette tray along said guideway longitudinally of said frame member.

7. In an automatic plate changer for X-ray photography the combination of a frame member provided with a guideway, a cassette tray carried by said frame member and movable longitudinally of the latter substantially the entire length of said guideway, a coil spring connected to said cassette tray and operable to move the latter in one direction along said guideway, a coil spring connected to said cassette tray and operable to move the latter along said guideway in an opposite direction, said coil springs being secured at one of their respective ends to said cassette tray and opposed relative to each other, mechanism connected to both of said coil springs provided with a manually operable lever and operable to increase the potential energy of each of said springs after the respective spring has been tensioned by movement of said cassette tray to cause said tensioned spring to move said cassette tray in an opposite direction against the potential energy of said opposed coil spring, and a detent carried by said frame member and engageable with said cassette tray and operable by a solenoid associated therewith to release said cassette tray and cause said tensioned coil spring to move said cassette tray and tension the opposed coil spring preparatory to further movement of said cassette tray in a direction opposite to said first mentioned direction.

8. In an automatic plate changer for X-ray photography the combination of a frame member provided with a guideway, a cassette tray carried by said frame member and movable longitudinally thereof along said guideway, tensioning means connected to said cassette tray and operable to cause movement thereof, a detent carried by said frame member and engageable with said cassette tray to maintain the latter at opposite limits of its longitudinal movement, electrically operated means associated with said detent for causing the release of the latter relative to said cassette tray, an electrical circuit including said electrically operated means, a switch, and a pair of contact members disposed at one end of said frame member, said contact members being actuable by movement of said cassette tray to open and close this circuit, a second electrical circuit including said electrically operated means, said switch, and a pair of contact members disposed at the opposite end of said frame member, said last mentioned contact members being actuable by movement of said cassette tray for opening and closing this second circuit, and an auxiliary switch common to both of said circuits and operable to interrupt one of said circuits at a time to prevent the movement of said cassette tray from completing the circuit

to said electrically operated means by closure of the contact members included in the circuit interrupted by said auxiliary switch, and again releasing said detent after said cassette tray has moved to one of its limits of travel, except by operation of said first mentioned switch.

9. In an automatic plate changer for X-ray photography the combination of a frame member provided with a guideway, a cassette tray carried by said frame member and movable longitudinally of the latter substantially the entire length of said guideway, tensioning means connected to said cassette tray and operable to move the latter in one direction along said guideway, tensioning means connected to said cassette tray and operable to move the latter along said guideway in an opposite direction, said tensioning means being connected to said cassette tray in opposition relative to each other, a detent carried by said frame member and engageable with said cassette tray to maintain the latter at opposite limits of its longitudinal movement, means connected with both of said tensioning means and operable to increase the potential energy of either of said tensioning means sufficiently to cause said tensioning means having increased potential energy to move said cassette tray to an engaging position with said detent against the potential energy of said opposed tensioning means as the latter becomes effective during movement of said cassette tray, electrically operated means carried by said frame member for releasing the engagement of said detent relative to said cassette tray, an electrical circuit including said electrically operated means, a switch, and a pair of contact members disposed at one end of said frame member, said contact members being actuable by movement of said cassette tray for opening and closing this circuit, a second electrical circuit including said electrically operated means, said switch, and a pair of contact members disposed at the other end of said frame member and actuable by movement of said cassette tray for opening and closing this second circuit, and an auxiliary switch common to both of said circuits and operable to interrupt one of said circuits at a time to prevent movement of said cassette tray from completing the circuit to said electrically operated means, by closure of the contact members included in the circuit interrupted by said auxiliary switch, and again releasing said detent after said cassette tray has moved to one of its limits of travel, except by operation of said first mentioned switch.

10. In an automatic plate changer for X-ray photography the combination of a frame member provided with a guideway, a cassette tray carried by said frame member and movable longitudinally of the latter substantially the entire length of said guideway, tensioning means connected to said cassette tray and operable to move the latter in one direction along said guideway, tensioning means connected to said cassette tray and operable to move the latter along said guideway in an opposite direction, mechanism connected to both of said tensioning means provided with a manually operable lever and operable to increase the tension of either of said tensioning means, electrically operated means carried by said frame member, and means engageable with said cassette tray and operable by said electrically operated means to render one of said tensioning means effective to move said cassette tray along said guideway longitudinally of said frame member.

11. In an automatic plate changer for X-ray photography the combination of a frame member provided with a guideway, a cassette tray carried by said frame member and movable longitudinally thereof along said guideway, a tensioning member connected to said cassette tray for moving the latter along the guideway of said frame member in one direction, a tensioning member connected to said cassette tray for moving the latter along the guideway of said frame member in an opposite direction, means connected with both of said tensioning members and operable to increase the tension of one of said tensioning members at a time, electrically operated means carried by said frame member, and means engageable with said cassette tray for holding the latter at its extremities of travel against the tension of either of said tensioning members and operable by said electrically operated means in response to actuation by an operator to release said cassette tray thus causing said tensioning member having increased tension to become effective and move said cassette tray.

MONTFORD MORRISON.